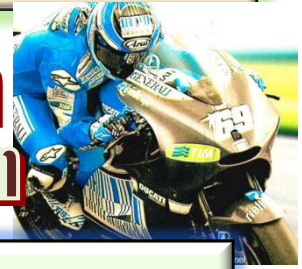


Unit (1) Force and Motion

Chapter (1) Motion in one direction



The motion: It is the change of object's location as time passes according to the location of another object



The type of movement 1- Straight 2- Curving
3- Both of straight and curving.

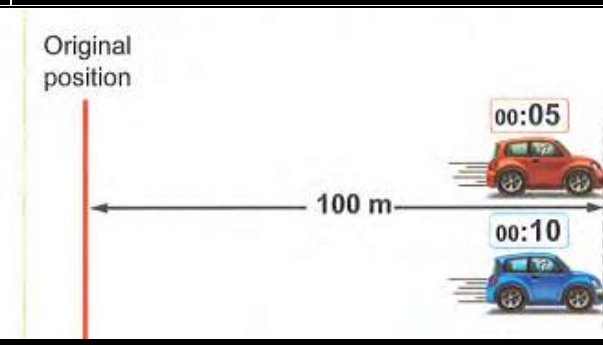
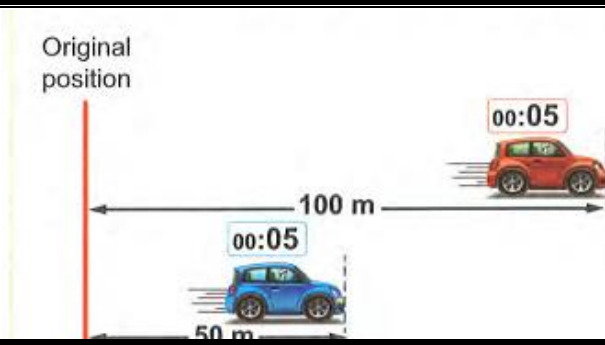
If the movement's path is straight then we call it moving in a straight line in one direction.

G.R. The movement of train (or metro) represents the simplest type of motion? Because the train (or metro) moves forward or backward in a straight path or curved path or combination of both.

To describe and measure the motion of object we use a physical quantity called Speed

Speed: In our daily life, we describe the movement of some objects around us as fast and some others as slow

The first case:	The second case
If the two cars move for the same period of time which is 5 sec. * The Red car covers a distance of 100 m The Blue car covers a distance of 50 m .	If the two cars move for the same period of time which is 100 m. * The Red car covers a distance of 5 sec The Blue car covers a distance of 10 sec .



The Red car is faster than the Blue car G.R.?

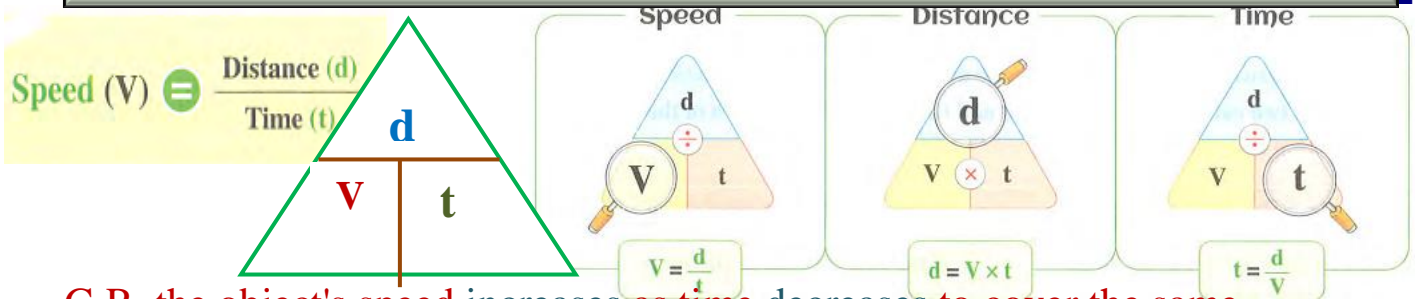
Because the red car covers large distance (100 m.) in the same time (5 sec.).

Because the red car takes less time (5 sec.) to cover the same distance (100 m)

The two factors necessary for the description of motion

- 1- The distance that covered by the motion
- 2- The time taken by the moving body to cover this distance

Speed it is the distance covered (moved) through a unit time.



G.R. the object's speed increases as time decreases to cover the same distance?

Because $V = \frac{d}{t}$ so the speed is inversely proportional with time

G. the object's speed increases by increasing the covered distance at constant time?

Because $V = \frac{d}{t}$ so the speed is directly proportional with distance

What the meant by

1- A train covers a distance 240 km in two hours

This means that the train moves with speed equals 120 km/h

2- A car moves with speed 100km/h

This means that the car covers a distance 100 km in one hour

3- The speed of a car equals zero This means that the car is at rest

Measuring units of speed

For illustration :

$$\frac{1 \text{ kilometre}}{1 \text{ hour}} = \frac{1000 \text{ metres}}{60 \times 60 \text{ seconds}}$$

$$= \frac{10}{36} = \frac{5}{18} \text{ m/sec.}$$



Ex.1 : A car moves at 72 km/h. $\longrightarrow 72 \times \frac{5}{18} = 20 \text{ m/sec.}$

Ex.2 : A car moves at 20 m/sec. $\longrightarrow 20 \div \frac{5}{18} = 72 \text{ km/h.}$

Measuring units of time

1 hour = 60 minutes

1 minute = 60 seconds

1 hour = 60 x 60 = 3600 seconds

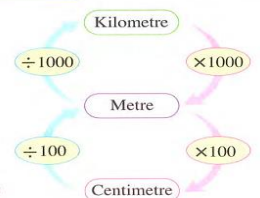


Measuring units of distance

1 kilometre = 1000 metres

1 metre = 100 centimetres

1 kilometre = 1000 x 100 = 100000 centimetres



Solved problems

1- Calculate the speed of runner who runs 240 m in one minute?

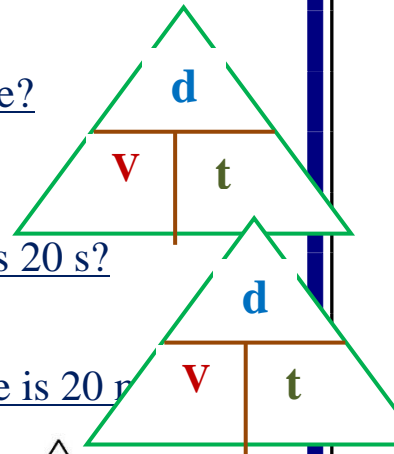
Solution $V = \frac{d}{t} = V = \frac{240}{60} = 4 \text{ m/s}$

2- Find the distance covered by car its speed 20 m/s the time is 20 s?

Solution $d = v \times t = 400 \text{ (} d = 20 \times 20 = 400 \text{ m)}$

3- Calculate the time taken by car its speed 20 m/s the distance is 20 m?

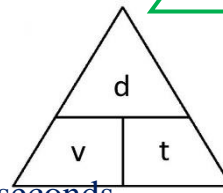
Solution $t = \frac{d}{v} = \frac{20}{20} = 1 \text{ s}$



Unsolved problems (H.W)

1- Calculate the speed of runner who runs 180 m in 3 minute?

2- Find the distance covered by car its speed 40 m/s the time is 40 seconds



Cars and planes are usually provided with a group of counters as speedometer, mileage, hour timer and compass.



عادة ما يتم تزويد السيارات والطائرات بمجموعة من العدادات مثل عداد السرعة والأميال وتوقيت الساعة والبوصلة.

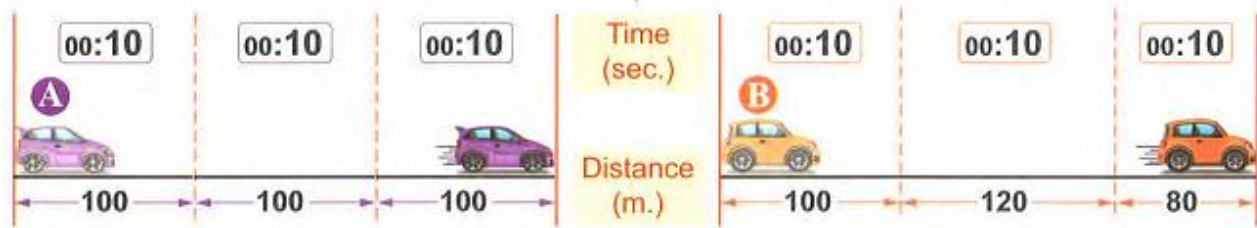
Speedometer in cars helps us in identifying the speed of the car directly

Kinds of speed

1- Regular (uniform) speed

2- Irregular (Non-uniform) speed

What is the difference between them ?



Regular (uniform) speed

It is the speed by which the object moves when it covers equal distances at equal periods of time.

The car A moves to cover equal distances (100 m) at equal periods of time (10 sec.).
So, the car moves at a regular (uniform) speed.

Irregular (non-uniform) speed-

It is the speed by which the object moves when it covers unequal distances at equal periods of time.

The car B moves to cover unequal distances (100, 120, 80 m.) at equal periods of time (10 sec.).
So, the car moves at an irregular (non-uniform) speed.

The thing that moves at a constant speed in the space?

All electromagnetic waves such as **light** transfer through the space with a constant speed equals 3×10^8 m/sec.

1-An object moves at regular speed 400 km/h?

This means that the object covers 400 kilometer each one hour

G.R. Most of moving cars cannot move inside crowded towns all the time by uniform speed.

Because the speed of the car changes according to the conditions of the road.

* The metro moves at an irregular speed.

Because the metro covers unequal distances at equal periods of time, or it covers equal distances at unequal periods of time.

Solved problems

1- Calculate the distance covered by an object moves at regular speed 240 km/h during 2 hours ?

Solution $v = \frac{\Delta d}{\Delta t}$ $\Delta d = v \times \Delta t = 240 \times 2 = 480$ m

2- Calculate the time needed for body moves at regular speed 50 km/h- to cover distance of 500 km ?

Solution $v = \frac{\Delta d}{\Delta t} = \Delta t = \frac{\Delta d}{v}$ $\Delta t = \frac{500}{50} = 10$ hours

Unsolved problems (H.W)

1- Calculate the distance covered by an object moves at regular speed 150 km/h during 3 hours?

2- Calculate the time needed for body moves at regular speed 40 km/h to cover distance of 400km?

Average speed

Average speed It is the total distance covered by moving object divided by the total time taken to cover this distance

Average speed $v = \frac{d}{\Delta t}$ $v = \frac{\text{Total distance covered (D)}}{\text{Total time(T)}} = \frac{d1+d2+d3}{t1+t2+t3}$

Solved problems

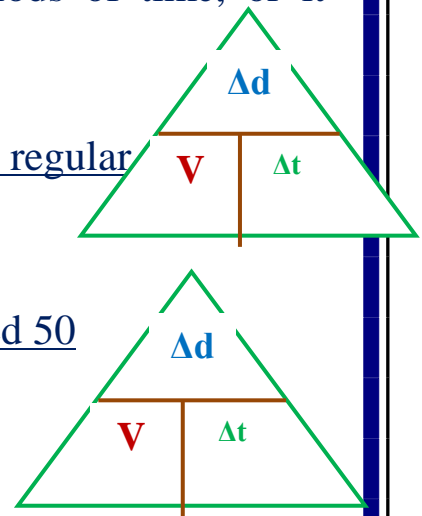
1- A racer covered a distance of **100 meters** of a straight track in **10 seconds** then he returned back waking he took **80 seconds** to come back to the starting point of running

Calculate the racer's **average speed**

a) While running b) while returning c) during the whole trip

Solution

a) The racer's average speed while running = $v = \frac{d}{t} = \frac{100}{10} = 10$ m/s



b) The racer's average speed while returning = $v = \frac{d}{t} = \frac{100}{80} = 1.25 \text{ m/s}$

c) The racer's average speed during the whole trip = $v = \frac{d}{t} = \frac{100+100}{10+80} = 2.22 \text{ m/s}$

Unsolved problems (H.W)

1-A runner covered the first 100 metres of the race at 10 seconds and the following 300 metres of the race at 40 seconds. Find in which part of the race did he have the highest average speed ? Then, calculate the average speed during the whole trip

2- Calculate the average speed of an object that covers a distance of 84 m through 12 sec., then 56 m through 8 sec., then 28 m through 4 sec

When the following happens...?

The value of average speed of a moving body equals to its speed at any moment ($V=V$)

When the body moves at a regular speed.

The value of average speed of a moving body differs from the value of its speed at any moment ($V \neq V$).

When the body moves at an irregular speed.

What the meant by:- the average speed of a moving car is **40km/h**

This means that the total distance covered by the car divided by the total time taken to cover this distance = 40

3-Relative speed السرعة النسبية It is the speed of moving object relative to an observer

It is the speed of moving object relative to a static or moving object

If there is a person standing on the side of the road (called the observer) to observe two cars (A & B), the car (A) moves at 100 km/h and car (B) moves at 80 km/h in the same direction.







Therefore:

- The speed of car (A) relative to the static observer = 100 km/h.
- The speed of car (B) relative to the static observer = 80 km/h.
- The speed of car (A) relative to an observer in car (B) = 100 - 80 = 20 km/h.

* The speed of car (A) relative to the static observer differs from its speed relative to an observer in car (B).

* Measuring the relative speed depends on the position of the observer who determines the magnitude of this speed.

<u>The observer state</u>	<u>Relative speed</u>	
<u>The observer is at rest</u>	The <u>relative speed</u> = The <u>real (actual) speed</u> of the object <u>relative speed</u> = 100 km	
<u>The observer is moving in the opposite direction of the moving object</u>	The <u>relative speed</u> = The <u>real speed</u> of the object + The <u>observer's speed</u> - So The real speed of the object = The relative speed of the object - The observer's speed <u>relative speed</u> = 100 - 60 = 160 km	
<u>The observer is moving in the same direction at different speed</u>	The <u>relative speed</u> = The <u>real speed</u> of the object - The <u>observer's speed</u> So, The real speed of the object, of the car = The relative speed of the object + The observer's <u>relative speed</u> = 100 - 60 = 40 km	
<u>The observer is moving in the same direction at the same speed</u>	The <u>relative speed</u> = The <u>difference between the two speeds</u> = Zero. <u>relative speed</u> = 60 - 60 = zero km object seems static	

G.R. The moving car seems stable (at rest) to an observer moves at the same speed and the same direction.

Because the relative speed equals the difference between their speeds equals zero.

What is meant by...?

1-The relative speed of a moving car is 90 km/h.

This means that the speed of the car relative to an observer equals 90 km/h.

2- The relative speed of a moving object equals its real speed.

This means that the observer is at rest.

3- The relative speed of a moving car equals 70 km/h to an observer moves in the opposite direction at a speed 20 km/h.

This means that the real speed of the car equals 50 km/h.

When the following happens...?.

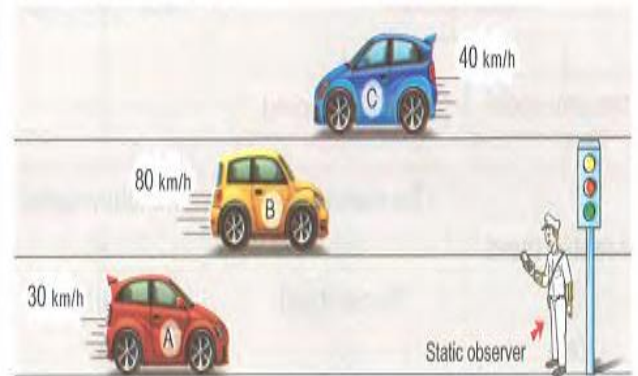
1- The relative speed of a moving object relative to an observer equals to double of its real speed.

When the observer moves in the opposite direction at the same speed of the moving object.

2- The relative speed of a moving object relative to an observer equals to zero.

When the observer moves in the same direction at the same speed of the moving object.

Problem two cars in the same direction, car (A) moves at a speed 30 km/h and a car (B) moves at speed 80 km/h, while a car (C) moves in the opposite direction at speed 40 km/h calculate the relative speed of car (B) to an observer



1- Stands on the ground

2- in car (A)

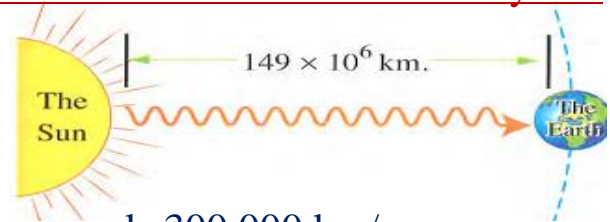
3- in car (C)

Solution

- 1- The relative speed of car (B) relative to observer on the ground = 80 km/h
- 2- The relative speed of car (B) relative observer on car (A) = $80 - 30 = 50$ km/h
- 3- The relative speed of car (B) relative to an observer on car (C) = $80 + 40 = 120$ km/h

The time needed for the sunlight to reach the Earth is determined by the relation: speed of light = Distance / Time

By knowing The distance between the Earth and the Sun equals 149 million km (approximately).



* The regular speed of the light in the space equals 300 000 km/sec.

The time needed for the sunlight to reach the Earth

$$t = \frac{d}{v} = \frac{149 \times 10^6}{300000} = 497 \text{ sec} = 8 \text{ minutes and } 17 \text{ seconds}$$

i.e. If the time of sunrise is six o'clock. This means that the light travelled from the Sun at five o'clock and fifty-one minutes and 43 see.

15. If the uniform speed of a car is 108 kilometres/hour, so its speed equals m/sec,
a. 10 b. 20 c. 30 d. no correct answer
16. A car moves at a regular speed equals 90 km/h, this means that the car covers a distance equals metres in 40 sec
a. 4000 b. 25 c. 2000 d. 1000
17. When the body covers equal distances at unequal intervals of time, this means that the body moves at
- a. non-uniform speed. b. increasing acceleration
c. uniform speed. d. decreasing acceleration.
18. In case of motion that is described as movement at an irregular speed, in this case, it is useful to refer to another term which is the speed.
a. uniform b. scalar c. vector d. average
19. A person takes a time of 10 minutes to transfer from home to work moving at an average speed of 3 m/sec. Which of the following equals the distance between home and work ?
.....
a. 600 m. b. 1.8 km. c. 60 m. d. 1.2 km.
20. A car moving on a straight line covers a total distance (d) in a total time (t), the average speed of the car is given
b. $V = \frac{d}{t}$ c. $V = d.t$ d. $V = \frac{h}{km}$
21. A runner ran the 1 100 metres of a race in 8 seconds and the 2nd 100 metres in 12 seconds, therefore his average speed during the whole race is
a. 8 m/sec. b. 10 m/sec. c. 12 m/sec. d. 20 m/sec.
22. The speed of a moving object relative to an observer in another moving object is called
a. uniform. b. irregular c. average speed. d. relative
23. If the relative speed of a car is 50 km/h relative to an observer in a bus moves in the same direction at 70 km/h, therefore the actual speed of this car is
- a. 20 km/h. b. 70 km/h. c. 120 km/h d. 170 km/h.
24. If car (A) moves at speed 80 km/h and car (B) moves at speed of 50 km/h in the same direction, the speed of car (A) relative to a passenger in car (B) iskm/h.
a. 50 b. 80 c. 30 d. 130
25. An observer in a moving car with 80 km/h was observing a moving car with 90 km/h in the same direction, so the observed speed of the second car is..... (Ale 2019)
a. 10 km/h. b. 80 km/h. c. 90 km/h. d. 170 km/h.
26. The relative speed of a moving object relative to an observer moves at the same speed in the opposite direction is the actual speed. (Luxor 2017)
a. double b. the same c. half d. quarter

2. Correct the underlined words :

- The motion in one direction in a curved line is considered the simplest type of motion.
- If car (A) took a shorter time than car (B) to cover the same distance, so car (A) was slower than car (B).

3. If car (A) covered a shorter distance than car (B) at the same time span, therefore car (A) was **faster** than car (B).
4. From speed measuring units are **metre/second²** or kilometre/hour. (Suez. Assiut 2019)
5. The **compass** helps in identifying the speed of the car directly. (Minia, Gharbia 2020)
6. When a moving object covers equal distances at equal periods of time, so it moves with **relative speed**.
7. **The acceleration** is the change of the distance through a unit time. (Cairo 2018)
8. When the object covers the double of distance at the same time, so its speed decreases **to quarter**. (Luxor 2018)
9. A car moves at a regular speed equals 20 m/sec, this means that the car covers **60 m** in the third second.
10. Ahmed takes 10 minutes to transfer from his home to work moving at an average speed 3 m/sec., the distance between home and work **equal** 3 km. (Kalyoubia 2020)
11. A moving car moves at a regular speed covers 500 metres in 25 sec., so its speed is **200 m/sec**. (Damietta 2016)
12. A moving car covers a distance of 200 km through 150 min, so its speed is **90** km/h. (Giza 2019)
13. If the uniform speed of a car is 25 m/sec, this means that its speed equals **72** km/h (Beni Suef 2020)
14. A moving car covers 180 km in two hours, so its speed is **50 m/sec**. (Kalyoubia 2015)
15. A moving car covers 20 metres in one second, so its speed is **90 km/h** (Kalyoubia 2016)
16. **Relative speed** represents the regular speed by which the moving object moves to cover equal distances at equal periods of time. (Cairo 2020)
17. If the value of the speed $(V) = \frac{d_1+d_2+d_3}{t_1+t_2+t_3}$ this means that this speed is **increased**. (Ismailia. Sharia 2017)
18. **Average speed** is the speed of a moving object relative to an observer (Kalyoubia 2019)
19. The value of a car speed relative to an observer standing on the ground **is the same** to an observer in another moving car.
20. **Relative speed** equals the total distance covered by the moving object divided by the total time taken to cover this distance. (Red Sea 2015)
21. Measuring the relative speed of a moving car depends on **the time**. (Red Sea 2020)
22. If two cars moving in the same direction at the same speed equals 100 m/sec. so the relative speed equals **200 m/sec**. (Beni Suef 2018)
23. The relative speed of two moving bodies in the same direction equals **the sum of** their speeds. (Menofia 2016. 2018)
24. The moving car with a certain speed seems to be at **high speed** to the moving observer at the same speed and the same direction. (Menofia 2017)
25. The relative speed of a moving car relative to an observer at rest is **less than** the real speed. (Giza 2018 Kalyoubia 2020)

3. Write the scientific term of each of the following :

1. • The change in the position of an object by the time passes relative (according) to the position of another fixed object. (Cairo, suez 2020) (.....)
2. • The distance that a moving object covers within a unit time. (New Valley 2017)
3. • The result of multiplying the speed of a body by the time. (Menia 2018)
4. The measuring unit of speed. (.....)
5. An instrument used in cars and planes to identify speed directly. (.....)
6. A moving object covers equal distances at equal periods of time(.....)
7. The speed by which the object moves to cover equal distances at equal periods of time. (Behira 2018 / Beni Suef 2020) (.....)
8. The thing which moves at constant speed in the space. ((.....))
9. The speed of a moving body that covers equal distances at unequal time span, (Kalyoubia 2019-Fayoum 2020) (.....)
10. • The total distance that a moving object covers divided by the total time taken to cover this distance. (Assiut -Suez 2020) (.....)
 - The regular speed by which the moving object moves to cover the same distance at the same period of time. (Behira – Dakahha 2019) (.....)
11. • The speed of a moving object relative to the observer. (Alex. Beni Suef. Willey 2020)

4. Give reasons for :

1. The motion of a train (or metro) can be considered from examples of motion in one direction. (Dukahlia 2018 North Sinai 2020)
2. • Cars and planes are provided with speedometers.
3. The object speed increases by decreasing the time needed to cover a certain distance. (Aswan 2017/Dakahlia 2020)
4. The speed of a moving object increases as the covered distance increases at a constant time.
5. Car (A) which covers 50 metres in 5 seconds is faster than car (B) which covers 64 metres in 8 seconds.
6. Most of moving cars cannot move inside crowded towns all the time by uniform speed.
7. • The Metro moves at an irregular speed. (Red Sea 2014)
8. The relative speed of a moving object in a certain direction differs according to the difference of the observer state.
9. A moving observer can't accurately determine the actual speed of a moving object.
10. A moving car seems stable (at rest) to an observer moves at the same speed and the same direction (Aswan Gharbia 2020)
11. The relative speed of car relative to a moving observer equals zero (Giza2020).

5. What is meant by each of the following ...?

1. The change of an object location as time passes. (Gharbia 2012)
2. An object moving in a straight line, covers a distance of 20 metres in one second (
3. A moving car covers a distance of 100 km in two hours (Giza. North Sinai 2019)

4. A car covers equal distances at equal periods of time. (Beni Suef 2015).
5. The distance covered by an object is changed by 2 metres each second. (Luxor 2019)
6. The distance covered by an object is changed by 15 m each 3 seconds. (Luxor 2018)
7. The speed of a moving object equals 100 km/h (Sheikh 2018)
8. A body moves at a uniform speed equals 5 m/sec. (Menia 2018)
9. The speed of a body equals zero (Port Said 2018).
10. A car moving at a uniform speed equals 80 km/h. (Qena, Part Said 2019)
11. A moving car covers equal distances at unequal periods of time.
12. The average speed of a moving car is 70 km/h. (Port Said, Beni Suef 2019)
13. The average speed of a moving car is 60 km/h. (Gharbia 2017)
14. The relative speed of a car related to a moving observer equals zero. (Matrouh 2017)
15. The relative speed of a train equals 90 km/h. (Giza 2014 Kalyoubia 2015)
16. The relative speed of a moving car equals 70 km/h relative to an observer which moves in the opposite direction at a speed of 20 km/h.

6. Problems :

1. A runner covers 450 metres in 45 seconds, Find his speed.
2. A train travels from Cairo to Alexandria a distance of 250 km in 2 hours. Find its speed.
3. A train covers 50 m in two seconds. Find its speed in km/h. (Sharkia 2016 Giza 2017)
4. A train starts to move at 7 o'clock in the morning, then what is the time of arrival if it moves at speed of 100 km/h to cover the distance of 500 km. (Damietta 2017-2020)
5. A bus covers a distance of 120 km at a speed of 90 km/h, then it covers 105 km at 70 km/h. Calculate the time needed to cover the whole distance.
6. A car moving at a uniform speed equals 80 km/h. Find its speed in m/sec.
7. One of the foxes attacked a deer at rest. If the average speed of the fox is 120 km/h, calculate the distance (by km and metres) covered by the fox to catch the deer if the time taken is 10 sec.
8. A body moves at a regular speed (m/sec.) according to the following mathematical equation $d = 6t$. Find: (a) The speed of this body. (b) The time needed to cover 360 m.

Chapter (2)

Graphic representation of moving in a straight line

(G.R) physicists use mathematical methods like graphics and tables

- To 1- predict the relation between physical quantities
- 2- Understand practical results
- 3- Describe physical phenomena in an easier way.



Graphic representation of regular (uniform) speed

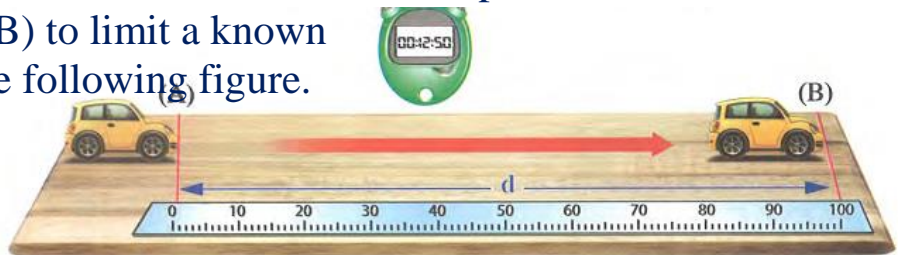
Activity To represent the uniform speed graphically.

Tools: A toy car operated by a battery. - A metric strip (or ruler).

* A marker. - A smooth wooden board - A stop watch

Procedures: 1. Place the wooden board at a horizontal position.

2. Put two marks (A) and (B) to limit a known distance (d) as shown in the following figure.

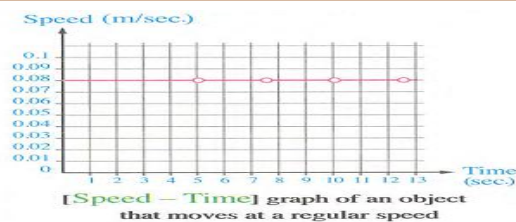
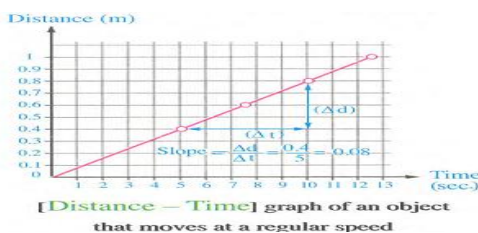


- 3. Operate the car and calculate the time (t) necessary to cover this distance (d)
- 4. Repeat the previous steps by changing the distance (d) and calculate the time needed in each trial.
- 5. Write the results in a table (as shown below).
- 6. Calculate the speed of the car in each trial from the relation $V =$

Number of trial	Covered distance (d) in metre	Time (t) needed to cover this distance in second	Speed $V = d/t$ (m/sec.)
1	0.4	5	0.08
2	0.6	7.5	0.08
3	0.8	10	0.08
4	1.0	12.5	0.08

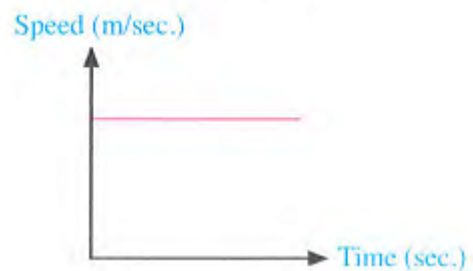
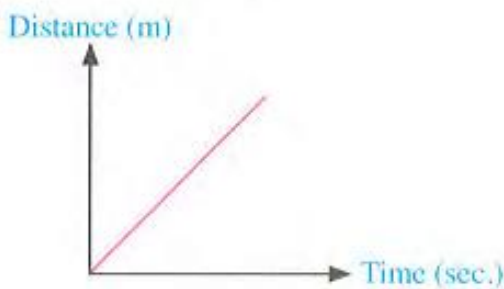
Distance (d) on the vertical axis (Y axis)
Time (t) on the horizontal axis (X axis)

Speed (V) on the vertical axis (Y axis)
Time (t) on the horizontal axis (X)

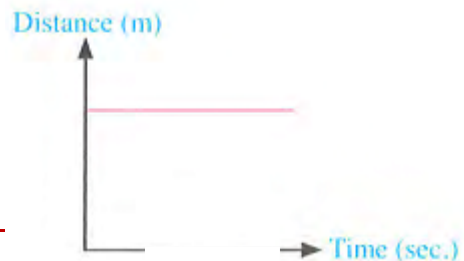


The regular speed is represented in

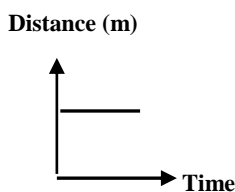
<u>The relation (distance - time)</u>	<u>The relation (speed-time)</u>
a <u>straight line passing through the origin point</u> (the intersection point of the two axes). <u>G.R.</u> Because the distance is directly proportional to the time, when the object moves at a constant speed.	a <u>straight line parallel to the time axis</u> (<u>X</u>). <u>G.R.</u> Because the object's speed remains constant as time passes.
<u>some facts about regular speed in a straight line:</u>	
<u>1. The (distance-time) graph</u> of a regular motion at a constant (uniform) speed is represented by a straight line passing through the origin point.	<u>2. The (speed-time) graph</u> of a regular motion at a constant (uniform) speed is represented by a straight line parallel to the time axis.



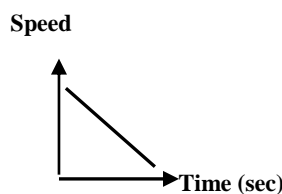
The (distance - time) graph of an object at rest is represented by a straight line parallel to the time axis.



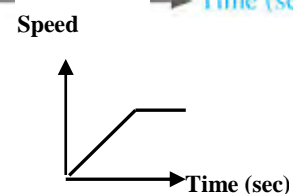
. Describe the motion of the body in each of



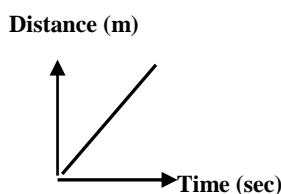
(A) The body is at rest



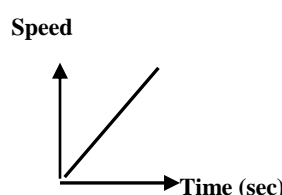
(B) The body moves with a decelerating motion .



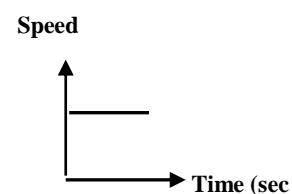
(C) The body moves with an accelerating motion then at a regular speed .



(D) The body moves with a uniform speed .



(E) The body moves with an accelerating motion .

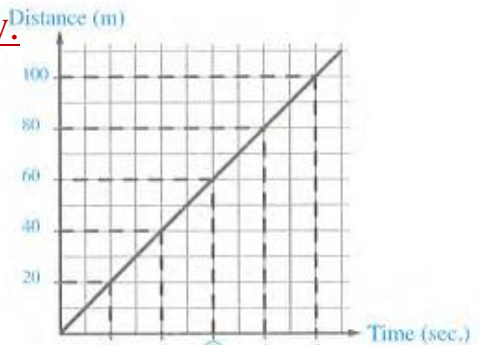


(F) The body moves with a zero acceleration (uniform speed) .

Problems

1- The opposite graph represents the motion of a body.

1. Mention the kind of the speed of this body. Giving a reason.
2. Calculate the speed of this body.
3. Calculate the distance covered by this body after 3 and 10 seconds.



Solution

1. The body moves at a regular (uniform) speed, because the (distance - time) graph is a straight line passing through the origin point (it covers equal distances at equal time intervals).

$$2. V = \frac{d}{t} = \frac{20}{1} = 20 \text{ m/s.}$$

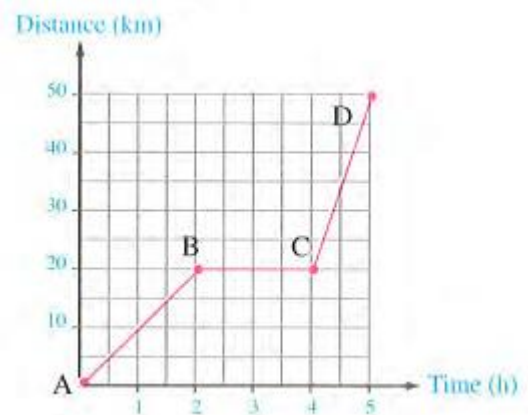
3. The distance covered by this body:

- After 3 seconds: $d = V \times t = 20 \times 3 = 60$ metres. (As shown in the graph).

After 10 seconds: $d = V \times t = 20 \times 10 = 200$ metres.

2-The opposite graph represents a bike motion through 5 hours:

1. Calculate the average speed of the bike during the trip.
2. What is the period in which the bike stops? And what is the time of this stopping?
3. What are the periods during which the bike moves at a regular speed? And what is the period during which the regular speed of the bike is the greatest?



Solution

$$1. \text{ Average speed } V = \frac{\text{Total distance}(d)}{\text{Total time}(t)} = \frac{50}{5} = 10 \text{ km/h.}$$

2. The stopping period = (BC) Time of stopping = $4 - 2 = 2$ hours.

3. The periods during which the bike moves at a regular speed: (AB) and (CD).

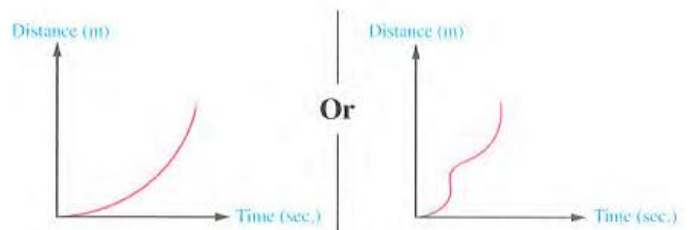
$$* \text{ The speed in the period (AB) } = \frac{20}{2} = 10 \text{ km/h.}$$

$$\bullet \text{ The speed in the period (CD) } = \frac{50 - 20}{5 - 4} = 30 \text{ km/h.}$$

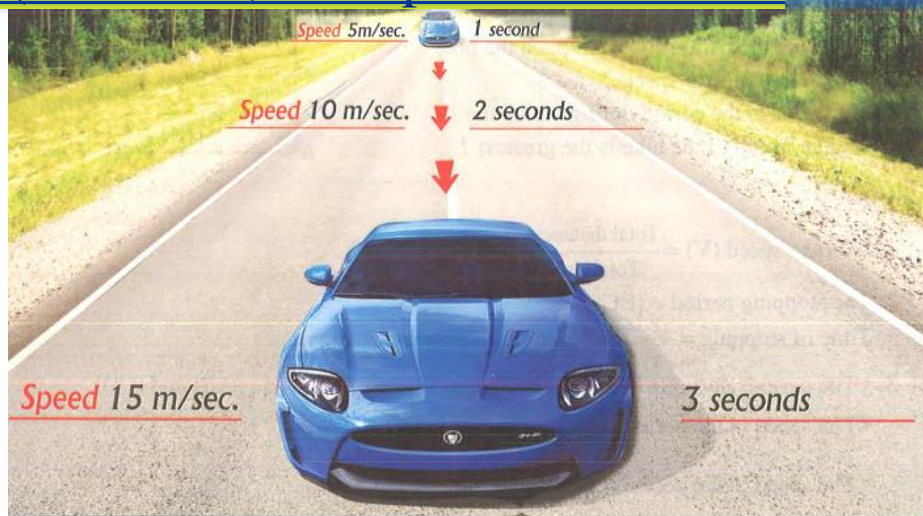
The regular speed for the bike is greater in the period (CD)

The relation (distance - time) graph for

an object moves at a non-uniform speed is represented as a curved line passing by the origin point.



Acceleration It is the change of an object's speed in one second (Unit of time) in a specific direction



$$\text{Acceleration} = \frac{\text{change in speed } (\Delta V)}{\text{change in the time } (\Delta t)}$$

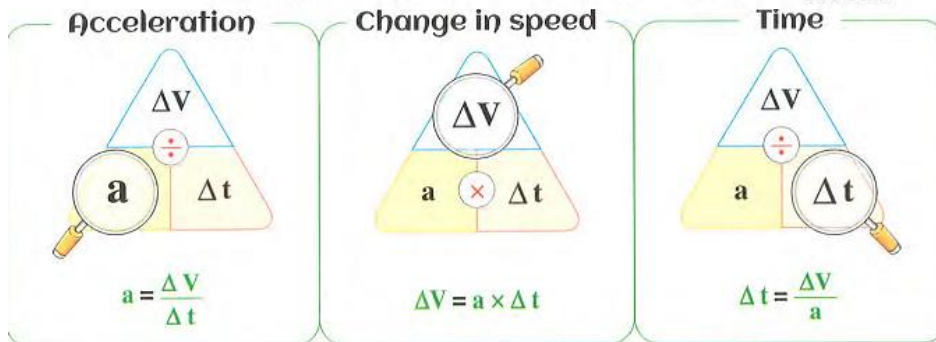
$$\text{Acceleration (a)} = \frac{\text{Final speed (V2)} - \text{initial speed (V1)}}{\text{Time } (\Delta t)}$$

The measurement units of acceleration

The speed units are meters/second - The time unit is second.

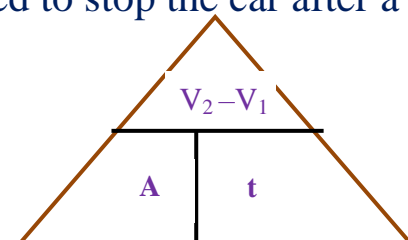
∴ Acceleration units = meters/second² = m/s²

$$\text{Acceleration unit} = \frac{\text{Speed unit}}{\text{Time unit}} = \frac{\frac{\text{metre}}{\text{second}}}{\text{second}} = \frac{\text{metre}}{\text{second}} \times \frac{1}{\text{second}} = \frac{\text{metre}}{\text{second}^2} = \text{metre/second}^2.$$



2. If the body is moving at a regular speed, so its acceleration equals zero G.R. Because its speed doesn't change as time passes [when (ΔV) = Zero, then (a) = Zero].
3. If the body starts moving from rest, so its initial speed (V₁) equals zero.
4. When the body stops moving, so its final speed (V₂) equals zero.
5. When the car is moving, then the brake is applied to stop the car after a period of time so, its final speed equals zero.

Acceleration units = meters/second² = m/s²

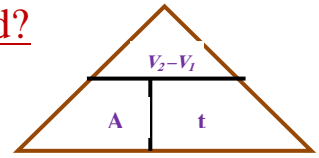


Problems:

①-A special car can move from rest and its speed reaches 90 m/s in 10 seconds. What is the acceleration with which the car moved?

Solution

$$\text{Acceleration of the car} = \frac{V_2 - V_1}{t} = \frac{90 - 0}{10} \text{ m/sec}^2$$



②-- A car moves at speed 40 m/s, then the driver use the break to stop the car through 20 seconds. Calculate the acceleration which the car moves.

Solution

$$\text{Acceleration of the car} = \frac{V_2 - V_1}{t} = \frac{0 - 40}{20} = -5 \text{ m/s}^2 \text{ Negative acceleration}$$

③-If an object moves from rest regularly until its speed reaches 10 meters/second after two seconds from the start of moving, Calculate

Solution

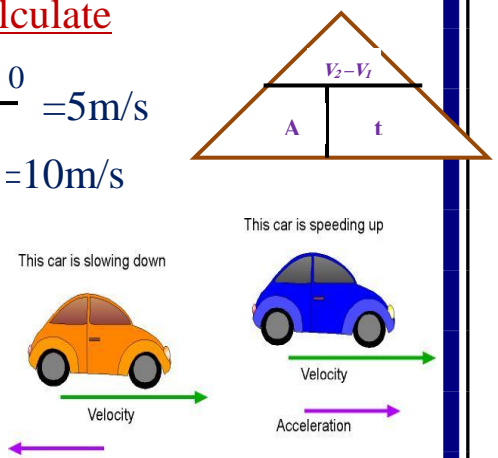
a -The change of speed through two seconds = $\frac{10 - 0}{2} = 5 \text{ m/s}$

b -The change of speed through one second = $\frac{10 - 0}{1} = 10 \text{ m/s}$

c -Acceleration = $\frac{10 - 0}{2} \text{ m/s}^2$

Whose movement starts from rest and then its speed increases to 12 through 3 seconds

$$\text{Acceleration is} = \frac{V_1 - V_2}{t} = \frac{12 - 0}{3} = 4 \text{ m / sec}^2$$



Positive acceleration

increases (Acceleration motion) تزايدية

The object's speed increases by equal values through equal time.

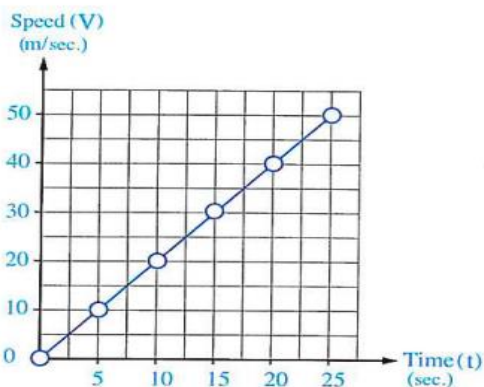
Its end final speed is greater than its start (initial) speed

Negative acceleration

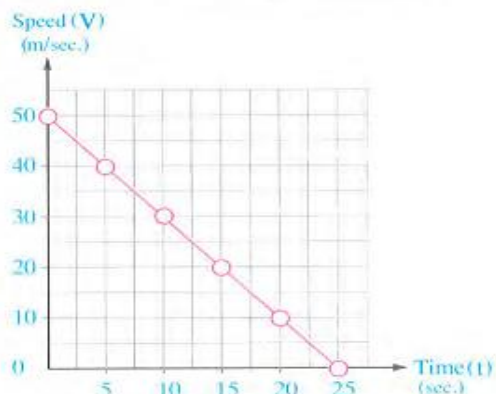
decreases (Deceleration motion) تناقصية

The object's speed decreases by equal values through equal time.

Its start (initial) speed is greater than its end final speed



[Speed – Time] graph of an object that moves at a **positive** acceleration.



[Speed – Time] graph of an object that moves at a **negative** acceleration.

We can conclude :

Initial speed

$$V_1 = \text{Zero}$$

$$V_1 = 50 \text{ m/sec.}$$

Final speed

$$V_2 = 50 \text{ m/sec.}$$

$$V_2 = \text{Zero}$$

Time period

$$\Delta t = 25 \text{ sec.}$$

$$\Delta t = 25 \text{ sec.}$$

Acceleration

$$a = \frac{50 - 0}{25} = + 2 \text{ m/sec}^2$$

$$a = \frac{0 - 50}{25} = - 2 \text{ m/sec}^2$$

- The sign **+** refers to the speed of the object increases regularly by 2 m/sec. each one second.

- The sign **-** refers to the speed of the object decreases regularly by 2 m/sec. each one second.

Positive acceleration

Negative acceleration

zero acceleration

What the meant by

1- An object moves with positive acceleration = 5m/sec²?

This means that the object's speed increase by 5m/sec each one second

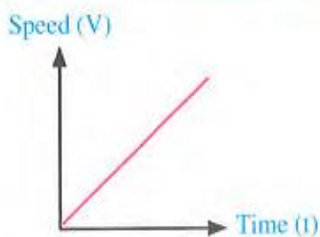
2- A body moves with negative acceleration = - 2m/sec²?

This means that the object's speed decrease by 2m/sec each one second

2- A body moves with zero acceleration?

This means that the object's speed constant
End final speed is = than its start (initial) speed

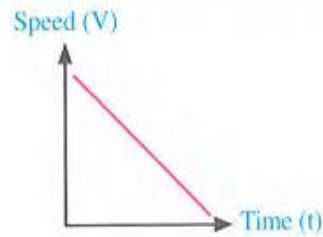
Positive acceleration



The object moves at (a non-uniform speed)
 $V(\text{initial}) < V(\text{final})$

So, it moves at an **accelerating** motion.

Negative acceleration

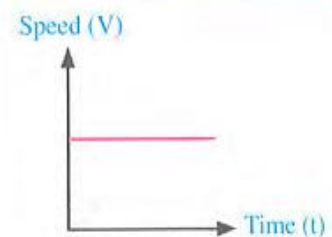


The object moves at (a non-uniform speed)
 $V(\text{initial}) > V(\text{final})$

So, it moves at a **decelerating** motion.

when

Zero acceleration



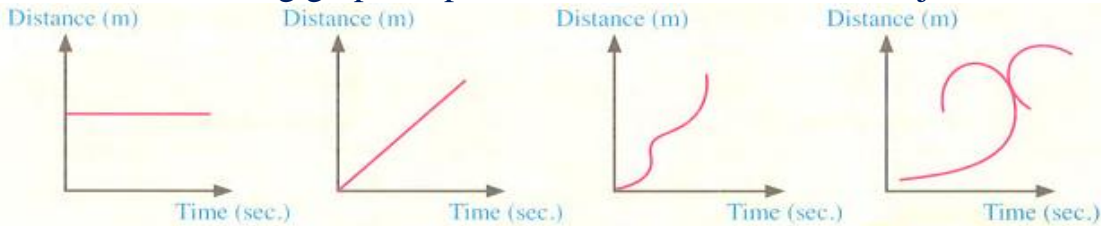
The object moves at (a uniform speed)
 $V(\text{initial}) = V(\text{final})$

? Questions on Lesson Two

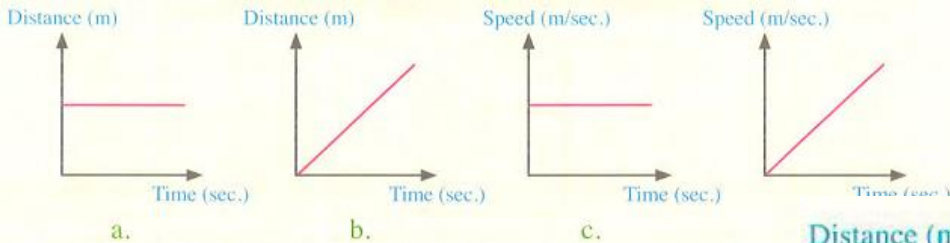
Unit one Lesson two

1- Choose the correct answer:

- (Distance -Time) graph for a regular motion at a constant speed is a
 a. straight line parallel to time axis. b. straight line parallel to the distance axis.
 c. straight line passing through the origin point.
 d. straight line cuts the time axis and the distance axis.
- For a car moves at a regular speed, the ratio d/t
 a. increases b. is constant c. decreases, . d. is doubled
- Which of the following graphs represents the movement of an object at a constant speed?

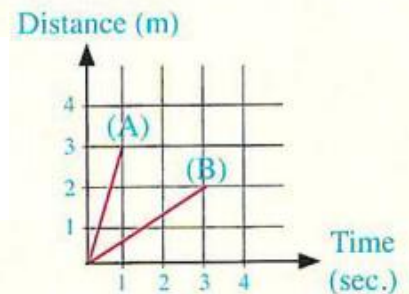


- The graph (.....) represents an object moves with uniform acceleration.



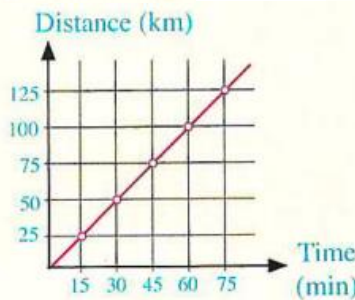
- In the opposite graph : The ratio between the speed of two objects ($\frac{A}{B}$) approximately is

- a. $\frac{9}{2}$ b. $\frac{9}{4}$ c. $\frac{3}{2}$ d. $\frac{9}{3}$



- From the opposite graph, what is the speed of the car ?..

- a. 25 kilometre per hour.
 b. 50 kilometre per hour.
 c. 75 kilometre per hour.
 d. 100 kilometre per hour.



- On recording the results of an experiment in which an object moves, the results were as follows:

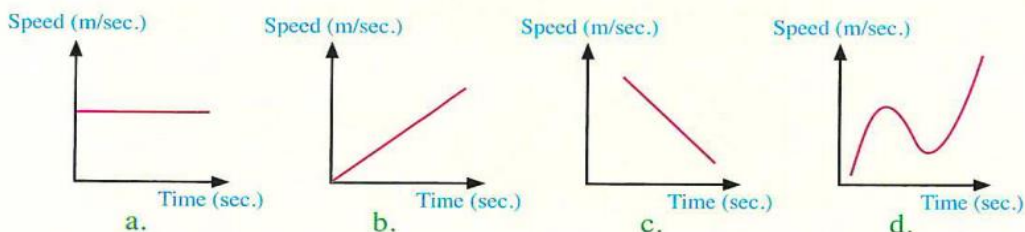
This object moves at.... Time (second)

- a. an increasing speed. b. a uniform acceleration
 c. a uniform speed d. an irregular speed.

Distance (m)	10	20	30
Time (sec.)	1	2	3

(Aswan, Red Sea 2015)

- Which of the following (speed - time) graphs describes the movement of an object moves at a constant speed ?



22. When the final speed of a moving object is less than its initial speed, therefore the object motion is described as .

- a. uniform speed.
- b. accelerating motion.
- c. decelerating motion.
- d. uniform acceleration.

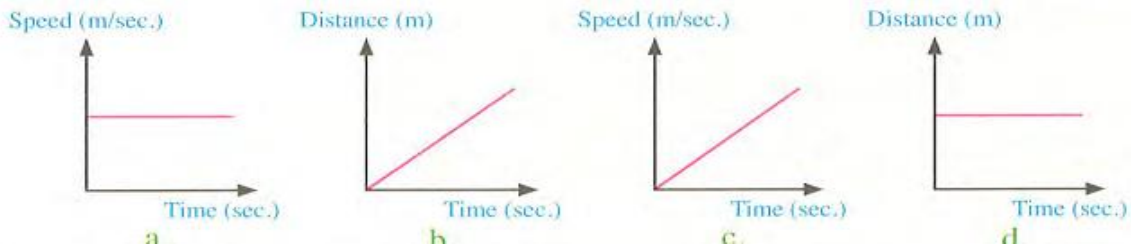
23. Movement is at a uniform acceleration

- a. if the object's speed changes at equal values in equal time intervals.
- b. if the distance that the object covers changes at equal values in equal time intervals
- c. if the average speed equals the regular speed.
- d. no correct answer.

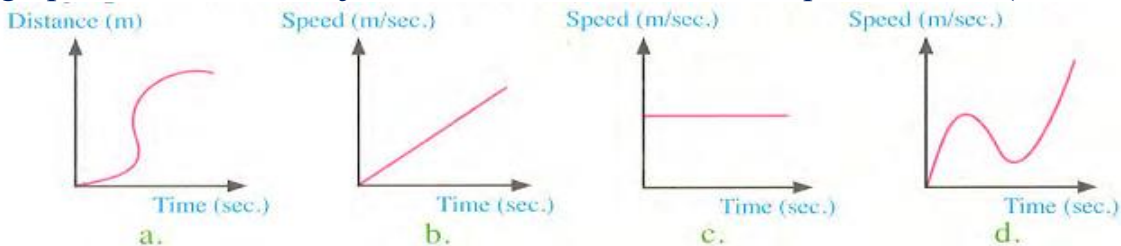
24. When a car moves by positive uniform acceleration of (6 m/ sec^2) this means :

- a. The car speed increases by the rate of (6 m/sec) every second.
- b. The car speed decreases by the rate of (6 m/sec) every second.
- c. The car covers 6 meters each second.
- d. The car acceleration increases by the rate of (6 m/ sec^2) every second.

25. Which of the following graphs represents the motion of a body at a uniform acceleration



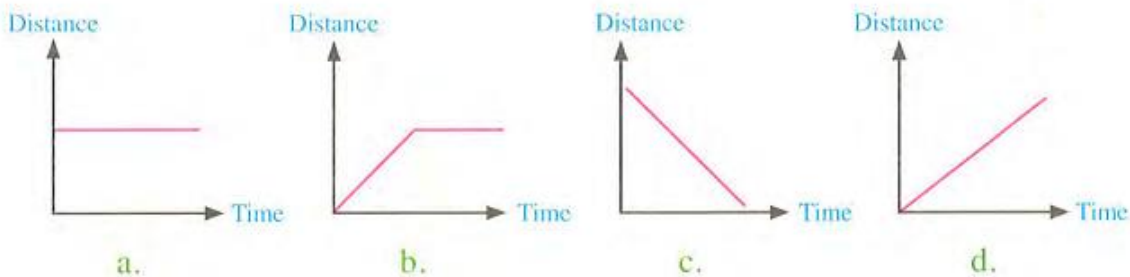
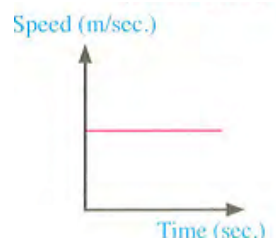
26. The graph..... is the object moves with acceleration equals zero. (Red Sea 2019)



27. A car takes 4 sec, to reach 9 times its initial speed, so the car moves with acceleration which its numeric value equals

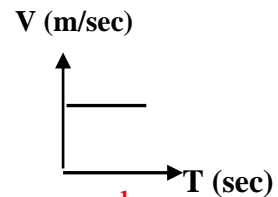
- a. quarter
- b. half
- c, three times
- d. double

28. The opposite graph represents the relation (speed-time) of a moving object. Which of the following graphs represents the relation (distance - time) of the same moving object



2. Correct the underlined words:

- To understand many of the physical phenomena, use acceleration between different variables to describe a specific phenomenon. (Sohag 2018)
- The (distance time) graph of an object moves at a regular speed is represented by a straight line parallel to the (Y) axis. (Sohag 2019)
- The distance covered by a body moving at a regular speed is inversely proportional to time needed to cover this distance
- The (speed - time) graph of a moving object at regular speed is represented by a straight line passes by the origin point. (Luxor 2015)
- The following graph represents a body at rest. (North Sinai 2020)
- Acceleration measuring unit is sec²/m.
- The car which begins its movement from rest, moves at uniform speed.
- When a moving object covers equal distances in equal periods of time, it is said that it is moving at a decreasing acceleration.
- Displacement is the value of the change of an object speed in one second (South Sinai 2019)
- Acceleration is constant if the object's speed increases by time. (New Valley 2018)



11. Acceleration (a) =
$$\frac{\text{Initial speed} - \text{Final speed}}{\text{Time } (\Delta t)}$$

12, When a body moves at an acceleration- 3 m/sec² this means that its initial speed is less than its final speed. (Sharkia 20216)

13. When a boat starts to move from rest till its speed becomes 2.5 m/sec. through 5 sec., this means that it moves with acceleration 10 m/ sec². (Ismailia 2017)

14. The results in the table in front of you represent the experiment of a moving object at decreasing speed.

Distance (m)	10	20	30	40
Time (sec.)	1	2	3	4

15. When an object moves at uniform acceleration. this means that the speed is zero. (Behira 2020)

16. When the driver of a moving car uses the brake to stop it after a period of time. its initial speed becomes equal to zero. (Cairo 2017)

3. Write the scientific term of each of the following :

- Mathematical methods that physicists use to predict the relation between certain physical quantities. (Fayoum 2018, Beni Suef 2019) (.....)
- The value (amount) of change in the object speed in one second. (Cairo 2017)
• The rate of change of speed. (.....)
- The measuring unit of acceleration. (.....)
- The change of the object speed by equal values (increases- decreases) through equal periods of time. (Cairo 2019) (.....)
- The acceleration by which an object moves when its initial speed is greater than its final speed. (.....)

- The acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time. (.....)
 - The acceleration by which an object moves when its speed decreases as time passes.
6. The acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time. (.....)
7. The acceleration by which an object moves when its final speed is less than its initial speed. . (Behira 2020) (.....)

4. Give reasons for :

1. Physicists use mathematical relations like graphs and tables in many physical phenomena. (Port Said 2020)
2. (Distance - Time) graph of an object that moves at a uniform speed is a straight line passing through the origin point. ((Sharkia 2019)Luxor 2020)
3. The ratio d/t remains constant in case of a body that moves at a uniform speed.
4. (Speed - Time) graph of an object that moves at a regular speed is a straight line parallel to the time axis.
5. When the driver of a moving car uses the brakes, we describe the car movement as a decelerating motion.
6. The body which moves at acceleration can't move at a regular speed. (Giza 2019. Damietta 2020)
7. The acceleration is positive when its value increases, while it is negative when its value decreases.
8. • The object which moves at a uniform speed, its acceleration equals zero(
 - A body moves at zero acceleration. (Dakahlia 2019)

5. What is meant by ... ?

1. The ratio d/t of a moving body is constant.
2. The slope of the straight line in graphic relationship (distance-time) of a moving body (Damietta 2011)
3. The change in the object speed per a unit time equals 100 m/ sec^2
4. A body moves at a uniform acceleration equals 3 m/sec^2 (Ismailia 2018)
5. A body moves by deceleration equals 2 m/ sec^2
6. A body moves at acceleration equals 3 m/sec
7. A car moves at 20 m/sec . and after 5 seconds, its speed becomes 15 m/sec
8. A body moves at zero acceleration. (Rehira2018)

6. What happens when .. ?

1. A body moves at a uniform speed (according to the acceleration). (Giza 2020)
2. The object's speed changes by equal values through equal periods of time.
3. The initial speed of a moving body is greater than the final speed
4. A car driver press the brake for stopping after a certain time. (Matrouh 2017)

7. Draw a graph that illustrates each of the following:

- 1 A body moves at a uniform speed.
2. A body at rest.

3. The relation (distance - time) for an object moves at a uniform speed and then is stops. (Dakahlia 2018)

4. A body moves at a regular speed 60 km/h. from the relation (Speed - Time)

5. A body moves at a regular acceleration 15 m/sec² from the relation (Speed - Time)

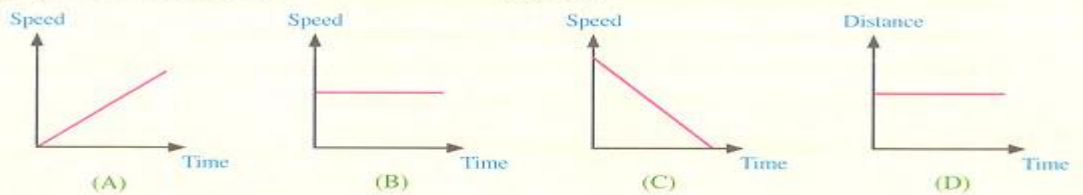
6. A body moves at zero acceleration. . (Kalyoubia 2017)

7. A body moves at a decreasing acceleration.

8. A body moves at an increasing acceleration. . (Suez 2020 Menofia 2020)

Which of the following graphs represents the movement of an object at : (Suez 2018)

- (1) An increasing acceleration. (2) A decreasing acceleration.
(3) A zero acceleration. (4) Rest.



8. Problems:

1. Calculate the acceleration of a moving car whose speed changes from 6 m/sec. to 12 m/sec during 3 sec.

2. A train moves from rest and its speed reaches 36 m/sec. in 9 seconds.

- (a) Calculate the acceleration. (b) What's the type of acceleration?

3. A special car can move from rest and its speed reaches 90 m/sec. in 10 seconds, What is the acceleration at which the car moved?

4. On a straight line there is a moving bus whose speed changes from 6 m/sec. to 12 m/sec. during a period of 3 seconds.

- (a) What is the amount of acceleration? (b) What is its type?

5. An object started its movement from rest and its speed changed into 36 km/h. in 10 seconds, calculate the object acceleration and state its type. (Sharkia, South Sinai 2017)

6. A car moves at a speed of 54 km/h then the driver used the brakes to decrease its speed to 36 km/h in two seconds. Calculate the time needed to stop the car from the moment of using the brakes. [knowing that the car moves at uniform acceleration].

7. A car moves at a speed 72 km/h, the driver uses the brakes, the car stops after 8 seconds, calculate the acceleration at which the car moves.

8. A car moved from rest and its speed increased to 10 m/sec in 4 seconds, then the car's speed decreased to 5 m/sec in 2 seconds.

Calculate: (1) The acceleration with which the car moved during :

- (a) the first period. (b) the second period.

(2) The time needed to stop the car if it moved in the same rate of change in speed in the second period,

9. A car moves at a speed of 40 m/sec. If the driver used the brakes to decrease the speed, so it decreases by 2 m/sec: Calculate its speed after 15 seconds from using the brakes

10. A car moves at a speed 50 m/sec. If the driver used the brakes to decrease the speed, so it decreases by 2 m/sec: Calculate its speed after 12 seconds from using the brakes:

Chapter (3) Physical quantities scalars and vectors

الكميات الفيزيائية القياسية والمتجهة

Examples of physical quantities are:

Mass – length – time – force.....



All physical quantities are classified into two types

- 1-Scalars physical 2- vectors physical

1- Scalar's physical quantities

It is the physical quantity that has magnitude only - no direction

<u>Scalar</u> physical quantities	Its measuring <u>unit</u>
Mass	Kilogram (kg)
Length=distance	Meter (m)
Speed	m/s or km/h
Time	Second or hour
Energy	Joule
Temperature	° C or F

2-vectors physical quantities

It is the physical quantity has magnitude and direction

<u>Vectors</u> physical quantities	Its measuring <u>unit</u>
Acceleration	m/s^2
Force	Newton
Velocity	m/s
Displacement	M
Wight	Newton

G.R.1- Length and time are scalar physical quantities?

Because they have magnitude only - and have no direction

G.R.2- Acceleration and force are vector physical quantities?

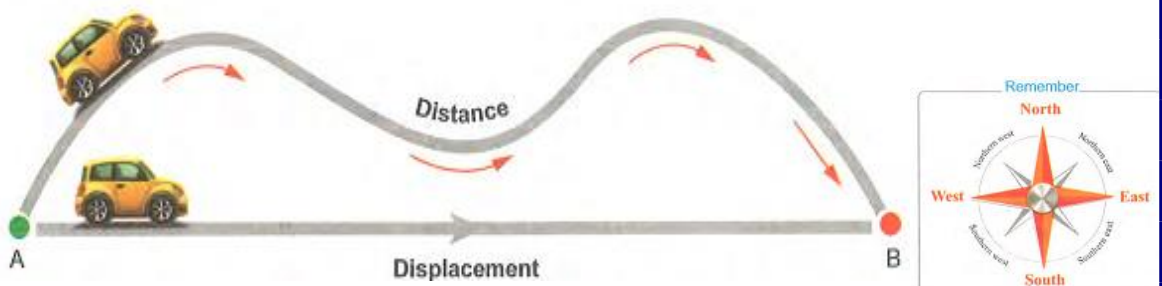
Because they have magnitude and direction

Different between distance and displacement

First: Distance and displacement. Second: Speed and velocity.

FIRST Distance and displacement

To understand the difference between distance and displacement, study the following examples



When a car moves from position (A) to position (B) as shown in the previous figure:

- The length of the curved line gives the distance covered by the car.
 - The straight line that starts from point (A) and ends at point (B) in the direction AB gives the displacement of the car.
- (The shortest length between (A) and (B) in direction AB) in the Eastward direction

Example A person wants to make a trip by his car from Cairo (starting point) to Tanta (end point).

- The distance of the trip depends on the path that the car takes

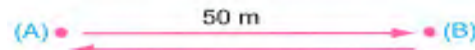


If the trip path is

<u>1-(Cairo Benha Tanta)</u>	<u>2- (Caire Zagazig Tanta)</u>
The distance covered $45+60=105$ km	The distance covered $80+85 = 165$ km

- You notice the difference in the distance between Cairo and Tanta (although the two cities remain constant), this difference in distance depends on the trip path.
- The shortest straight line that starts from Cairo and ends at Tanta represents the displacement of Tanta from Cairo which does not change. i.e. The displacement = 93 km in the Northern west direction "Vector".

Example



- When a body moves in a straight line from (A) to (B) covering 50 metres, then it returns back to (A).
 - The distance covered from (A) to (B) then to (A) = $50+50=100$ m.
 - The displacement from (A) to (B) then to (A) = Zero, because the body returns back to its starting point (A)
- i.e. The distance = The displacement (numerically) when the body moves in a straight line in one direction, this means that:
- The distance covered from (A) to (B) = 0
 - The displacement from (A) to (B) = in direction AB.

<u>Point of comparison</u>	distance	displacement
<u>definition</u>	It is the actual length of the path that a moving object takes from the start (primary) point of movement to the ending (final) point	It is the shortest straight line between two positions. from the start (primary) position of movement towards the end (final) position
<u>It is determined by</u>	Magnitude only	Magnitude and direction
<u>Its kind</u>	Scalar quantity	Vector quantity
<u>Measuring unit</u>	Meter or kilometer	Meter or kilometer
<u>Its simple</u>	d	d

What is the meant by 1-The distance covered by an object equals 10 km.

This means that the actual length of the path that a moving object covers from the starting point to the ending point equals 30 km.

2-The displacement of an object equals 200 km in the west direction.

This means that the distance covered in the west direction from the primary position of movement towards its final position equals 200 km.

G.R. 1-Distance is a scalar physical quantity

Because it is identified by magnitude only

G.R. 2-Displacement is a vector physical quantity.

Because it is identified by magnitude and direction

When each of the following happens...?

1-The displacement happened equals the distance covered .

When the object moves in a straight line in one direction

2-The amount of the displacement happened is less than the distance covered.

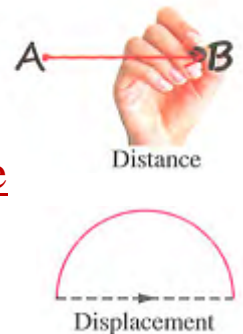
When the object moves in a curved path (or any path doesn't represent a straight line).

3-The displacement of 2 different objects are equal.

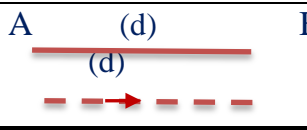
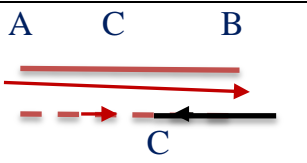
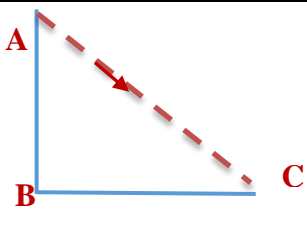

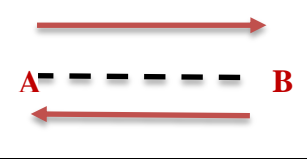
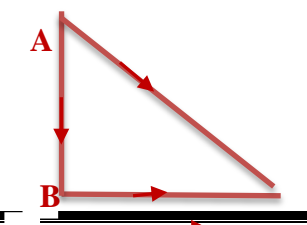
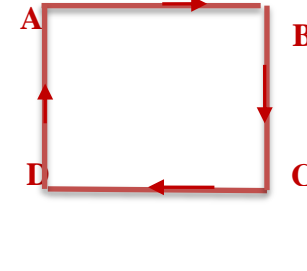
When they have the same magnitude and move in the same direction

4-The displacement of a moving object equals zero.

When the object returns to its primary position of movement, where the final position of movement is the same of its primary position.



Guidelines to solve problems on distance and displacement In straight line

If a body move in	Figure	Distance (d)	Displacement (d) →
1- In a straight line in one direction (From A to B)		AB	\vec{AB} In the east direction
2- In two opposite direction (From A to B) then from B to C)		$AB + BC$	$\vec{AC} = \vec{AB} - \vec{BC}$ In the east direction
3- In two perpendicular direction (From A to B) then from B to C)		$AB + BC$	(according to Pythagorean theorem) $\sqrt{(AB)^2 + (BC)^2}$ In the southern east direction.
4- In three perpendicular direction (From A to B) then from B to C then C to D)		$AB + BC + CD$	\vec{AD} In the south direction
5- In more than one direction, then return back to starting point (From A then return back to A)		$2AB$	<u>zero</u>
		$AB + BC + CA$	
		$AB + BC + CD + DA$	

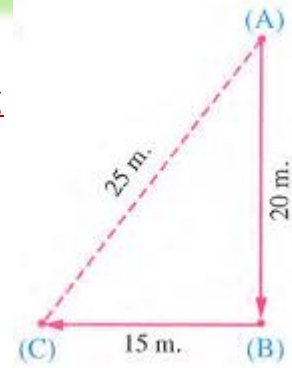
Problems

1-If a body moved from point (A) to point (C) passing by point (B) as shown in the figure. Calculate

1. Distance covered by the body.
2. Displacement done by the body.

Solution

1. Distance= $20+15=35$ m.
2. Displacement= 25 m in the direction (AC).

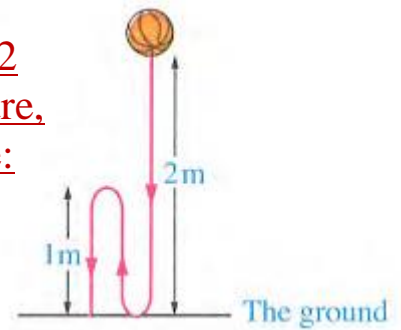


2-A rubber ball fell downward from a height equals 2 metres from the ground, then returned upward 1 metre, then fell down again to rest on the ground. Calculate:

1. Distance.
2. Displacement.

Solution

1. Distance= $2+1+1=4$ metres.
2. Displacement= 2 metres downward

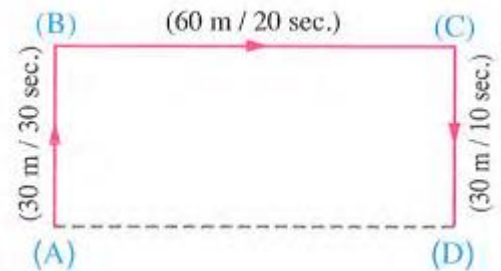


3-A car starts motion from point (A) and covers 30 metres northward to point (B) within 30 seconds, then 60 metres eastward to point (C) within 20 seconds, and then 30 metres southward to point (D) within 10 seconds. Find:

1. Total distance covered by this car.
2. Total time that car took to cover this distance.
3. Displacement and what is its direction?

Solution

1. Total distance = $30+60+30=120$ m.
2. Total time = $30+20+10=60$ sec.
3. Displacement = 60 m in the direction (AD).



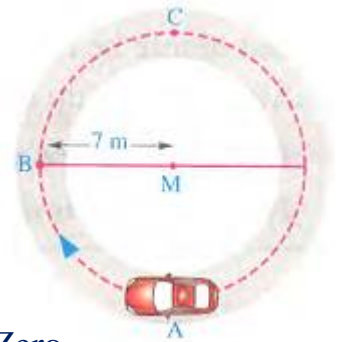
Guidelines to solve problems on distance and displacement In circular path

The body movement	Figure	Distance (d)	Displacement (d) \rightarrow
1- In complete circle From (A : B:C:D:A)		The circumference of the circle = $2\pi r$ $\pi = \frac{22}{7}$ $r = \text{radius}$ $2\pi r$	<u>zero</u>
2- In a $\frac{3}{4}$ circle From (A : B:C:D)		$\frac{3}{4}$ circumference of the circle = $\frac{3}{4} \times 2\pi r$ $\pi = \frac{22}{7}$ $r = \text{radius}$ $\frac{3}{2} \times \pi r$	$AD = \sqrt{(AM)^2 + (DM)^2}$
3- In a $\frac{1}{2}$ circle From (A : B:C)		The circumference of the circle = $2\pi r$ $\pi = \frac{22}{7}$ $r = \text{radius}$ πr	The diameter $AC = 2r$ in the east direction \rightarrow
4- In $\frac{1}{4}$ circle From (A : B)		The circumference of the circle = $2\pi r$ $\pi = \frac{22}{7}$ $r = \text{radius}$ $\frac{1}{2} \times \pi r$	$AB = \sqrt{(AM)^2 + (BM)^2}$

problems

1- The opposite figure represents a car motion on a circular path from point (A). Calculate the distance and the displacement when the car moves in

1-A complete circle . 2-A $\frac{1}{2}$ circle 3-A $\frac{1}{4}$ circle



Solution

.1-A complete circle

*The distance covered (d) *
=The circumference of the circle
 $=2\pi r = 2 \times \frac{22}{7} \times 7 = 44 \text{ m.}$

The displacement (d) = Zero.

2-A $\frac{1}{2}$ circle.

The distance covered (d)
 $=\frac{1}{2}$ the circumference of the circle
 $\frac{1}{2} \times 44 = 22 \text{ m.}$

The displacement (d) = (AC)
= The diameter of the circle
 $= 2 r = 2 \times 7 = 14 \text{ m}$ in the north direction

3-A $\frac{1}{4}$ circle.

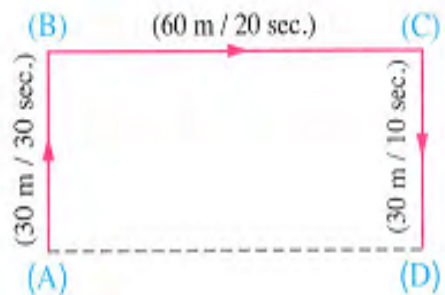
• The distance covered (d)
 $= \frac{1}{4}$ the circumference of the circle
 $= \frac{1}{4} \times 44 = 11 \text{ m.}$

• The displacement (\vec{d}) = \overline{AB}
[According to the Pythagorean theorem]
 $= \sqrt{(AM)^2 + (MB)^2} = \sqrt{(7)^2 + (7)^2} = 9.9 \text{ m}$
in the northern west direction.

SECOND Speed and velocity

- To know what is the difference between speed and velocity.

Study the opposite figure which represents the movement of an object from the primary position (A) to the final position (D) passing by positions (B) and (C). [The path of this object is A \rightarrow B \rightarrow C \rightarrow D. We conclude that:



Speed	Velocity
Total distance covered by the object (d) AB+BC+ CD $30+60+30=120 \text{ m.}$ Total time taken by the object to cover this distance = $30+20+10= 60 \text{ sec.}$	The displacement covered by the object (d) = AD = 60 m in the eastward direction. Total time=60 sec.
The total distance divided by the total time is known as the <u>Average speed</u> (V) = $\frac{\text{Total distance (d)}}{\text{Total time (t)}}$	The displacement divided by the total time is known as the <u>Average velocity</u> (V) = $\frac{\text{Displacement (d)}}{\text{Total time (t)}}$

What is meant by The average velocity of a moving car is 60 km/h?

This means that the displacement covered by a moving car is 60 km in one hour

Point of comparison	Average speed (V)	Average Velocity (V)
definition	It is the distance covered in a unit time	It is the displacement covered in a unit time
It is determined by	Magnitude only	Magnitude and direction
Its kind	Scalar quantity	Vector quantity
Measuring unit	m/s or km/h	m/s or km/h

What is meant by...?

A body covered 50 m northward direction in 5 sec

$$V = \frac{(d)}{(t)} = \frac{50}{5} = 10 \text{ m/sec northward.}$$

This means that the velocity of this body equals 10 m/sec in northward direction

The measuring units of velocity are m/sec, or km/h

(The same measuring units of speed)

The velocity is the speed to a given direction

(When the body moves in a straight line in one direction).



Velocity is a vector physical quantity and to determine it accurately, it is necessary to identify its magnitude and direction.

Such as: When we say that the predator (Cheetah) is one of the fastest wild animals. its speed is about 27 m/sec., but if we want to represent its velocity, we say that its velocity is 27 m/sec, in a certain direction.



We can say that Cheetah's velocity = 27 m/sec. in the westward direction.

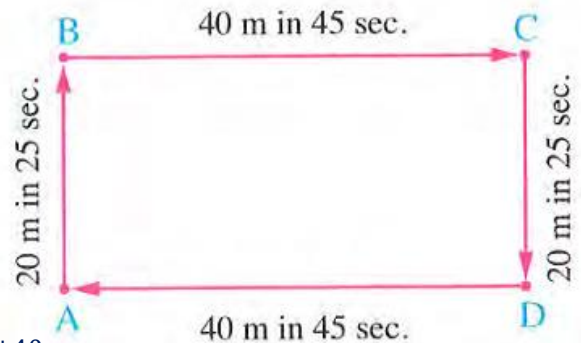
Problems

1-In the opposite figure, a person starts moving from point (A) and returns back to the start point through B, C and D. Calculate:

1. Average speed.
2. Velocity (Give a reason).

Solution

1. Average speed (V) = $\frac{\text{Total distance (d)}}{\text{Total time (t)}} = \frac{20+40+20+40}{25+45+25+45} = 0.8\text{m/sec}$
2. Velocity Zero. Because the displacement equals zero.

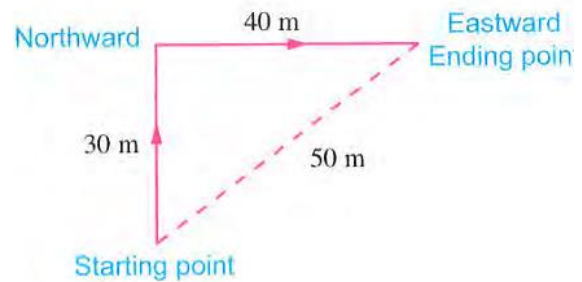


2-In the opposite figure, a body covered 30 metres northward within 30 seconds, then 40 metres eastward within 20 seconds and stopped at a point about 50 metres from the starting point. Calculate:

1. Total distance moved by the body.
2. Average speed.
3. Displacement.
4. Average velocity

Solution

1. Total distance = $30+40=70$ m.
2. Average speed (V) = $\frac{\text{Total distance (d)}}{\text{Total time (t)}} = \frac{30+40}{30+20} = 1.4$ m/sec
3. Displacement = 50 m in the northern east direction.
4. Average velocity (V) = $\frac{50}{50} = 1$ m/sec. in the northern east direction.

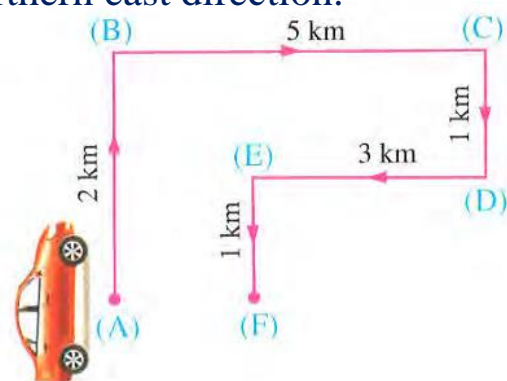


3-In the opposite figure, a car starts motion from point (A) to point (F) passing by points (B), (C), (D) and (E). Calculate:

1. Total distance covered by the car.
2. Displacement done by the car.
3. Velocity if you know that the total time spent by the car equals 0.033 hours

Solution

1. Total distance = $2+5+1+3+1=12$ km.
2. Displacement = $5-3=2$ km in eastward direction AF.
3. velocity (V) = $\frac{\text{Displacement}}{\text{Total time}} = \frac{2}{0.033} = 60.6$ km/h. in eastward direction AF.



Importance of wind velocity for flights:

- The movement of wind arises from the difference of air pressure in different regions above the Earth's surface.
- The movement of the Earth around itself from west to east affects the direction of wind, which affects the value of velocity of the plane.

So. Pilots take in consideration the velocity of the wind.

Application: The opposite figure shows the flight path of a plane covered a fixed distance between the two cities (1) and (2) back and forth

What happens when the plane takes off...?

* In the same direction of wind from city (1) northeast direction to city (2).
The value of its velocity increases, so the time of the trip decreases and therefore the amount of the fuel consumed decreases,

* In the opposite direction of wind from city (2) southwest direction to city (1).

The value of its velocity decreases due to the resistance of the wind to the movement of the plane, so the time of the trip increases and therefore the amount of the fuel consumed increases.

G.R. Pilots take in consideration the velocity of the wind.

Because the direction of wind affects the velocity of the plane and hence the time of the trip and the amount of the fuel consumed.

16. The distance and displacement are equal when the body moves in a in one direction

- a. zigzag a. in one direction. c. straight line

17. From the opposite figure, when an object moves from point (A) to point (D) passing through points (B) and (C), the displacement from (A) to (D) equals in the direction (AD).

- a. 20 cm. b. 40 cm. c. 60 cm. d. 80 cm.

18. In the opposite figure, a body starts its motion from point (A) directed to the south to point (B), it covers (A) a distance of 40 m, then it is directed to the east to point (C) which far 30 m apart from the point (B), so

(A) The value of the body displacement equals

- a. the length of AB. b. the length of BC.
c. the length of AC. d. the length of AB + BC.

(B) The length of the distance covered equals

- a. the length of AB. b. the length of BC.
c. the length of AC. d. the length of AB+ BC.

19. In the opposite figure, a body starts its motion from point (A) to (B), then to point (C), then returned to point (A), so the distance covered equals..... meter

- a. 70. b. 30.
c. 50. d. 40.

20. In the opposite figure, an object starts movement from point (A) to point (C) passing through point (B), so its displacement is..... m

- a. 70 b. 30 c. 50 d. 40 (Men 2018).

21. A body moved a distance of 20 metres in a straight line in the same direction, so the amount of its displacement is ..

- a. 20 m. b. 40 m. c.80 m d. zero.

22. If a person moves 8 m to the north, then 4 m to the east, then 8 m to the south, his displacement equals in the east direction.

(Luxor 2013)

- a. 20 m b. 4 m c. 8 m d. 12 m

23 is considered from the fastest wild animals.

- c. Cheetah. a, Wolf b. Lion d. Elephant

24. Measurement unit of velocity is.....

_(Matrouh 2016):

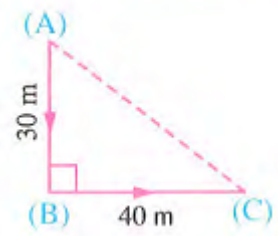
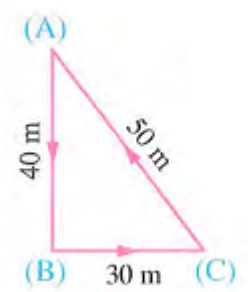
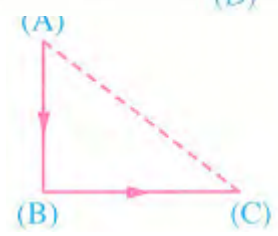
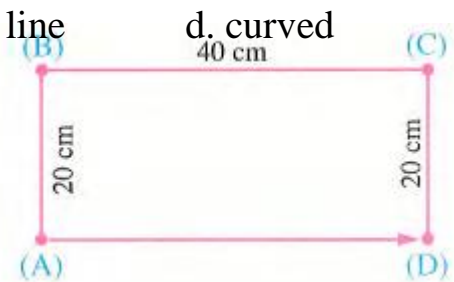
- a. m. sec. b. m/sec. c. m. d. m/sec²

25. The average velocity is determined by the relation.....

- a. distance/time. b. distance x time. c. displacement/time. d. speed/time.

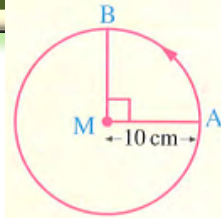
26. The plane which flies against the wind direction than that which flies in the same direction of wind.

- a. consumes more fuel b. takes longer time
c. its speed increases d. (a) and (b) are correct



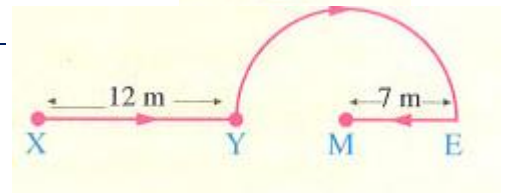
27. From the opposite figure, when an object moves from point (A) to point (B), the displacement from (A) to (B) equals.....cm

- a. $10\sqrt{2}$ b. 10 c. 20 d. 31.4



28-In the opposite figure, the object moves from point (X) to point (M) that represents centre of sphere passes through points (Y) and (E), so its displacement =

- a. 5 m b. 7 m
c. 12 m d. 19 m

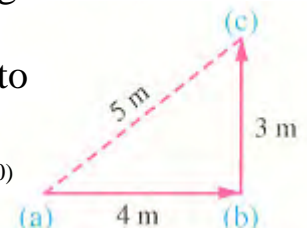


2. Choose from column (B), what suits it in column (A)

(A)	(B)
<u>Distance</u>	a. is the shortest distance covered by the object in a fixed direction
<u>Speed</u>	b. is the distance moved through a unit time
<u>displacement</u>	c. is the speed of a moving object relative to the observer.
<u>Relative speed</u>	d. is the actual length of the path that a moving object takes from the start point of movement to the end point.

3. Correct the underlined words :

- The distance is a vector physical quantity and its measuring unit is the metre,
- The length is a vector quantity.
- The force is from scalar physical quantities.
- The time is a vector physical quantity.
- The distance is a vector quantity and the displacement is a scalar quantity.
- Mass is a vector physical quantity and its measuring unit is kilogram.
- Speed is a vector physical quantity.
- In the opposite figure an object moves eastward from point (a) to point (b) during two seconds, then to point (e) northward in 3 seconds, so its velocity through that period is 1.4 m/sec. (Kalyoubia 2020)
- Displacement is characterized by both magnitude and time.
- The vector physical quantities need magnitude only to be determined.



11. Velocity = $\frac{\text{Distance}}{\text{Total time}}$ (Aswan 2019)

12. Velocity is the quantity that we can identify it accurately by knowing its magnitude only. (Kalyoubia 2014)

13. Regular speed is the value of displacement in one second. (Cairo 2020)

14. To determine the density we must know its magnitude and direction.

15. Acceleration is the actual length of the path that a moving object takes from the starting point of movement to the end point. (Sharkia 2019/ Gharbia 2020)

16. The value of distance is the length of the shortest straight line between two positions. (Menia 2019/Behira 2020)

17. A person moves 40 m northward then returned 20 m southward, so his displacement is 60 m northward. (Qena 2019)

18. A racer covered 50 m northward, then 10 m eastward, then 50 m southward and then returned back to the starting point, so the value of his displacement equals 300 m.
19. When an object moves in a curved line in one direction, the covered distance is equal to the displacement.
20. The regular speed is the scalar speed, but in a given direction.
21. The displacement measurement unit is m/sec.
22. Velocity is the rate of change of acceleration.
23. The measuring unit of velocity is sec./m.
24. Lion is considered one of the fastest wild animals.
25. Pilots take in consideration the uniform speed of the wind.

4. Write the scientific term of each of the following :

1. •The physical quantity that has magnitude only and has no direction.
- The physical quantity which magnitude is enough for identifying it.
2. The physical quantities that include time, length and mass. (Ismailia 2013)
3. The physical quantity enough to identify its magnitude as well as direction. (Suez 2016)
4. The physical quantity that refers to the change in the speed of an object in a unit time.
5. The distance covered in a certain direction between the starting point and the ending point. (Luxor 2018/Qena 2019/ Giza 2020)
6. The vector quantity which is measured in km/h.
7. The vector physical quantity which is measured in m/sec^2
8. The length of the shortest straight line between primary position and final position. (Menofia 2018) (The New Valley 2017,2019)
9. The actual length of the path that a moving object covers from the starting point to the ending point of the motion. (New Valley 2020)
10. The rate of change of displacement. (Behira 2014 / Matrouh 2019)
11. The displacement covered in one second. (Menia, Qena 2020)
12. The predator wild animal that its velocity is represented by determination the direction of its motion. (Fayoum 2015)

5. Give reasons for :

1. Mass, length and time are considered scalar physical quantities. (Sohag 2015, 2016) _
2. Force is a vector physical quantity. (Menofia 2019/Suez 2020)
3. Distance is a scalar quantity, while displacement is a vector quantity.
4. Acceleration is a vector physical quantity. (North Sinai 2020) (Beni Suef 2015)
5. The velocity is a vector physical quantity. (North Sinai 2018, 2019)
5. When an object moves, where its starting point is the ending point, its velocity is zero
6. The amount of consumed fuel by a plane flies between two cities differs according to the wind direction. (Menofia 2019/ Menia 2020)
7. Pilots take in consideration the velocity of the wind during their flights.

6. What is meant by.?

1. Length is a scalar physical quantity.
- 2 Force is a vector physical quantity

3. A The body moves 60 metres and the value of the displacement equals zero
4. The displacement of an object is 50 metres in east direction.
5. Displacement equals the covered distance.
6. A body covered 40 m northward direction in 20 sec.
7. The distance which an object travels in the east direction equals 30 m.
8. The value of the length of the shortest straight line between two positions equals 5 m.

7. Problems :

1. A rubber ball falls from a height of 10 metres, then it rebounds from the ground upward distance of 5 metres, then falls down to rest on the ground. Calculate
 - (a) The distance covered,
 - (b) The displacement.
2. If you move to a distance of 5 metres northward and your colleague moves to a distance of 5 metres southward, compare between :
 - (a) The distance that you covered and the distance that your colleague covered.
 - (b) The displacement that you covered and the displacement that your colleague covered.
3. An object moves in a straight line northward at a speed of 5 m/sec, and its speed reaches 20 m/sec. through 3 seconds. Calculate the following :
 - (a) The velocity after 3 seconds.
 - (b) The acceleration of the moving object.
4. An object moves 8 m to the east then moves 5 m to the west determine.

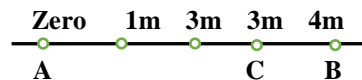
The magnitude and the direction of the object's displacement. (Menofia 2019)

5. A body moves from point (A) to point (B), then change its direction to point (C) through 10 sec. Calculate.

(a) Total distance which the body moved.

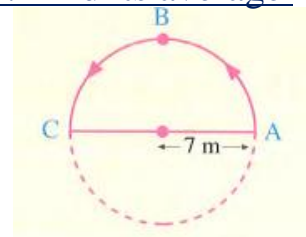
(b) Displacement done by the body.

(c) The velocity. (Damietta 2016 Ismailia 2019)



6. A car covered 600 m in eastward direction within 60 sec. Find its average velocity.

7. In the opposite figure, a body moves in a circular path, its radius = 7 m from (A) to (C) passing by point (B) within 3.5 sec. If you know that the circumference of the circle = $2\pi r$ (where $\pi = \frac{22}{7}$, r = radius).



Calculate : (a) Total distance. (b) Displacement.

(c) Velocity. (Kalyoubia 2015)

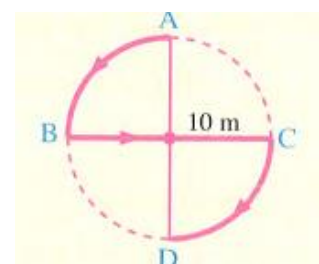
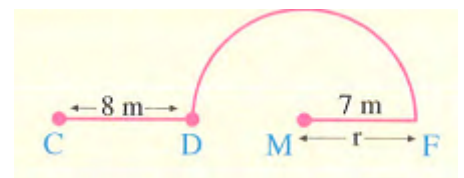
8. In the opposite figure : An object is moving from point (C) to point (M), passing by two points (D, F) in 5 sec.,

Calculate : (a) The covered distance.

(b) The velocity (Luxor 2020)

9. In the opposite figure, a car moves in a circular path whose radius is 10 metres, the car movement changed as in the opposite figure if you know that the circumference of the circle $2\pi r$ where ($\pi = 3,14$), Calculate :

(a) The total distance covered by the car from point (A) to point (D) passing by points (B) and (C). (b) Displacement.



Unit (2) Light Energy

Chapter (1) Mirrors

Light reflects when it falls on a reflecting surface such as mirrors or any other smooth shiny surfaces.

For example:

<u>If you look at a mirror</u>	<u>If you look at a smooth shiny surface (like a still water surface)</u>
you can see	you can see
The image of your face in the mirror	The image of the constructed buildings and trees in this still water surface

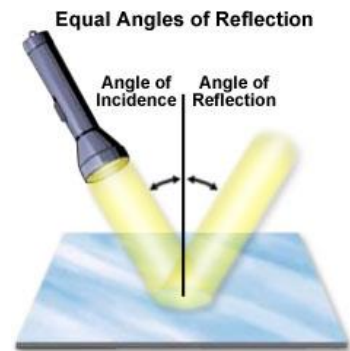


Light Reflection

It is the phenomenon of the light bouncing off (return back) in the same medium when it meets a reflecting surface

Concepts concerning reflection of light:

المفاهيم المتعلقة بانعكاس الضوء



—The normal—

It is the perpendicular line to the reflecting surface on the point of incidence.

—The incident light ray—

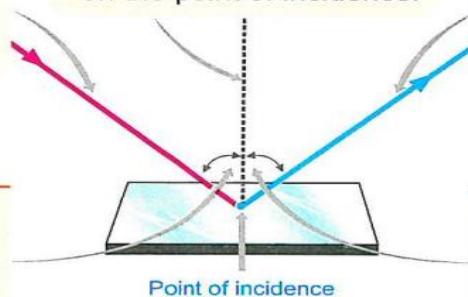
It is the light ray that falls on the reflecting surface.

—The reflected light ray—

It is the light ray that bounces (returns back) from the reflecting surface.

—Angle of incidence—

It is the angle between the incident light ray and the normal.



—Angle of reflection—

It is the angle between the reflected light ray and the normal.

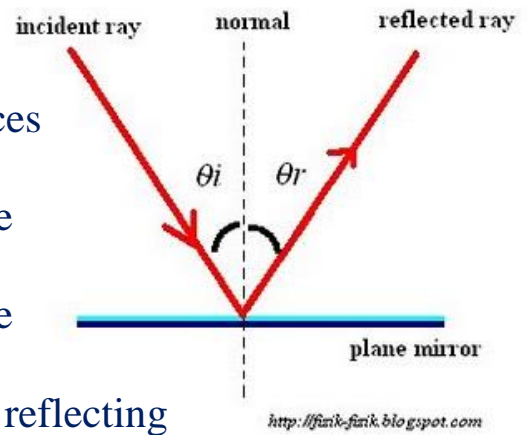
1-The incident ray: it is the light ray that falls on the reflecting surface

2-The reflected ray: it is the light ray that bounces (return back) from the reflecting surface

3-Angle of incidence: it is the angle between the incident ray and the normal

4-Angle of reflection: it is the angle between the reflected light ray and the normal

5-The normal: it is the perpendicular line to the reflecting surface on the point of incidence



What is the meant by

1- Angle of incidence of light ray is 60°?

It meant that the angle between the incident ray and the normal = 60°

2- The angle between the reflected ray and the normal = 30° ?

It meant that Angle of reflection of light ray is 30°

3- The angle of incident of light ray equal zero?

It meant that this angle of light ray fall perpendicular of a reflecting surface



Laws of the reflection of light

1 -First law : angle of incident = angle of reflection.

2 -Second law: the incident light ray and the reflected light ray and the normal all lie in one plane perpendicular to the reflecting surface

G.R. The incident ray which falls perpendicular on a reflecting surface reflects on itself?

Because the angle of incident and the angle of reflecting = zero

Activity The two laws of light reflection.

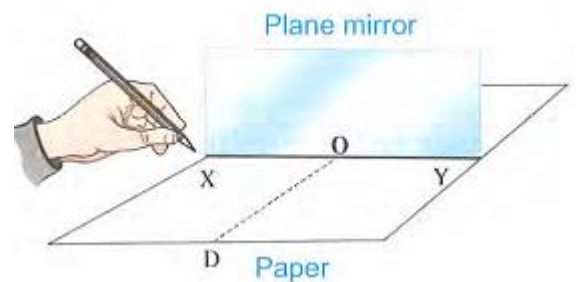
Materials: A plane mirror -Protractor -White paper sheet- Ruler -Pins

Steps:

1. Draw a straight line (XY) on the paper, then fix the plane mirror in a perpendicular position on this line as shown in the opposite figure.

2. Draw a line (OD) [which represents the normal] perpendicular on the line (XY).

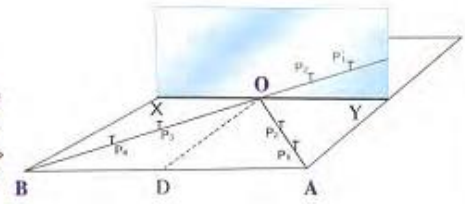
3. Draw a straight line (AO) [which represents the incident light ray on the mirror], which makes an angle & AOD with the normal [which is



called the angle of incidence] then, measure this angle and place two pins (P_1) and (P_2) horizontal on the line

4. Look at the other side of the mirror and see the images of the pins (P_1) and (P_2) then place two pins (P_3) and (P_4) to be in a straight line with (P_1) and (P_2)

5. Lift the two pins (P_1) and (P_2) and connect between their positions with a straight line. Extend the line to meet the reflecting surface at point (O) [the line (BO) represents the reflected light ray.



6. By using the protractor, measure the angle $\angle BOD$ that (BO) makes with the normal [which is called the angle of reflection].

Observation: The angle of incidence = The angle of reflection.

7. Repeat these steps by changing the value of incidence angle ($\angle AOD$) by using the protractor and assign each time the angle of reflection ($\angle BOD$).

Observation: Angle of reflection changes by changing the angle of incidence, where they are always equal.

Conclusion:

-Reflection of light is governed by two laws:

First law: Angle of incidence = Angle of reflection.

Second law: The incident light ray, the reflected light ray and the normal line to the reflecting surface at the point of incidence all lie in one plane perpendicular to the reflecting surface.

problems

1-Find the angle of incident and angle of reflection for all the followings

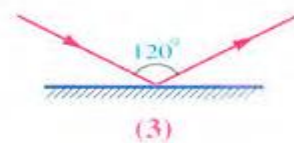
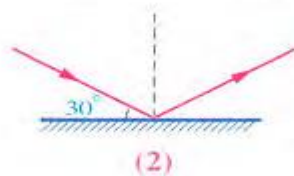
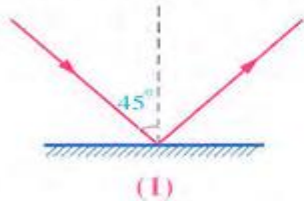


Fig. (1):

Angle of incidence =
Angle of reflection ..
Angle of reflection = 45°

Fig. (2):

The angle between the incident ray and the reflecting surface = 30° .
The angle of incidence =
The angle of reflection =
 $90^\circ - 30^\circ = 60^\circ$

Fig. (3):

The angle between the incident ray and the reflected ray = 120° .
Angle of incidence =
Angle of reflection = $120^\circ = 60^\circ$

2-In the opposite figure

An incident light ray fall von mirror (A) and then reflected on mirror (B) calculate each the following

A-The angle of reflection on mirror (A)

B-The angle of incident on mirror (B)

Solution

A-Angle of incident =angle of reflection

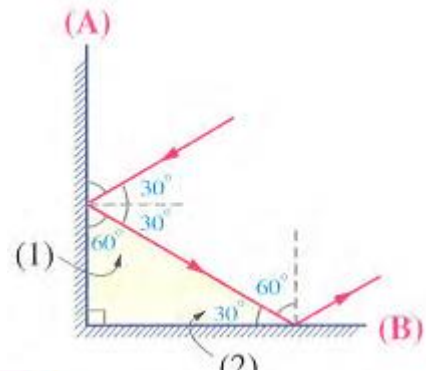
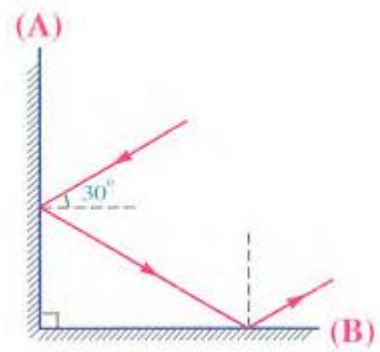
The angle of reflection on mirror (A) = $30^\circ=30^\circ$

B-The angle (1) between the reflected light ray and the mirror (A) = $90^\circ-30^\circ=60^\circ$

The sum of angles of triangle= 180°

The angle (2) between the incident light ray and the mirror (B) = $180^\circ-(60^\circ+90^\circ)=30^\circ$

The angle of incident on mirror (B) = $90^\circ-30^\circ=60^\circ$



Mirrors are divided into two main types

First
Plane mirrors

Second
Spherical mirrors

A. Concave mirror

B. Convex mirror

First plane mirror

plane mirror is a piece of plane glass, painted from behind with a thin layer of silver metal to give glass a bright surface that reflects the incident rays that fall on it

Activity The properties of the image formed by the plane mirror

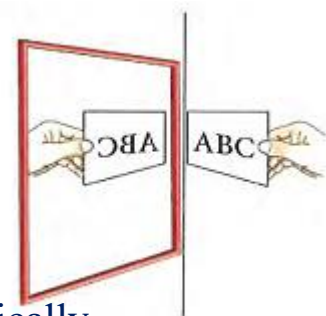
The material: A plane mirror - white paper sheet

Pins - ruler - protractor

The steps:

1- Place the card in front of the mirror that is fixed vertically.

2-Record your observation on the properties of the image formed in the plane mirror



Observation & Conclusion:

The properties of the image formed by a plane mirror are:



The properties of the image formed by the plane mirror

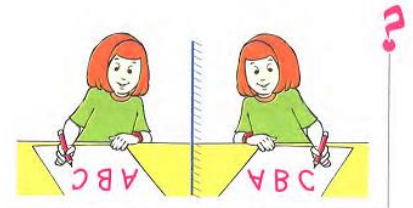
- 1- The image is upright
- 2- The image is equal to the object.
- 3- The image is laterally inverted.
- 4 - The image is a virtual image (cannot be received on a screen)
- 5 - The distance of the object to the mirror = the distance of its image to the mirror.
- 6- The straight line connecting the object and its image is perpendicular on the surface of the mirror



G.R. The word Ambulance is written in a converted way on the Ambulance car?

Because the mirrors of the cars in front of the ambulance car, form a laterally inverted image for this word, and thus it appears laterally corrected to the drivers.

The opposite figure shows a girl and her image by a plane mirror. Check whether the girl is right-handed or left-handed.



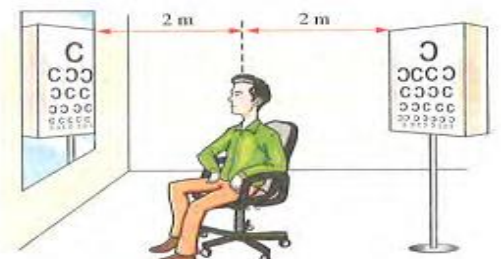
Problems

1- If a person stands at a distance of 2 m from a plane mirror. What is the distance between the person and his image?

Solution The distance between the person and the mirror = The distance between his image and the mirror, so the distance between the person and his image = $2+2=4$ m

The distance between Ramy and his image $3.5+3.5=7$ m.

2- From the opposite figure, Calculate the distance between Samy and the image of the vision chart in the plane mirror.



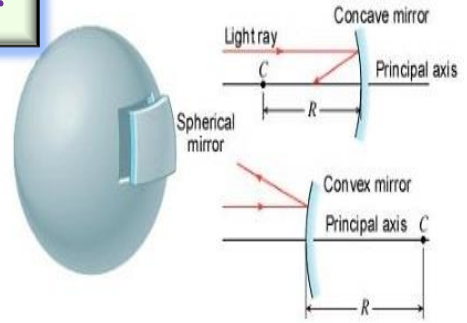
Solution

- The distance between Samy and mirror (d_1) = 2 m.
- The distance between mirror and vision chart = the distance between mirror and image of vision chart (d_2) = $2+2=4$ m.
- The distance between Samy and image of vision chart (d) = $d_1+d_2=2+4=6$ m.

Second The spherical mirror

The spherical mirrors

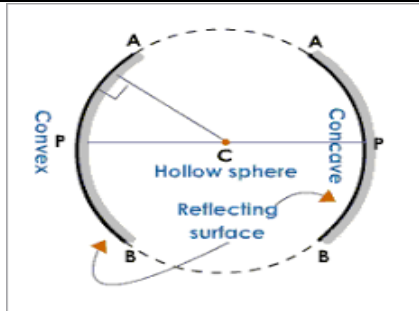
It is a mirror that its reflecting surface is a part of a hollow sphere



- There are two types of the spherical mirrors.

The types of the spherical mirrors

Concave mirror (converge)	Convex mirror (diverge)
its reflecting (shinning) surface is a part of the inner surface of the sphere	its reflecting (shinning) surface is a part of the outer surface of the sphere
It called <u>converge G.R</u> Because it <u>converge</u> or <u>collects</u> the parallel light rays that falls on its surface	It called <u>diverge G.R</u> Because it <u>disperse</u> or <u>diverges</u> the parallel light rays that falls on its surface



G.R. The stainless –steel spoon is considered as a spherical mirror?

Because it's inner surface is concave mirror

While it's outer surface is convex mirror

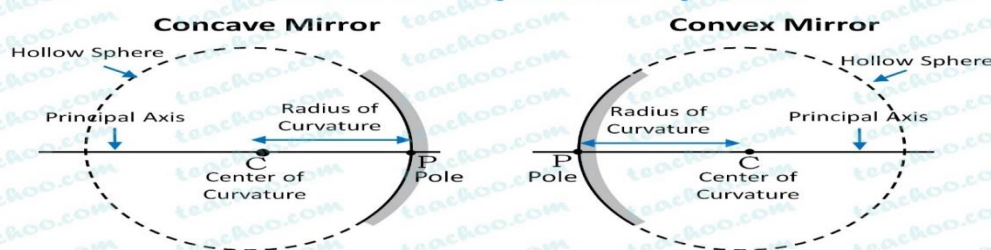


Its inner surface acts as a concave mirror

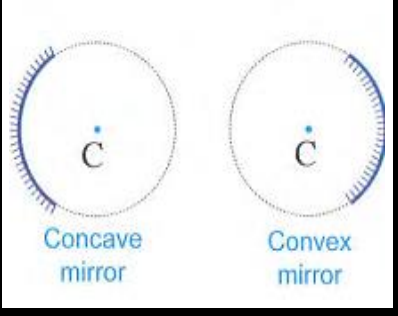

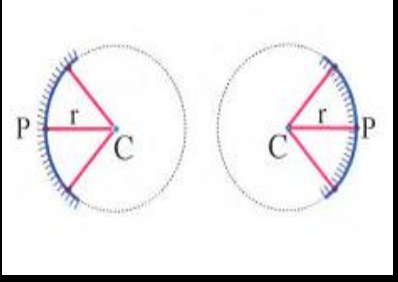

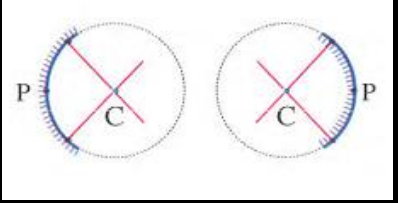
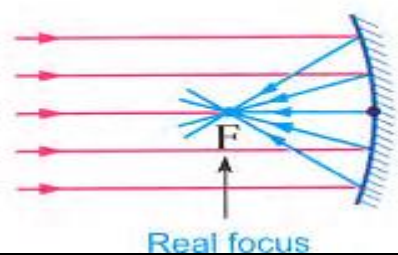
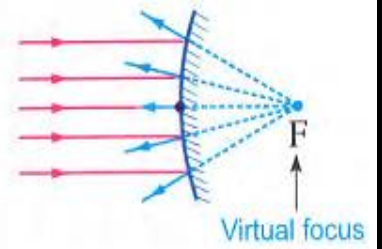


Its outer surface acts as a convex mirror

Mirrors as a part of Sphere

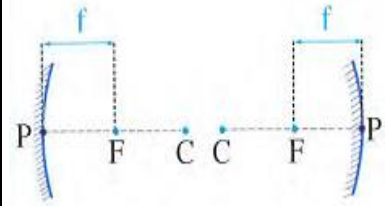


Identify the concave mirror and the convex mirror.

Concept	Definition	Figure
<u>1-Centre of mirror curvature (C)</u>	Is the Centre of the sphere that the mirror is considered as a part of it Its position <u>the concave mirror</u> (in front of the reflecting surface In <u>the convex mirror</u> behind the reflecting surface)	
<u>2-The pole of the mirror (p):</u>	Is the point that lies in the middle of the reflective surface of the mirror	
<u>3- radius of mirror curvature (r)</u>	It is the distance between the center of mirror curvature (C) and any point on its surface <u>It is the radius of the sphere that the mirror is a part of it (r).</u>	
<u>4-The principal axis (cp)</u>	Is the straight line that passes by the pole of the mirror and its center of curvature	
<u>5-The secondary axis</u>	Any straight line that passes by the center of curvature of the mirror and any point on its surface except the pole of the mirror	
<u>6-The focus of the concave mirror</u>	it is the point collection of the reflected light rays (in the concave mirror) <u>real</u> in case of the concave mirror on front of the reflecting surface	
		<u>virtual</u> in case of the convex mirror behind the reflecting surface 

7- focal length of the mirror (f)

It is the distance between the focus of mirror(f) and its pole(P)
 $f = \frac{1}{2} R$



G.R. the spherical mirror has only one principle axis and uncountable number of secondary axis?

-it has only one principle axis because. It has one center of curvature and one pole

-it has uncountable number of secondary axis because. Secondary axis is any straight line passes by its center of curvature and any point on its surface except the pole is consider as Secondary axis

The relation between the radius, diameter and focal length

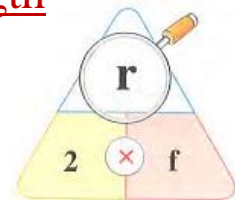
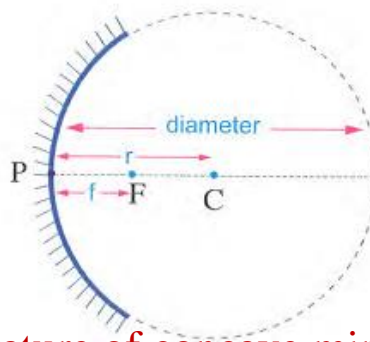
The radius of curvature = $2 \times$ Focal length

Focal length = $\frac{\text{radius of curvature}}{2}$

Radius of curvature (r) = $\frac{1}{2}$ diameter

Focal length = $\frac{1}{2}$ radius

Focal length = $\frac{1}{4}$ diameter



Problem calculate the radius of curvature of concave mirror whose focal length is 8cm

Solution Focal length = 8 cm

Radius of curvature (r) = $2 \times$ Focal length (f) = $2 \times 8 = 16$ cm

2- Calculate the focal length of a concave mirror, whose diameter is 32 cm.

Solution

Radius of mirror curvature (r) = $\frac{1}{2}$ diameter = $\frac{1}{2} \times 32 = 16$ cm.

$F = \frac{1}{2} r$ $F = \frac{1}{2} \times 16 = 8$ cm.

What is the meant by

1- The focal length of spherical mirror is 10 cm?

It meant that It is the distance between the focus of mirror(f) and its pole(P) is 10 cm

2- The Radius of curvature of spherical mirror is 20 cm?

It meant that It is the distance between the center of mirror curvature (C) and any point on its surface is 20 cm

A- Concave mirror

Science, Technology and Society

According to the Old Greek legend that Archimedes knew a lot about mirrors and the use of sunlight as a weapon against the Roman fleet that invaded Sicily in 212 B.C.



A huge concave mirror was placed to collect the Sun rays and directed them towards the sails of ships (which represents the focus of the mirror) so, as to generate extreme heat that led to the burning of these sails and turning them to blazing fire balls.

G.R. Convex mirror is used as a side-view mirror on the passenger's side of a car

Because it form an erect smaller image for the way behind the car

G.R. Concave mirror is used to generate high heat energy.

Because the concave mirror collects the reflected light rays falling on it in one point (focus) generating high heat energy

Activity 3 The focus and the focal length of the concave mirror.

Materials:

- * A concave mirror.
- * A screen.
- * A far light source (as the Sun).

Steps:

1. Facing a concave mirror to the Sun rays (parallel beam of light rays is incident parallel to the principal axis of the concave mirror).
2. Move the screen in front of the concave mirror to obtain the smallest and clearest image.
3. Measure the distance between the lit point and the pole of the mirror.

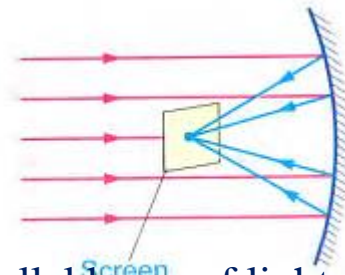
Observation:

The parallel light rays coming from the Sun are reflected and collected in one lit point (smallest and clearest image)

Conclusion:

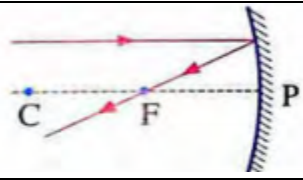
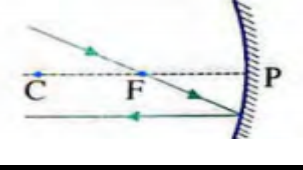
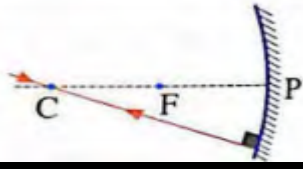
1. The point of the collection of the parallel light rays after being reflected from the concave mirror is called "The focus of the mirror".
2. The distance between the focus of the concave mirror and its pole is called "The focal length of the mirror".

Focal length (f) = $\frac{1}{2}$ x radius of mirror curvature (r) $(f) = \frac{1}{2} r$



* Light rays of the Sun are parallel rays and so as any far light source.

The image formed by the concave mirror

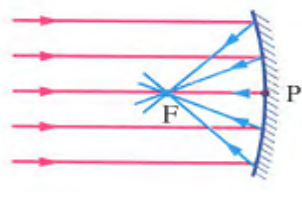
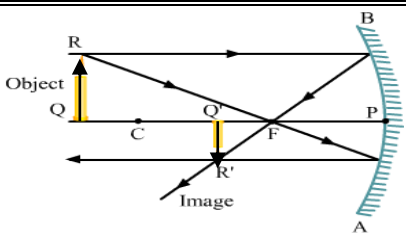
<u>The path of the incident ray</u>	<u>The path of the reflected ray</u>	<u>Explaining figure</u>
<u>1- parallel to the principal axis of the mirror.</u>	It reflects passing through the focus F	
<u>2- passing through the focus F</u>	It reflects parallel to the principal axis	
<u>3- passing through the Centre of curvature C</u>	It reflects back on itself	

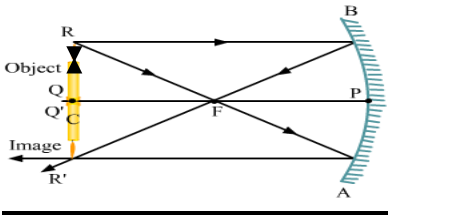
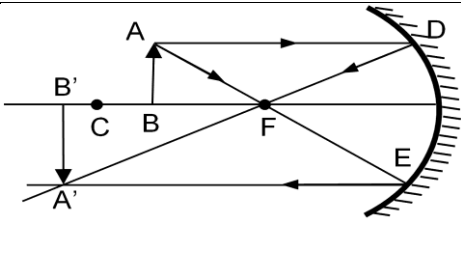
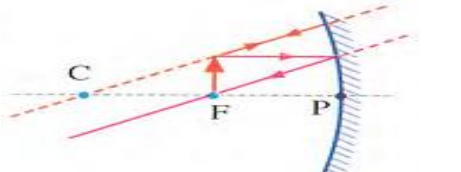
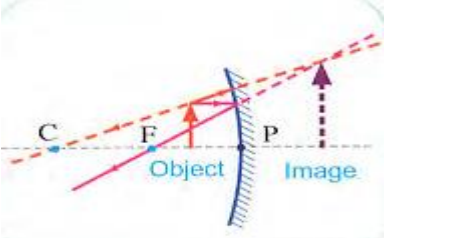
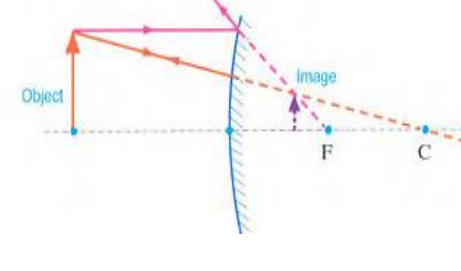
G.R. The light ray that passes through the centre of curvature, reflects on itself.

Because it falls perpendicular to the spherical mirror, so its angle of incidence equals its angle of reflection equals zero.

* When you place an object in front of a concave mirror, the position of the formed image and its properties can be determined by using only two rays from the previous three rays. where the image is formed at the intersection of the reflected rays or their extensions.

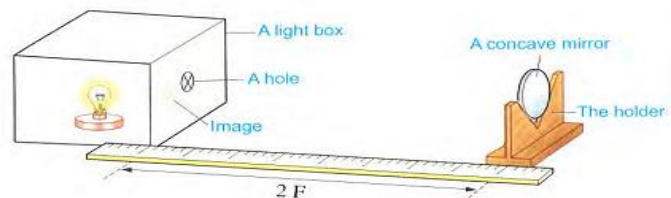
The Properties of the image formed by the mirror

<u>Position of the object</u>	<u>Characteristics of the images</u>	<u>The cases of image formation</u>	<u>Position of the image</u>
<u>very far the rays parallel to principle axis</u>	- <u>Real</u> - inverted - <u>very tiny (dot)</u>		at the focus
<u>At a distance larger than the radius of curvature.</u>	- <u>Real</u> - inverted - <u>smaller than the object</u> (diminutive) مصغر		Between the focus and the center of curvature

<p><u>At the centre of curvature of the mirror.</u></p>	<p><u>Real -inverted--</u> <u>Equal the object</u></p>		<p>At the center of curvature of the mirror</p>
<p><u>Between (c) And (f). Greater than focal length (f). and less than double (f)</u></p>	<p><u>Real - inverted -</u> <u>larger than object</u></p>		<p>At a distance greater than the radius of curvature</p>
<p><u>Between (f) and (p).</u></p>	<p><u>No image</u></p>		<p><u>No image</u></p>
<p><u>Between (f) and (p).</u></p>	<p><u>virtual - upright</u> <u>- larger than object-</u> <u>(magnified)</u></p>		<p>Behind the mirror</p>
<p><u>The formation of the images on a convex mirror</u></p>	<p><u>virtual -upright</u> <u>smaller than -</u> <u>the object,</u> <u>virtual (not received on a screen</u></p>		<p>Behind the mirror is always</p>

Activity: Determine half the radius of the concave mirror.

The materials: A concave mirror – a holder for the mirror – light box with a hole



The steps

- 1-Place the mirror on a holder in front of the light source (lit hole).
- 2-Move the mirror nearer and farther until an image of the hole is formed next to it and is equal to it.
- 3-Measure the distance between the mirror and the hole, it is equal to the radius of curvature of the mirror.

Deduce: The focal length of the mirror (f) = half the radius of curvature (R)

$$\text{Focal length} = \frac{1}{2} \text{ radius}$$

Uses of mirror

1- in pocket torch

to reflect the light of the lamp



2- in front light of cars to reflect the light of the lamp



3- in shaving

to get enlarged and erect image of the face



4- in marine lighthouses in marine parts and airports to reflect the light of the lamp to guide ships



5- in aircrafts landing at airports to reflect the light of the lamp to guide airplanes



6- In solar ovens.

To heat food, water etc.



7- In dentists clinics.

To form magnified images of the teeth at the back of the mouth cavity (molars teeth).

8- In some types of telescopes.

To monitor the space and also to form enlarged and near images of the celestial bodies



B- Convex mirror

- In the last activity (Activity 4),

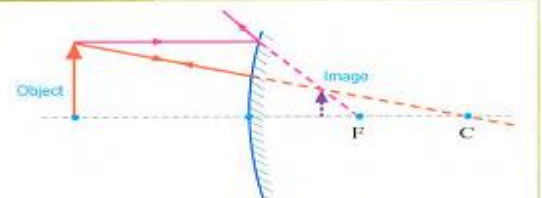
if the concave mirror is replaced by a convex mirror, the formed image cannot be received on the screen, because it is a virtual image which formed as a result of the intersection of the extensions of the reflected light rays.

The properties of the formed image by the convex mirror :

* Wherever the position of the object in front of the convex mirror, the properties of the formed image is always:

* Virtual. * Erect. * Diminished.

The position of the image formed by a convex mirror is behind the mirror.



Uses of Convex mirror

Convex mirror is a diverging mirror, so that it is used for many purposes for example, it is used:

1- In cars (on the right and the left sides of the driver).

To form an erect and minimized image for the way behind the car.

2 At shopping centers.

To allow high rates of security at these places. On the corners of narrow roads.

3. On the corners of narrow roads.

To monitor cars movement on these narrow crossroads to avoid accidents.

4-At cars park.

To monitor cars movement at the park to avoid accidents.

5-At the platforms of the Metro and railway stations.

To avoid passenger injury at opening or closing, the Metro doors



<u>Focus of the concave mirror</u>	<u>Focus of the convex mirror</u>
It is a real focus	It is a virtual focus.
It is the point of collection of the reflected light rays	It is the point of collection of the extensions of the reflected light rays.
It is located in front of the concave mirror	It is located behind the convex mirror

<u>The real image</u>	<u>The virtual image</u>
It can be received on a screen	It cannot be received on a screen
It is formed as a result of the intersection of the reflected light rays	It is formed as a result of the intersection of the extensions of the reflected light rays
It is formed in front of the mirror	It is formed behind the mirror
It is always inverted	It is always erect.

Questions on Lesson one

Unit Two Lesson one

1- Choose the correct answer:

1. The bouncing off the light ray in the same medium when it meets a reflecting surface the .

- a. incident ray.
- b. reflected ray.
- c. light reflection phenomenon.
- d. light refraction phenomenon.

2. If a light ray falls on a reflecting surface by an angle equals 45° , the angle of ref equals

- a. 35° .
- b. 90° .
- c. 55° .
- d. 45° .

3. When a light ray falls perpendicular on a reflecting surface, its angle of reflection equals

- a. zero.
- b. 30° .
- c. 60° .
- d. 90° .

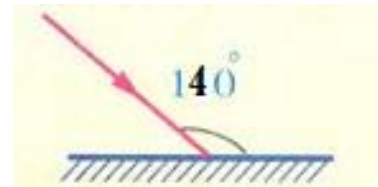
4. If the angle between the incident light ray and the reflected light ray is 40° , its am reflection equals ..

- a. 20° .
- b. 40° .
- c. 80° .
- d. 90° .

5. A light ray is incident on the surface of a plane mirror, as in the figure it reflects where the angle of incidence equal .

(Beni Suef 2020)

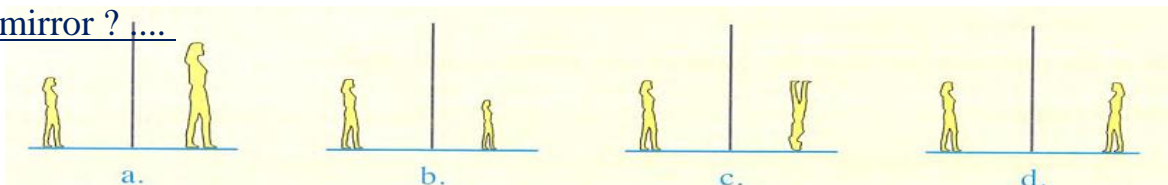
- a. 40°
- b. 50° .
- c. 70° ..
- d. 140° .



6. If a person was putting a pen in his left pocket, then the formed image of the pen on a plane mirror will be on theside as it is

- a. left - reversed
- b. right- up right.
- c. right- reversed
- d. left-virtual.

7. Which one of these figures represents the correct image for an object placed in front of a plane mirror ? ...



8. If you stand in front of a plane mirror at a distance of 2 m, the distance between you your image is

- a. 1 m.
- b. 2 m.
- c. 3 m.
- d. 4 m.

9. If the distance of the object to the plane mirror is 10 cm, the distance of its image to mirror

- a. 5 cm.
- b. 10 cm.
- c. 20 cm.
- d. no correct answer.

10. The image of the body formed behind the plane mirror is always

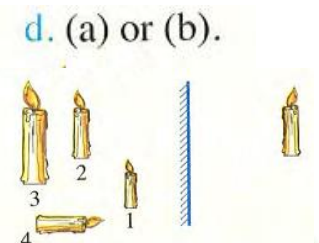
- a. virtual - enlarged - erect.
- b. real - diminished-inverted.
- c. real - equal - reversed.
- d. virtual - equal - erect.

11. If you put a plate written on it the word (Light) in front of a plane mirror, it appears in the mirror as a plate written on it ..

- a. Light.
- b. ɹɹɹɹɹɹ.
- c. ɹɹɹɹɹɹ.
- d. (a) or (b).

12. If a candle is put in front of a plane mirror, which one of the image you see ?

- a. 1
- b. 2
- c. 3
- d. 4



13. If the angle of incidence equals 45° , so the angle between the reflected light ray and the reflecting surface equals ..

- a. 45° . b. zero. c. 90° d. 60°

14. If a light ray falls on a smooth (plane) mirror as shown in the opposite fig. it reflects by an angle of reflection equals..

- $^\circ$ a. zero. b. 60° . c. 30° d. 120

15. A light ray that falls on a plane mirror as in the figure it reflects, where the angle of reflection equals.....

- a. zero b. 60° . c. 90° . d. 120° .

16. The reflected light ray when falling on another reflecting surface called

- a. the light reflection. b. the reflected light ray. .
c. the angle of incidence d. the incident light ray. ,

17. If you put an object in front of a plane mirror, the ratio between the length of the image and the length of the object is . (North Sinai Red Sea 2019)

- a. more than one. b. less than one. c. equal to one. d. no correct answer.

18. A body was put in front of a plane mirror at a distance 4 metre, an image is formed behind the mirror. If the mirror moved towards the body one metre, the distance between the first image and the second image is metre.

- a. 1 b. 2 c. 3 d. 4

19. The optical piece which forms an equal laterally inverted image of the body is the

- a. convex lens. b. concave lens. c. spherical mirror d. plane mirror.

20. The point at the middle of the reflecting surface of a spherical mirror is called

- a. focus of mirror b. pole of mirror.
c. centre of curvature. d. face of curvature.

21. The straight line that passes by the pole of the mirror and its centre of curvature is expressed the . (Bent Suef 2015/Fayeum 2016 / Alex 2017)

- a. pole of the mirror b. secondary axis of the mirror
c principal axis of the mirror. d. no correct answer.

22. The parallel rays that are incident on the plane mirror are reflected back asrays

- a. diverging b. converging c. parallel d. refracted

23. The Romans use a huge optical piece to burn the sails of enemies' ships by using the Sun rays. What is the suitable optical piece to do that ? .. (Port Said 2014, 2018)

- a. Convex mirror b. Concave mirror. c. Plane mirror. d. Concave lens.

24. The focal length of the mirror is the distance between

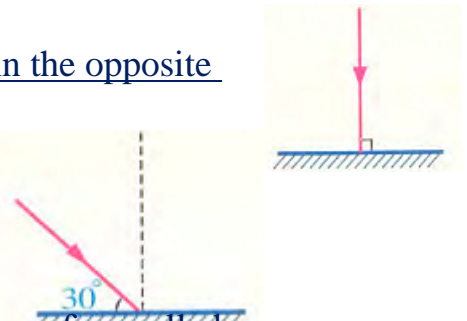
- a. the centre of curvature of the mirror and its pole.
b. the centre of curvature of the mirror and any point on its surface.
c the focus of the mirror and any point on its surface.
d. the focus of the mirror and its pole.

25. The focal length of a spherical mirror equals radius of curvature.

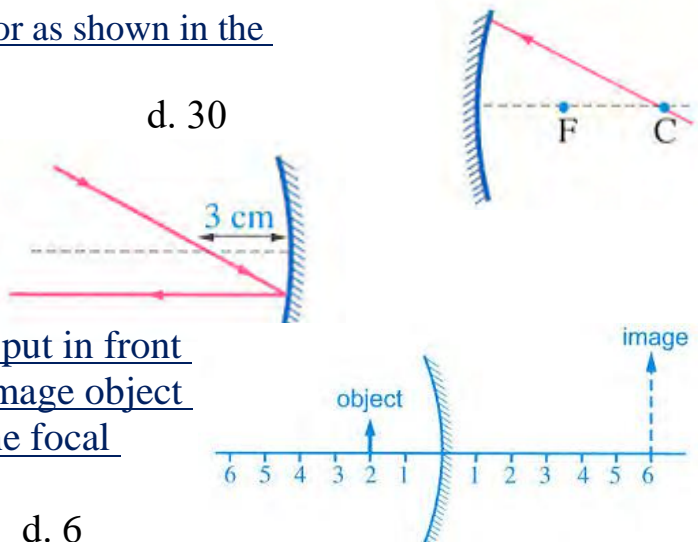
- a. double b. half c. quarter d. four times (Cairo 2017I Sohas 2020)

26. The distance from the centre of mirror curvature and its focus equals

- a. radius of curvature. b. quarter of the diameter of curvature.
c. diameter of curvature. d. half of the focal length.



27. A concave mirror of focal length 5 cm, its diameter of curvature equals
 a. 5 cm. b. 10 cm c. 15 cm. d. 20 cm..
28. A concave mirror was cut from hollow spherical glass ball of diameter 16 cm. its focal length is
- a. 8 cm. b. 6 cm. c. 4 cm. d. 2 cm
29. A spherical mirror whose radius is 60 cm, its focal length is equal to. (Damietta 2016/ Sohag 2019)
 a. 30 cm. b. 120 cm. c. 60 cm. d. 90 cm.
30. A concave mirror has a focal vertex (length) of 10 cm, the radius of curvature of its surface equals (Sharkia 2017 North Sinai 2018)
 a. 5 cm. b. 10 cm. c. 20 cm. d. 40 cm.
31. A concave mirror with a focal length of 20 cm, and the object is placed at a distance of 50 cm from the mirror, the image is formed at a distance.....
 a. more than 40 cm. ... b. more than 20 cm, and less than 40 cm.
 c. equals 20 cm. d. equals 60 cm.
32. A concave mirror focal length 10 m. to form a virtual image for a body, the body should be placed atfrom the mirror
 a. 10 b. 15 cm c. 20 cm d. 5 cm
33. A concave mirror of Real length 10 cm, to form an equal image to a body, the body should be placed at from the mirror at from the mirror
 a. 5cm b. 10 cm c. 15 cm d. 20 cm
34. A concave mirror has a focal length of 8 cm, an object is placed in front of this mirror forming an image at a distance 20 cm from the mirror, this means that the object is placed atfrom the mirror
 a. 8m. b. less than 8 cm
 c. 20 cm d more than 8 cm and less than 16 cm.
35. If a light ray falls on a spherical mirror as shown in the figure, so it reflects by an angle equals.
 a. zero b. 45° c. 90° d. 30
36. In the opposite figure
 Radius of mirror curvature =cm
 a. 3 b. 6
 c. 9 d. 12
37. In the opposite figure, an object is put in front of a concave mirror, a virtual upright magnified image is formed. What is the focal length of the mirror ?
 a. 2 b. 3 c. 4 d. 6
38. Light rays coming from the Sun are
 a. convergent b. parallel.. c. divergent. d. reflected.
39. The incident light ray at a point on the surface of a concave mirror reflects, where the angle of incidence.....
 a. equals the angle of reflection b. is more than the angle of reflection.
 c. double the angle of refraction d. is smaller than the angle of refraction.

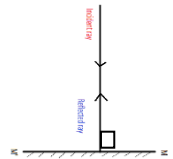


2. Choose from column (B), what suits it in column (A)

	(A)	(B)
	The position of the object related to the <u>concave mirror</u>	The properties of the formed image
1	1. The double of the focal length	a. Virtual, erect and magnified
2	2. Very far	b. Real, inverted and larger than the object
3	3. Larger than the double of the focal length	c. Virtual, erect and equal to the object
4	4. Between the centre of curvature and the focus	d. Real and very tiny
5	5. Less than the focal length	e. Real, inverted and equal to the object
		f. Real, inverted and smaller than the object

3. Correct the underlined words :

- The bouncing of the light ray in the same medium when it meets a reflecting surface is expressed by the light refraction phenomenon.
- Light rays is passing when falling on reflected surface.
- The incident ray is the light ray that bounces from the reflecting surface.
- If the angle between the incident light ray and the reflected light ray on a plane mirror equals 140° so the incident angle equals 40° .
- If the angle between the reflected light ray and the reflecting surface equals 40° , the angle of incidence = 40°
- A light ray that falls on a plane mirror as in the figure, it reflects where the angle of reflection equals 90°
- When the light ray falls by an angle of 30° on the reflecting surface, so the reflected will be perpendicular on the reflecting surface.
- The distance between the object and a plane mirror is more than the distance between the plane mirror and the image. (Cairo 2015-Port Said 2019)
- The image which is formed by the plane mirror is real and inverted.
- The word ambulance is written on ambulance cars minimized. (Beni Suef 2019)
- When the angle between the incident light ray and the reflecting surface is 30° , the angle of reflection is 30° .
- The image of the object that is formed by the convex mirror is always virtual, erect and equal to the object. (Kalyoubia 20 (Damietta, Luxor 2017/
- If a person stands at 2 m from a plane mirror, so the distance between the person and his image is 6 m.
- The focus is the point that is in the middle of the reflecting surface of.
- The focal length of the spherical mirror is the distance between the focus and the centre of mirror curvature.
- If the radius of curvature of a concave mirror equals 20 cm, its focal length will be 30 cm. (Cairo 2019)



17. The secondary axis of the spherical mirror is the straight line that passes by the pole of the mirror and its centre of curvature.
18. The image of the object that is formed by the converging mirror is always, upright and laterally inverted.
19. The concave mirror is called diverging mirror.
20. In the spherical mirrors the radius of curvature of the mirror= the focal length $\times \frac{1}{2}$
21. A spherical mirror whose diameter is 40 cm, so its focal length equals 40 cm.
22. A spherical mirror whose diameter is 12 cm, its focus lies at a distance 6 cm from the pole
23. A concave mirror of a focal length 10 cm, so its radius of curvature= 5 cm.
24. Virtual image can be received on a screen.
25. The real image is the image that cannot be received on a screen.
26. The light ray which is incident parallel to the principal axis of a concave mirror, reflect passing by the centre of curvature of its face. Men 20 12
27. The incident light ray of the concave mirror that passes through the focus, reflects of itself
28. The light ray that falls on a mirror passing with its centre of curvature, reflects passing through the focus.
29. If you put a lighted body at a distance of 17 cm from a concave mirror, its focal length equals 20 cm, so the image is formed in front of the mirror.
30. If an object is put in front of a concave mirror at the focus, the formed image is real. inverted and equal to the object.
31. When putting a body on a distance of 16 cm from a concave mirror its focal length is 12 cm, then the image formed will be virtual upright and magnified image.
32. When an object is put between the focus and the centre of curvature of a concave mirror, the formed image is virtual, upright and equal to the object. (
33. When an object is put at a distance greater than the radius of curvature of a concave mirror, the formed image is real, inverted and enlarged.
34. When an object is placed at the centre of curvature of a concave mirror, its formed image is real, inverted and enlarged.
35. When the object is at the centre of curvature a concave mirror, the image is real, inverted and enlarged. (Dakahlia 2017,2019 New Valley 2016)
36. The image of the object that is formed by converging mirror is virtual, erect and equal to the object. (Red Sea 2018)

4. Write the scientific term of each of the following:

1. • The change in the direction of light ray in the same medium, when it falls on a reflecting surface.(.....)
2. Angle of incidence = Angle of reflection. (.(.....))
3. The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface. (New Valley 2018/ Port Said 2019) .(.....)
4. The light ray that falls on the reflecting surface. .(.....)
5. The light ray that bounces from the reflecting surface.(.....).

6. The angle between the incident light ray and the line perpendicular on the reflecting surface. (South Sinai 2011/Cairo 2019) .(.....)
7. The angle between the reflected light ray and the line perpendicular on the reflecting surface from the point of incidence. (Giza, Aswan 2018) .(.....)
8. A mirror which gives laterally inverted and equal size image for an object. (Cairo 2015/ Fayoum 2016) .(.....)
9. A mirror which is a part of a hollow sphere. (Suez 2019) .(.....)
10. A mirror whose reflecting surface is the inner surface of a sphere and converges the light rays. (Alex. 2017/ Sharkia 2019) .(.....)
11. A mirror whose reflecting surface is the outer surface of a sphere and diverges the (Kalyoubia 20106/ Behira 2019).(.....)
12. A mirror always forms a diminished image for the object. .(.....)
13. •A point that is in the middle of the reflecting surface of the spherical mirror. rays.(.....)
14. • The distance between the pole of the mirror and its centre of curvature.(.....)
15. The straight line that passes by the pole of a spherical mirror and its centre of curvature (Kafr El-Sheikh 2019/ Menofia 2020 (Gharbia 2016) .(.....)
16. The centre of the sphere that the mirror is considered as a part of it.(.....)
17. The straight line that passes by the centre of curvature of the mirror and any point on its surface except the pole of the mirror. .(.....)
18. The point of collection of the parallel rays after being reflected from the mirror.
19. The distance between the pole of the mirror and its focus. .(.....)
20. Light rays produced by a distant (far) object. .(.....)
21. The scientist who used the way of concentrating the Sun rays to destroy the Roman fleet in 212 B.C. .(.....)
22. The image that can be received on the screen. (New Valley 2018) .(.....)
23. • The image that cannot be received on the screen. (.....)
24. A mirror used to get virtual, upright and magnified image for the object. .(.....)
25. The spherical mirror which forms virtual, upright and small image for the object, wherever its position in front of the mirror.(.....)
26. A light piece of reflecting surface forms a real, inverted and enlarged image. .(.....)

6. Give reasons for:

1. •When you look at a mirror, you see your face image. (Suez 2019)
2. The perpendicular incident light ray on a plane mirror reflects on itself.
3. The angle of reflection of a light ray falls perpendicular on a plane mirror equals zero. (Dakahlia 2019)
4. The image formed by a plane mirror is virtual.
5. The image formed by a plane mirror can't be received on a screen. (Menia 2020)
6. The word AMBULANCE is written in a laterally inverted (reversed) way on the ambulance car. (Fayoum 2018/ Qena 2019)

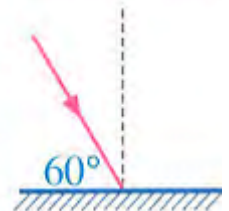
7. • When you look at a plane mirror, you find that you hold the pen by the left hand which is inverse the real position.
8. The spoon made of silver is a spherical mirror. (Port Said 2016)
9. The concave mirror is called converging mirror, while the convex mirror is called diverging mirror.
10. The spherical mirror has only one principal axis and uncountable number of secondary axes.
11. Concave mirror is used to generate high heat energy. (Behira 2016) (Dakahlia 2020)
12. The focal length of a concave mirror can be determined by knowing its radius of Curvature. (Cairo 2018, 2020)
13. The incident light ray on a concave mirror passing through the centre of curvature reflects on itself. (Luxor 2014)

7. What is meant by ... ?

1. Light reflection phenomenon. (Assiut 2019/ Cairo 2020)
2. The angle of incidence on a reflecting surface is 60° .
3. The angle of reflection of a light ray on a mirror is 30° . (Alex. 2017 Qena 2020)
4. The angle of incidence of a light ray on a plane mirror = ZERO. (Dakahlia 2017/
5. The image formed by a plane mirror is virtual. (Ismailia 2012)
6. The radius of curvature of a convex mirror is 8 cm. (Red Sea 2015/ Alex 2019)
7. The focal length of a concave mirror = 10 cm. Sharkia 2018 Port Said 2019)
8. The distance between the principal focus of a spherical mirror and its pole is 20 cm. (Giza 2018 / Gharbia 2020) -

8. What happens when... ?

1. The angle of incidence of a light ray increases from 20° to 50°
2. A light ray falls perpendicular to a plane mirror. (Luxor 2016)
3. A light ray is incident by an angle 35° on a plane mirror.
4. A light ray that falls on a plane mirror as in the opposite figure. (Sohag 2018) (South Sinai 2016)
5. The body becomes closer to the mirror (concerning : the distance between the image and the plane mirror]. (Kalyoubia 2019)
6. A light ray is incident on a concave mirror passing through its focus. (Luxor 2015)
7. Incidence of a light ray parallel to the principal axis of a concave mirror. (Cairo 2019 Beni Suf 2020)



9. Problems :

1. Sun ray is incident on a concave mirror the image that is formed was real, very small at a distance 2 cm from the reflecting surface of the mirror. The same mirror used w obtain real, inverted and magnified image for another object, draw the path of ray in the second case then calculate the distance between the object and the mirror.
2. If the angle between the incident ray and the reflected ray is 140° , find the angle of incidence and the angle of reflection.

What is the relation between them ? (Aswan 2015 Sohag 2016. 2017)

Chapter (2) Lenses

What is meant by lenses ?

Observe the opposite optical tools, you will notice that lenses are the basic structural unit in all these optical tools.

- The lens is usually made of clear glass or transparent plastic



Lens It is a transparent medium that refracts the light and is defined with two spherical surfaces

Uses of lenses

1- In medical eyeglasses
_for reading or walking



2- In telescopes to form enlarged and near images for the celestial bodies



3- In microscopes to form magnified images for the tiny bodies that cannot be seen by naked eye



4- In binoculars المنظار الحربي to see the far object

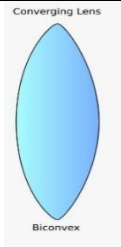


5- In magnifier lens to see the minute parts

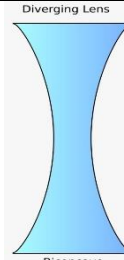


The types of lenses

Convex lens (converging)



Concave lens (diverging)

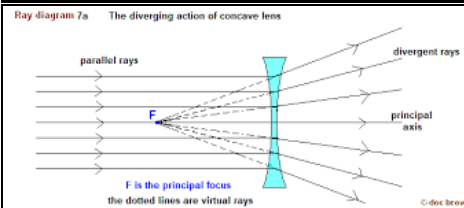
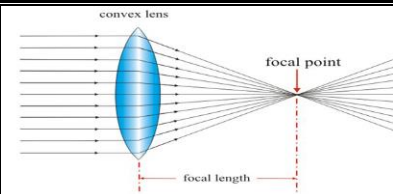


It is a transparent optical piece which is thick at the centre and less thickness at the tips.

It is a transparent optical piece which is thin at its centre and thicker at the tips.

it is called converging lens G.R.?
Bec. it Collect the light rays falling on it

it is called diverging lens G.R.?
Bec. diverge the light rays falling on it

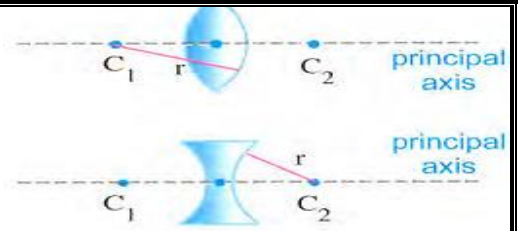


Identify the following concepts:

Concept	Definition	Figure
<u>1-The centre of curvature of the lens face (c):</u>	Is the <u>centre</u> of the sphere where this <u>face</u> is a part of it. (C ₁ , C ₂) The lens has two center	
<u>2-The optical centre of the lens (p)</u>	Is a <u>point</u> inside the lens lies on the <u>principal axis</u> in the <u>mid distance</u> between its faces.	
<u>3 -The radius of curvature of the face of the lens (p)</u>	It is <u>half the diameter</u> of the sphere where this face is a part of	

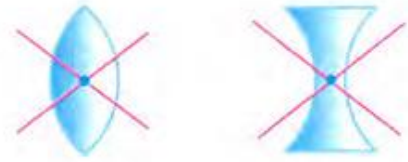
4-The principal axis

Is the line between the two centres of the lens passing by the optical centre of the lens
The lens has only one principal axis



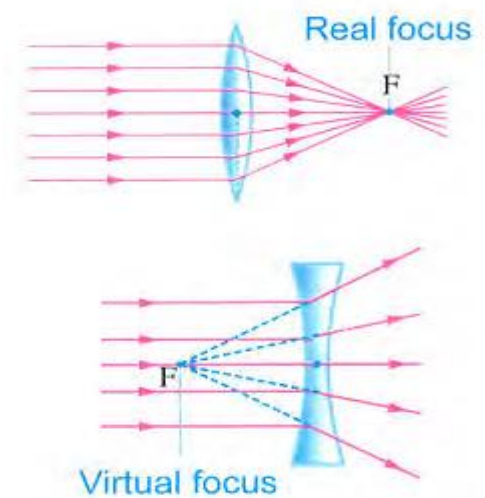
5-The secondary axis

* It is any line passes by the optical centre of the lens except the principal axis
Note: The lens has uncountable number of secondary axis



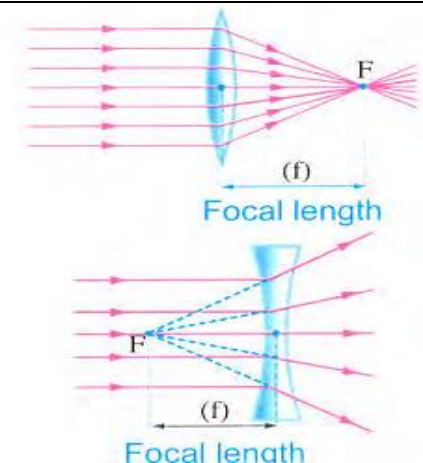
6-The focus of the lens (F) (principle focus)

it is the point collection of the reflected light rays (in the convex lens) or their extension in (concave lens)
real focus in case of the convex lens on front of the reflecting surface
virtual focus in case of the concave lens behind the reflecting surface



7- focal length of the lens (F)

It is the distance between the principle focus of lens and the optical center of the lens
 $f = 1/2 R$



G.R. The lens has two centres of curvature(two focuses (foci).
Because it has two spherical surfaces.

Exercise What happens when a beam of light rays parallel to the principal axis falls on the surface of a convex lens and that of a concave lens ?

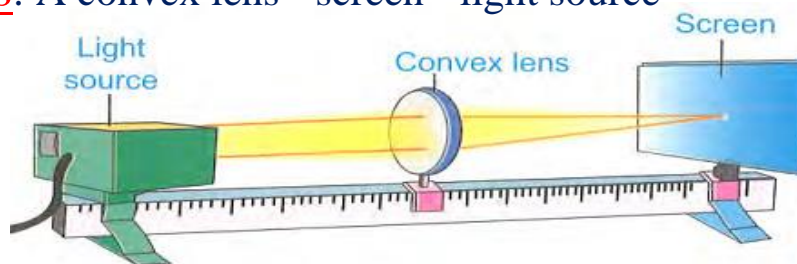
Answer

A. Convex lens	B. Concave lens
The parallel rays pass through the convex lens, then they are converged in a lit point which known as the real focus of the lens	The parallel rays pass through the concave lens, then they are diverged and their extensions are collected in a lit point which known as the virtual focus of the lens

First: The convex lens

Activity The focus and focal length of the convex lens (converging):

Materials: A convex lens - screen - light source



The steps:

1. Fix the lens where the light source is facing one of its faces.
2. Move the screen closer and farther from the other side of the lens until you get the lit point.
3. Measure the distance between the lit point and the optical centre of the lens

Observation:

The rays after being refracted are collected in one lit point is called the focus of the lens that can be received on the screen.

Conclusion:

1. The convex lens is a converging lens as it collects the refracted light rays.
2. The point of collection of the parallel rays (produced from the Sun or any distant object) after being refracted from the convex lens is called "the focus of the lens (F)".
3. The distance between the focus of the lens and its optical centre is called "the focal length of the lens (f)".

G.R. The formed image by the convex lens can be received on the screen.

Because it is a real image formed by the collection of the refracted light rays.

G.R. A piece of paper can be burnt by a convex lens.

Because convex lens can converge and concentrate the parallel rays of sunlight in a point (real focus) which leads to the burning of this paper.

The convex lens forms a real image of the Sun on a piece of paper

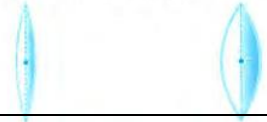


(A) Thin lens. (B) Thick lens.

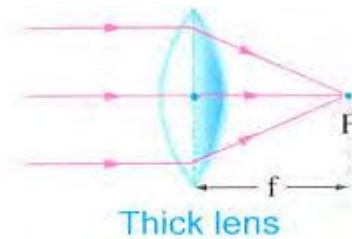
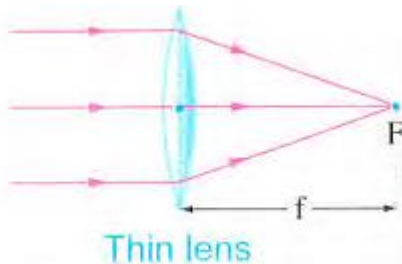
Exercise

Which of the opposite lenses has a larger focal length

? And why?



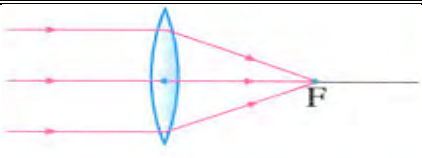
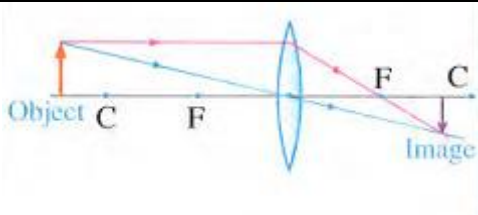
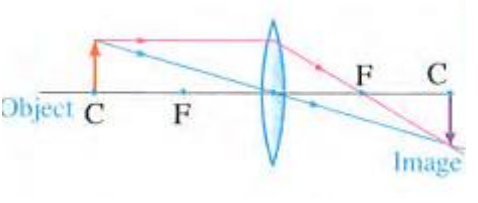
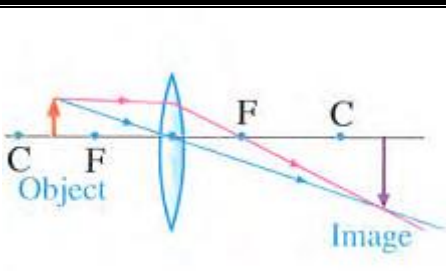
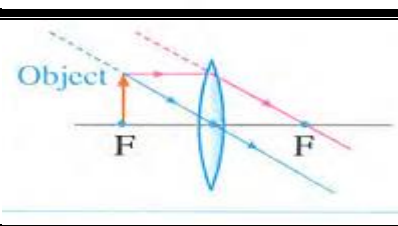
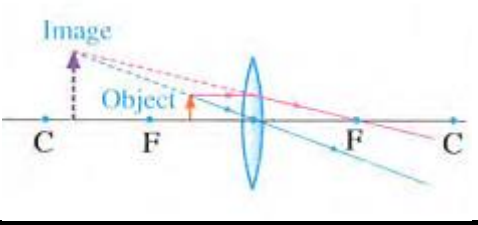
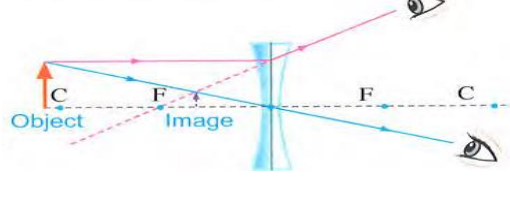
(A) Thin lens	(B) Thick lens
It has a large focal length	It has a small focal length
<u>The reason</u> As the convexity of its lens face is small so. the focus is farther to the optical centre	<u>The reason</u> . As the convexity of its lens face is large se the focus is nearer to the optical centre



.The path of rays falling on the convexe lenses

The path of the incident ray	The path of the reflected ray	Explanation Figure
<u>The incident light ray passing through the focus,</u>	exits the lens parallel to the principal axis	
<u>The incident light ray parallel to the principal axis, of the lens</u>	exits the lens passing through the focus	
<u>The incident light ray passing through the optical centre of the lens continues</u>	pass inside the lens and passes without refraction	

The Properties of the image formed by the convex lenses

<u>Position of the body</u>	<u>Characteristics of the images</u>	<u>cases of image formation</u>	<u>Position of the image</u>
<u>very far</u>	- <u>Real</u> - <u>inverted</u> - <u>very tiny</u> (dot)		at the focus
<u>More than twice the focal length</u>	1- <u>Real</u> 2- <u>Inverted</u> 3- <u>Smaller</u> than the object		Between the focus and twice the focal length
<u>At twice the focal length</u>	1- <u>Real</u> 2- <u>Inverted</u> 3- <u>equal</u> to the object		At twice the focal length
<u>Between the focus and twice the focal length</u>	1- <u>Real</u> 2- <u>Inverted</u> 3- <u>enlarge</u>		At a distance large than twice the focal length
<u>At the focus</u>	No image is formed		A light spot is formed at the infinity
<u>At a distance smaller than the focal length</u>	1- <u>Virtual</u> 2- <u>upright</u> 3- <u>enlarge</u>		in front of the lens at the object side
<u>The image formed by the concave lens:</u>	1- <u>virtual</u> 2- <u>erect</u> 3- <u>smaller</u> .		In the same side of the object

G.R. The concave lens is also known in this case as the diverging lens?
Because it diverges the rays after they pass through it.

The vision

The use of lenses to treat the vision defects

The most important of the vision defects:

Short-sightedness – long-sightedness.

How does the vision occur ?

- The light rays reflected from the body to fall on the eye, refract when passing through the cornea, then the eye lens (convex lens).

- The refracted light rays fall on the retina a real, inverted and diminished Image.

The optic nerve transmits the image to the brain which re-corrects the image to be seen erect, normal size and in its normal position.

* The diameter of the eyeball is the distance between the optical centre of the lens and the retina.

* To see clearly, the image must be formed exactly on the retina.

G.R. vision defects occur?

Because the eye cornea is not always convex, or the eye is not always spherical.

The normal person can see clearly

The far objects at distance up to 6m

The near objects at distance = not less than 25 cm

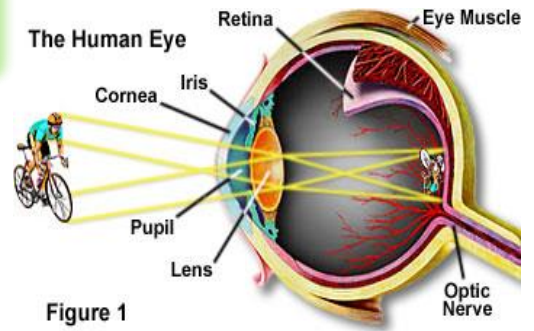


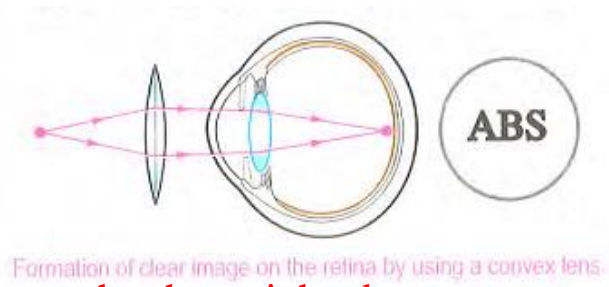
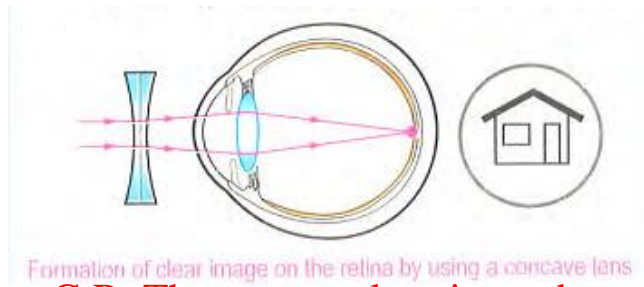
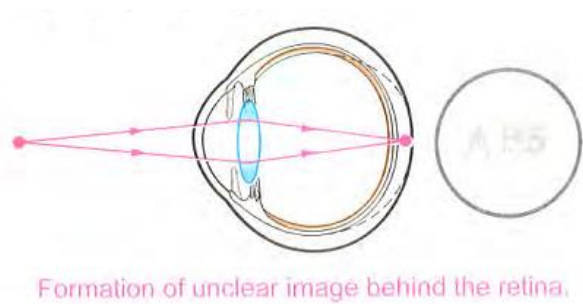
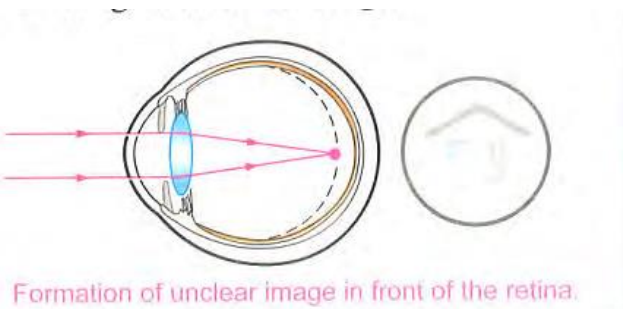
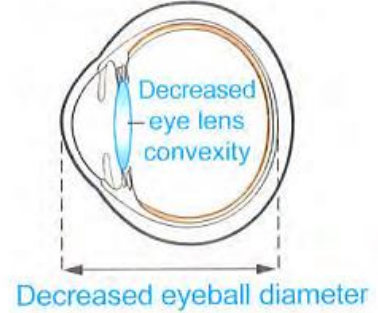
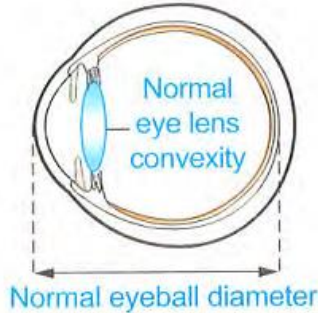
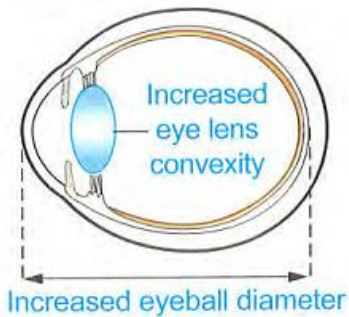
Figure 1



<u>Short-sightedness</u>	<u>Long - sightedness</u>
It is a vision defect through which near objects can be seen clearly but far objects seems distorted مشوه	It is a vision defect through which far objects can be seen clearly but near objects seems distorted
<p>Reason</p> <p>1- increase the <u>diameter of eyeball</u> this causes the retina to be far from the eye lens</p> <p>2- increase the <u>convexity of the eye lens surface</u> this causes a shorter focal length for eye lens</p>	<p>Reason</p> <p>1- Decrease the <u>diameter of eyeball</u> this causes the retina to be close to the eye lens</p> <p>2- Decrease the <u>convexity of the eye lens surface</u> this causes a longer focal length for eye lens</p>
<u>Lead to</u> the light rays coming from far object are collected at point In front of the retina (unclear)	<u>Lead to</u> the light rays coming from near object are collected at point Behind the retina (unclear)

Correction By using a concave lens G.R. Because it diverge rays coming from the far object so the image formed on the retina

Correction By using a convex lens G.R. To collect the rays coming from the near objects so the image formed on the retina



G.R. The concave lens is used to correct the short-sightedness.

Because it diverges the rays coming from the far objects before falling on the eye, so the image is formed exactly on the retina.

G.R. The convex lens is used to correct the long-sightedness.

Because it collects the rays coming from the near objects before falling on the eye, so the image is formed exactly on the retina..

Contact lenses:

- 1-It is very thin lenses made of plastic, and can stick to the eye cornea by the eye fluid
- 2-It is used instead of the glasses.



Science, Technology, and Society

Cataract

Cataract is one of the most dangerous diseases that infect the eye

The effect Cataract diseases causes difficulty of vision as a result of darkness of the eye lens



The reason of Cataract diseases

- 1- Old age
- 2- illness
- 3- Side effects of drugs
- 4- genetic readiness.

The Treatment of Cataract

Is done through surgery to exchange the eye lens with a plastic lens transplanted permanently in the eye. In this way, the person can see again and clearly.

Land area measurement

Land surveyors and topographical scientists use a special device to determine heights and distances by sending a beam of laser rays, then receiving it again by the mirrors and lenses provided in their devices.

So, it is possible to make very accurate measurements by calculating the time that the laser beam bounced from a distant point and returns to its source.



To measure the distance:

$$d = \frac{V \times t}{2}$$

? Questions on Lesson Two

Unit two Lesson two

1- Choose the correct answer:

1. Lenses used in the.....

- a. cameras. b. medical glasses. c. binoculars d. all the previous things..

2. Concave lens is called..... lens.

- a. diverging b. converging c. collecting d. no correct answer

3. The convex lens..

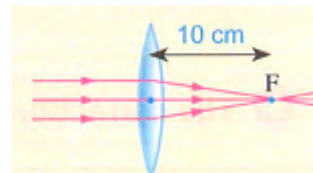
- a. is thin at the centre and more thickness at the tips.
 b. is thick at the tips and less thickness at the centre.
 c. is collects the light rays falling on it d. is diverges the light rays falling on it.

4. The straight line that joins between the two centers of curvature of the lens and passes through its optical centre is called.

- a. the focal length. b. the principal axis.
 c. the secondary axis. d. the radius of curvature.

5. To determine the focal length of a lens, the mathematical relationship.can be used.

- a. $f = \frac{r}{2}$ b. $f = rx2$ c. $f = \frac{2}{r}$ d. $f = \frac{1}{4} r$



6. From the opposite figure, the radius of curvature is .

- a. 5 cm. b. 10 cm.
 c. 15 cm. d. 20 cm.

7. If the focal length of a concave lens is 6 cm, the radius of curvature equals.....

- a. 3 cm b. 6 cm c. 9 cm d. 12 cm.

8. A convex lens, the distance between its focus and its optical centre is 10 cm, so the double of the focal length is

- a. 10 cm b. 20 cm c. 30 cm. d. 40 cm.. (Sohag 2018)

9. If the radius of curvature of a lens is 40 cm, its focal length equals..

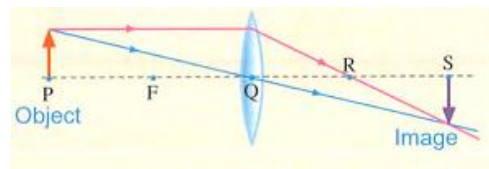
- a. 5 m. b. 10 cm. c. 20 cm. d. 50c m.

10. If the distance between the two centers of curvature of the lens is 20 cm. this means that the focal length is _ (Kalyoubia 2018 Beni S 2010)

- a. 5 cm b. 10 cm. c. 15 cm d. 20 cm

11. The distance isthe focal length of the lens

- a. PQ b. PS
 c. QR d. QS



12. The convex lens which has great thickness from the following its focal length is in

- a. 4 cm b. 6 cm c. 8cm d. 10 cm

13. If a light ray falls passing through the optical centre of the convex lens it leave the lens

- a. passing through the focus b. parallel to the principal axis
 c. without refraction d. no correct answer

14. If a light ray falls on a convex lens and passing through its focus it.....,

- a. passes in a straight line without deviation b. refracts parallel to the principal axis
 c. passes from the optical centre in a straight line d. no correct answer

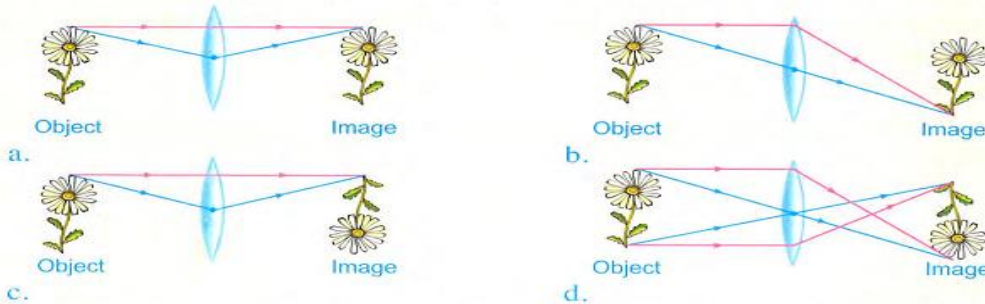
15. A convex lens with a focal length of 20 cm, and an object was placed 40 cm from the lens, the image of the object is formed at

- a. 40 cm. b. 20 cm c. 10cm d. 5cm

16. A convex lens has its focal length of 20 cm, put a body at a distance more than the double of its focal length, the formed image is real, inverted and small at a distance cm

- a. 5. b. 8 c. 10 d. no correct answer

17. Which of these figures represents the correct image formed by a convex lens?



18. The optical piece that forms an equal, laterally inverted image of the body is the.

- a. spherical mirror. b. plane mirror.
c. convex lens. d. concave lens. (Kalyoubia, Aswan 2018)

19. The optical piece which forms virtual, upright and diminished image of the body is

- a. convex mirror. b. plane mirror. c. convex lens. d. concave mirror.

20. When the object is at the centre of curvature of the lens (C), the image is formed at a distance the radius of curvature. (Behira 2017)

- a. equals to b. greater than c. smaller than d. no correct answer

21. An object when placed at a distance less than the focal length of the convex lens, the properties of the image formed are

- a. real inverted and enlarged b. a. real inverted and smaller
c. virtual, upright and enlarged. d. no correct answer

22. An object is placed at the focus of a convex lens, the image will be formed .

- a. between the focus and the centre of curvature b. at the centre of curvature.
c. not formed. d. no correct answer

23. If an object is put at a distance greater than the double of focal length image is formed

- a. between the focus and the centre of curvature b. at the double of focal length
c. at infinity d. in front of the lens in the same side.

24. If an object is placed at a distance more than the twice of the focal length from convex lens its focal length 5 cm and the image which is formed is an inverted, real and smaller at a distance cm.,.

- a. 3 b. 5. c. 8. d. 10

25. On putting a torch in front of a convex lens at a distance equal to its focal length, the light rays emerged from the lens are

- a. parallel b. diverged. c. converged. d. no correct answer.

26. A convex lens has a focal length of 50 cm an object is placed at a distance of 80 cm from the lens, the image of the object is formed at a distance of

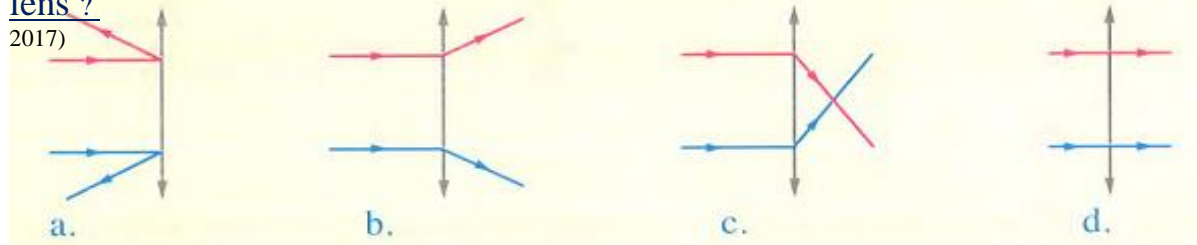
- a. greater than 100 cm. b. equals 100 cm.
c. equals 50 cm. d. no correct answer. (Menofia 2016Kafr El Sheikh 2019)

27. A lens is placed in the passage of Sun rays, a very small image for the Sun is formed at a distance 20 cm from the optical centre of the lens, if this lens is used to form a real, inverted and enlarged image for another body. What is the distance between the body and the optical centre of the lens ? .

- b. 20 cm. c. 30 cm. d. 40 cm. a. 10 cm.

28. Which of the following figures represents the correct path of rays through the convex lens ?

(Beni Suef 2017)



(Beni Suef 2017)

29. An object is placed at 80 cm from a convex lens of focal length 20 cm. The image of the object is formed at a distance..... cm from the lens. (Qena 2018)

- a.30 b. 50 c. 100 d. 133

30. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror so the length of the formed image becomes

- a 16 cm b. 8 cm c.4 cm d. less than 4cm

31. The virtual image is always formed by the

- a. a plane mirror. b. convex mirror .
c. concave lens d. all the previous answer

32. The virtual-upright magnified image formed in case of

- a. concave lens. b. convex mirror
c. plane mirror. d. concave mirror and concave lens

33. The ratio between the body length and its image formed by a concave lensone

- a. more than b. less than c. equal to d. no correct answer

34. The image formed by using a concave lens is..... (Cairo 2019)

- a. real, inverted and enlarged. . b. virtual, upright and diminished.
c. virtual, upright and diminished d. virtual, upright and enlarged

35. The image formed byis always virtual, erect and small.

- a. convex lens b. concave mirror
c. plane mirror d. convex mirror and concave lens

36. The person with normal vision sees the object clearly at a distance not less than

- a. 25 cm. b. 20 cm. c. 15 cm. d. 10 cm. (South Sinai 2010/ Sharkia 2019)

37. Vision defects occur because.....

- a. the eye lens is not always convex. b. the eyeball is always spherical.
c. the eye ball is not always spherical d. (a) and (c). .

38. Short-sightedness person is the person who

- a. sees the far only objects clearly. b. sees the far and near objects unclearly
c. sees the near objects only clearly d. can't see neither far nor near objects.

39. In short-sightedness....

- a. the images of the near objects is formed behind the retina b. the eyeball diameter is large.
c. the eyeball diameter is small d. no correct answer.

2. Correct the underlined words:

1. The lens is a transparent medium that reflects the light and is defined with two spherical surfaces. Port Sad 2019
2. The concave mirror is a transparent medium that refracts the light and is limited with two spherical surfaces.
3. The types of lenses are concave and plane.
4. The concave lens is converging lens.
5. The concave lens collects the rays fall on it.
6. The concave lens converges the light rays that falling on its surface.
7. Each lens has one centre of curvature.
8. The straight line joining between the two centers of the lens curvature and passes through its optical centre is called radius of curvature.
9. The focus is a point inside the lens in the mid distance between its faces, the principal axis passing through it.
10. The incident ray that passes through the optical centre of the lens passes without reflection.
11. The incident light ray parallel to the principal axis, exits from the convex lens passing through the optical centre of the lens.
12. The properties of the formed images by the convex lens depend on the length of the object from the lens.
13. When you put an object at a distance 100 cm away from a convex lens whose focal length is 50 cm. It forms an image at a distance 10 cm away from it.
14. The object that is placed at the twice of the focal length of a convex lens doesn't an image of it.
15. The focal length of the thin convex lens is equal to the focal length of the thick convex lens.

3. Write the scientific term of each of the following statements:

1. •A transparent medium refracts the light (.....)
2. The transparent optical piece which is thick at the tips and thin at the middle and diverges the light rays falling on it. (.....)
3. The optical piece that is thick at the centre and less thickness at the tips(.....)
4. The point inside the lens on the principal axis in the mid distance between its faces. (.....)
5. Half the diameter of the sphere, where the face of the lens is a part of it. (.....)
6. The line joins the centre of curvature of the lens and its optical centre(.....)
7. The straight line joining between the two centers of curvature of the lens and passing through the optical centre(.....)
8. The midpoint inside the lens, through which light rays pass without refraction (.....)

5. Give reasons for :

1. The convex lens is called converging lens , while the concave lens is called diverging lens (New Valley2020)
2. The focal length of the thick convex lens is less than that of the thin convex lens
3. The lens has two centers of curvature ,
4. • The collective lens has two foci , but the collective mirror has one focus
 - The lens has two foci , while the spherical mirror has one focus . Dakahlia 2019
5. The object that is placed at the focus of a convex lens has not an image,
6. A piece of paper can be burned by a convex lens.
7. • The image formed by the concave lens cannot be received on the screen.
 - It is impossible to obtain a real image by using a concave lens .
8. Concave lens has a virtual focus .
9. Vision defects occur .
10. Short - sightedness person sees the far objects distorted .
11. Some persons have short - sightedness . (Cairo Matrouh 2019)
12. In short - sightedness , the retina is far from the eye lens .
13. Concave lens is used to correct short - sightedness person .
14. Occurrence of long - sightedness of the person .
15. Long - sightedness person cannot see the close objects clearly
16. The retina is close to the eye lens in the long - sightedness person .
17. The image of the near objects are formed behind the eye retina in the long - sightedness ,
18. The long - sightedness is corrected by using a convex lens .
19. The infection of the eye with the cataract .

6. What is meant by ... ?

1. The focal length of a convex lens is 15 cm .
2. The distance between the optical centre of a convex lens and its focus is 10 cm .
3. The radius of curvature of a concave lens is 20 cm
4. The image formed by the lens may be real or virtual .
5. The image formed by the concave lens is virtual ,
6. A person suffers from short - sightedness .
7. A person suffers from long - sightedness .

7. State one function (importance) for each of the following :

1. The convex lens (in eye's medicine field) .
2. The concave lens . 3. The contact lenses . South
4. Space telescope .

8. What happens when ... ?

1. The radius of curvature of the face of the lens increases twice (concerning the focal length) .
2. You move a screen closed and farther from a convex lens when its other side is facing to a light source
3. Concentrating sunlight by a magnifying lens on a piece of paper .

4. A light ray passes through the optical centre of the lens .
5. A light ray is incident parallel to the principal axis of the convex lens .
6. A light ray passes through the focus of the convex lens .
7. An object is put at the focus of a convex lens .
8. An object is put at a distance equals to the double of the focal length of a convex lens .
9. You want to see a virtual, erect and magnified image of an object through a convex lens
10. Incidence of a beam of light rays parallel to the principal axis of a concave lens,
11. An object is put in front of a concave lens,
12. The eye lens surface in man is too (more) convex.
13. The eye lens surface in man is less convex.
14. • The length of the eye radius is larger than the normal.
 - The diameter of the eyeball elongates.
15. • The diameter of the eyeball becomes shorter than a certain length..
 - The shortness of the radius of the eyeball.
16. The infection of the eye with the cataract disease.

9. Show by drawing, the path and the directions of rays in the following cases:

1. The incident light ray passing through the optical centre of the lens.
2. The incident light ray parallel to the principal axis.
3. The incident light ray passing through the focus.
4. • A body is put in front of a convex lens at a distance of 30 cm, knowing that its focal length is 15 cm.
5. • The formation of the image of a body is placed at a distance smaller than the focal length of a convex lens then mention the properties of the formed image.
6. An object is put at the focus of the convex lens.
7. • The formed image by a convex lens to an object at a distance larger than the focal length and smaller than twice the focal length (mention the properties of the image).
8. • An object was placed at a distance of 5 cm from a convex lens, its focal length is 2 cm (mention the properties of the image).
9. • The eye sees the image of an object which is placed at a distance of 8 cm from a concave lens has a focal length 2 cm (mention the properties of the image) .

Unit (3)

The Universe and the Solar System

What is meant by the universe?

- * The vast universe is filled with millions of stars.
 - * Everything changes in the universe, where : Stars always change.
- Galaxies get away from each other very fast, so the universe is in a state of continuous expansion.

Univers

It is the wide and extended space that contains all the galaxies, stars, planets, moons and living organisms and everything
The universe is very vast

The Sun and the earth are tiny parts in the universe

The universe has about 100,000 million galaxies

The galaxy they are groups of stars that rotate together in cosmic space by the effect of gravity

They are the greatest units that form the universe

Each galaxy has distinctive shape according to the harmony and order of the groups of stars on it

Galaxies gather in groups called clusters مجموعات

Galaxies clusters مجموعات المجرات they are groups of galaxies that rotate together in cosmic space by the effect of gravity

The Milky Way A lot of old stars gather in the center surrounded by small stars located in the spiral arms of the galaxy.

The Milky Way one of the spiral galaxies

The Milky Way contains the sun and the solar system

Our sun is a star of millions of stars rotate around the center of galaxy.

G.R. The Milky Way is given that name?

Because it appears in the sky at night as a splashing milk الفن المبعثر or spreading straw اللين المرشوش



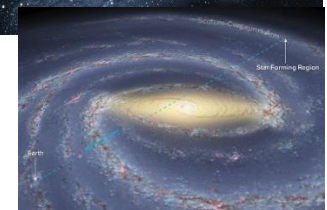
Andromeda galaxy



Scorpion galaxy



Ursa Major galaxy

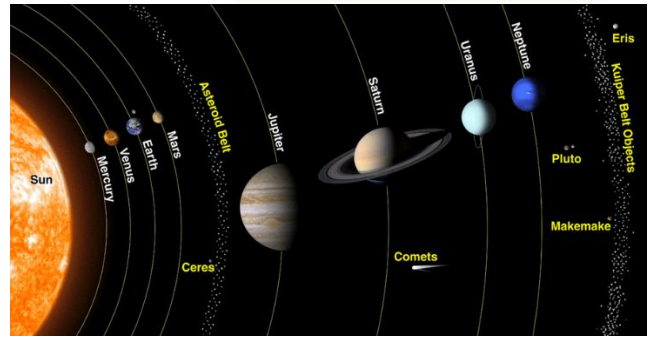


The solar system

It is the sun and eight planets revolving around the sun

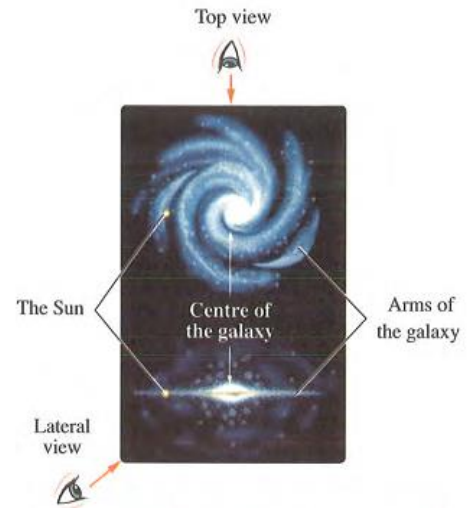
The solar system is located in one of the spiral arms of the Milky Way on the edge of the galaxy

The sun takes about 220 million years to complete one rotation around the centre of the galaxy.



The planet earth the earth is one of the Planets revolve around the sun

Planets revolve around the centre of the galaxy (Milky Way).



The force of gravity is responsible for keeping the planets in their orbits around the Sun and the moons in their orbits around the planets.

As the distance between the Sun and the planet increases, the Sun's gravity decreases, and so the planet's movement around the Sun becomes slower.

What happens if...?

The gravity between the Sun and the planets is vanished.

The planets will leave their orbits and float in a random fashion in space, and therefore there will be no solar system.

The Earth rotates in a fixed orbit by the effect of the Sun gravity

We can summarize the previous details in the following figure:



Measuring distance between the celestial bodies

The distances in the universe are so vast so that they are measured by the light-years. Since the speed of light equals 300000 km / second

Light year It is the distance covered by light in one year
it equal = 9.467×10^{12} km (94670000 million kilometer)

What is the meant by

The distance between the sun and a star is 3 light years?

This means that the distance the sun and this star = $3 \times 9.467 \times 10^{12}$ km
 = 28.401×10^{12} km

G.R. Astronomers don't measure the distances between stars?

Because the distances between stars are very large. in kilometres.

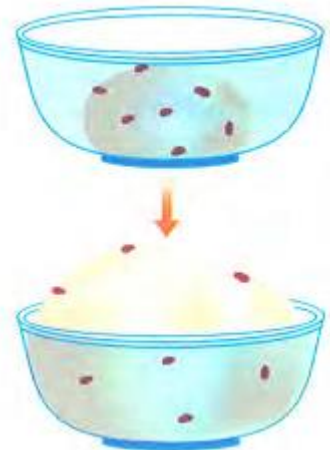
Activity

Expansion of the universe and distances of Galaxies

Tools: worm water - some flour - some raisin **الزبيب**

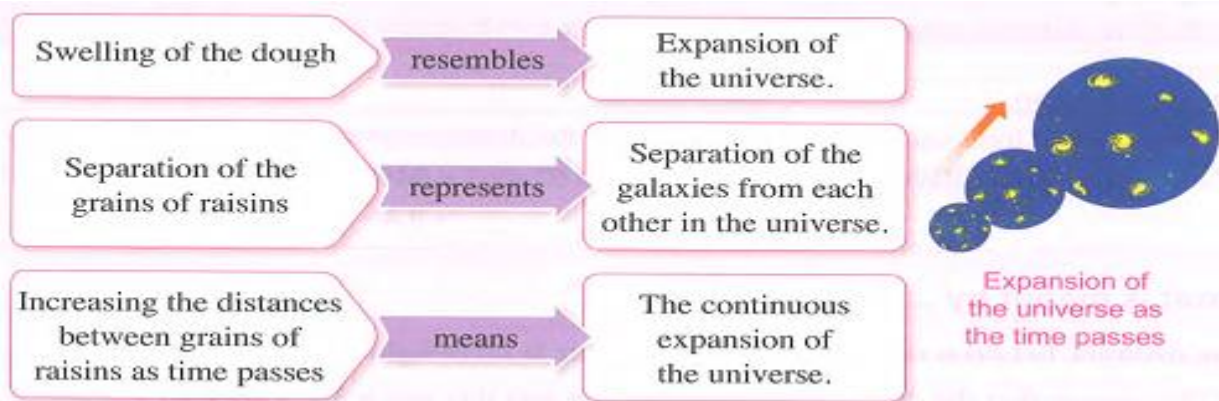
Activity

- 1- Mix Flour with some water and some of the bread yeast to make bread dough. (Which represent the universe)
- 2- Mix the ingredients well to make bread dough
- 3- Insert some raisins (which represent the galaxies) in the dough.
- 4- Leave the dough to ferment in a warm environment.



Observation When the dough expands, the grains of raisins become apart (away) from each other as the time passes.

Conclusion: If we consider the dough represents the universe and the grains of raisins represent the galaxies, So



Expansion of the universe

It is the continuous separation between galaxies in space as a result of their regular

G.R. The continuous expansion of the space (universe).

Due to the movement of galaxies apart

The origin of the universe

How did the universe originate...?

There was no one to relate what happened. But the discoveries in physics and astronomy enabled scientists to trace the history of the universe from the first second fraction of its evolution.

Many scientists believe that the universe emerged from a massive explosion called Big Bang.

The Big Bang theory [1933]

The Big Bang theory assumed that:

-The beginning of the universe was a gaseous ball of high pressure, high temperature and small in volume.

-A massive explosion occurs to this ball since 15000 million years and its components were scattered in space followed by continuous expansion and changing processes till now.

Resulted from this explosion, all forms of matter, energy, space and time.

Big Bang

It is a theory that explains the origin of the universe from a massive explosion since 15000 million years and resulted in it all forms of matter energy, time and space followed by continuous expansion and changing processes

► Enrichment information

In 1964, scientists Robert Wilson and Arno Penzias coincidentally discovered radio waves coming from space.

•They concluded that these waves are a type of the echo of the Big Bang which still frequented in the universe.

TV sets can receive such signals (waves) on the Earth.

These scientists have won the Nobel prize for physics in recognition of the discovery.



History of the universe

The stages of the origin of the universe since Big Bang

Through Big Bang

The gaseous ball form which the universe originated exploded and the process of expansion and changing started



Within minutes

The temperature became about 10000 million degree
The atomic particles produced from explosion merged together producing gaseous clouds of 75% **hydrogen** and 25% **helium**.
These gases produced the galaxies, stars and universe through millions years



After 1000 million years

The previously formed matter merged in the form of masses



After 2000 to 3000 million years

Gravity helped in gathering more masses forming (**Ancestral galaxies**) having areas of empty space between them

After 3000 million years

Galaxies began to form



After 5000 million years

Our Galaxy The Milky Way, took its disc form



After 10000 million years

The Sun was born
Then the earth and planets were created

After 12000 million years

Earliest life forms began to appear on earth



After 15000 million years

The **universe** as it **now**



Theories about the evolution of the solar system

1. There are many scientific and philosophical theories about the evolution of the solar system. they are about twenty theories and they (as we shall see)
2. They are still unproved and subject to change.

We will study the most important of these theories to recognize the evolution of scientific ideas about the evolution of the solar system.

1-Nebular assumption (Laplace)

The crossing star theory (Chamberlain and Molten)

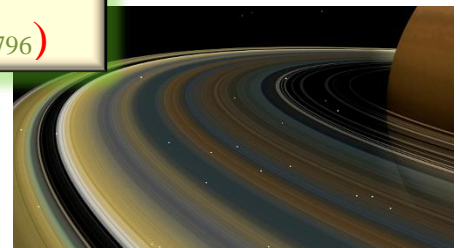
3-The modern theory of the world (Fred Hoyle)

1 -Nebular assumption (Laplace 1796)

1. In 1796 Laplace published a research entitle (World order)

This research included a vision of Laplace about the evolution of the solar system

2. This perception has been affected by two observations. Which are
 - a- There is something that looks like clouds or nebula in the space.
 - b-The space contains many cloudy rings surrounding some planets such (rings of Saturn.



It suggested that the solar system developed as the following:

1

A-The Solar system originated from (glowing gaseous sphere). Called Nebula

The contraction of nebula

B-it lost its heat gradually, so its size contracted and its revolving speed around itself increased.

2

The gaseous rings

a- under the effect of **centrifugal force** the nebula lost its sphere form and became in a form of a **flat rotating disk**.

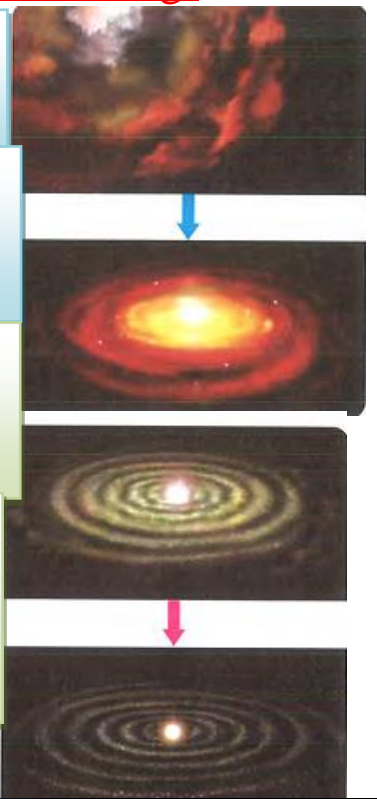
b- Parts got **separated** from it by the effect of the **centrifugal force** to form **gaseous rings** that also rotate in the same direction in which the nebula rotates.

3

the formation of solar system

a-The **gaseous rings** were cooled and frozen forming the **planets** of the solar system.

b-The flaming mass that remained in the center formed the **sun**.

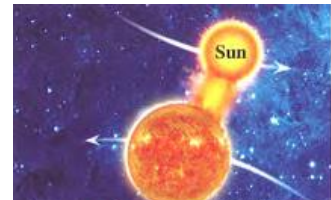
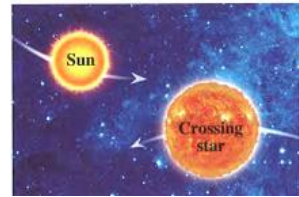


2-The crossing star theory (Chamberlain and Molten 1905)

The crossing star theory is based on some assumptions:

1-A **huge star** approached to the sun.

2-This **star attracted** the sun to it, which led to a great expansion in the part of the sun facing it



3-This expanded part was exploded which lead to

- The sun escaped from the gravity of that star.
- a gaseous line was formed of a great length from the sun until the least planet

4-The **gaseous line started** to condense due to the attraction forces and then it cooled **forming the planets**.

-The modern theory of the world (Fred Hoyle, 1944)

Fred Hoyle built his theory on the origin of the solar system on the basis of well-known astronomical phenomenon known as "Stars explosion phenomenon".

Stars explosion phenomenon Glowing of a star for a short time to become one of the most shining stars in the sky, then its glowing disappears gradually to return as it was.

-The interpretation of this phenomenon is not known specifically until now.

The following is an attempt to interpret this phenomenon:

1-Sudden violent nuclear reactions occur within the star which led to its explosion.

2-The star bombs huge amounts of gaseous materials as a result of this explosion which led to increasing its size and its shining.

3- When the bombed gases are cooled, the shining of the star returned as it was,



Explosion of stars

He assumed :(modern theory of the world (Fred Hoyle)

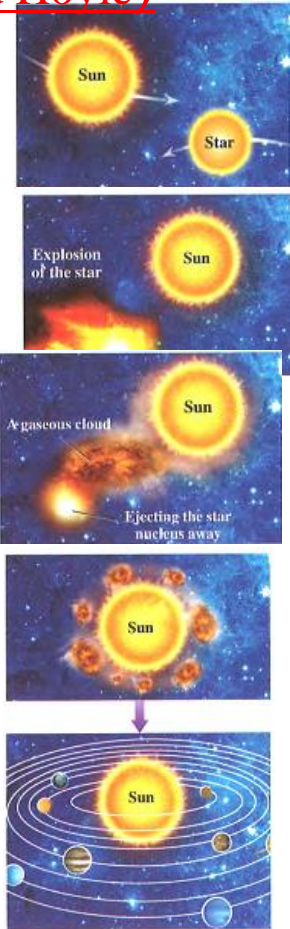
1- A star was rotating near the sun

2-The star exploded due to huge nuclear reactions.

3-The force of the explosion led to the bombing of the star's nucleus away from the gravity of the sun.

4-A cloud of gas remained and was subject to cooling and contraction processes forming planets.

5-The force of the sun's attraction controlled the orbits of planets around it



G.R. Explosion of some stars suddenly.

Due to occurrence of sudden and violent nuclear reactions.

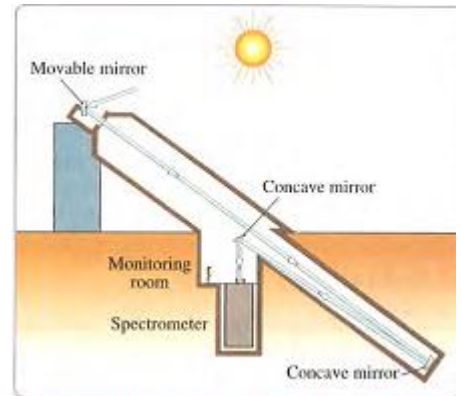
P o c	<u>Nebular theory</u>	<u>Crossing star theory</u>	<u>Modern theory</u>
<u>The founder</u>	Laplace	Chamberlain and Moulton	Fred Hoyle
<u>The origin of the solar system</u>	A glowing gaseous sphere revolving around itself (Nebula)	The Sun.	A star rather than the Sun.
<u>The force that causes the formation of the solar system:</u>	The centrifugal force arising from the rotation of nebula around its axis.	The force of attraction of the crossing star and the force of explosion of the expanded part from the Sun.	The force of explosion of the huge star resulting from the occurrence of sudden and violent nuclear reactions within it

The solar telescope

Importance it form a picture of a sun to help studying

How does the solar telescope work...?

- 1-It works on reflecting the Sun rays downward to a concave mirror in a tunnel under the Earth's surface.
- 2-The sunlight is gathered, then separated into a solar spectrum by the spectrometer (this shows the different light wavelengths emitted by the Sun).
- 3-A complete picture of the Sun is formed in a monitoring room where astronomers can study its light.



Internal structure of solar telescope



Astronomers got most of their information about the Sun from the study of its spectra

Telescopes rotating in orbits around the Earth are better than are on the surface area of the Earth ?

Because they can see celestial bodies more clearly.

Also, they can catch rays able to penetrate the Earth's atmosphere.

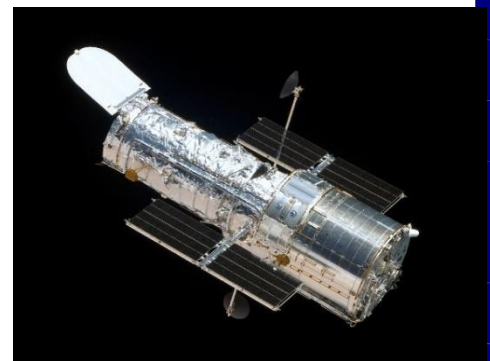
The Hubble telescope

The Hubble telescope was launched in April in 1990

It rotates around the Earth at a height of 500 km.

Importance of Hubble telescope:

It collects photos for the universe that give us details about its state since millions of years, these photos give astronomers an opportunity to study the evolution of the universe after the Big Bang.



Questions

on The lesson

Unit Three Lesson one

1- Choose the correct answer:

- The number of galaxies in the universe is aboutmillion galaxies
a. 10 000 b . 100 000 c. 20 000 d . 200 000 .
 - The building units of the universe are
 - planets
 - stars
 - galaxies
 - moons
- The universe contains a galaxies and stars .
a. Galaxies and stars b . planets and moons .
c . living organisms d . all the pervious answers .
 - Galaxies are formed of groups of
a. moons . b . constellations c. stars d . planets .
 - Galaxies gather in groups known as ... Ismailia 2014
a. galaxies clusters b . solar system .
c . ancestral galaxies d . planets
 - are located in the spiral arms of Milky Way galaxy .
a. Old stars b . Moons c . Small stars d . (a) and (c)
 - is the star of our solar system .
a . Moon b . Galaxy c . The Earth d . The Sun
 - The Sun and the surrounding planets revolve around the centre of the
a . Earth b . Moon . c . Galaxy d . no correct answer .
 - The solar system consists of the Sun and planets rotate around the Sun.
a. nine b . eight c . six d. seven
 - The solar system is located in one of the arms of the Milky Way galaxy .
a . spiral b . oval c. straight d . circular
 - The Sun takes about to complete one rotation around the centre of the galaxy .
a . 220 thousand years b . 220 million years
c . 230 million years d . 320 million years
 - The light year is
 - the distance covered with light in one year .
 - the light speed in km / sec .
 - the time consumed by light to cover a certain distance .
 - the speed of light and electromagnetic waves in km / sec . - Astronomers measure the distances between stars with light year , because the stars....
a. generate great amounts of light and heat b. seem small light points .
c . are millions of kilometers away from each other d . no correct answer
 - The scientists believe that the universe emerged from a massive explosion and it is in ...
a. continues contraction . b . contraction then expansion ,
c . expansion then contraction . d . continues expansion .
 - The continuous expansion of the universe is due to ... separation of galaxies . (Assiut 2019
a. separation of galaxies . b. approaching of galaxies .
c . equivalent of galaxies . d . no correct answer .

16. Scientists believe that the matter of the universe was a ball of high pressure and high temperature .
 a . liquid b . solid c . gaseous d . no correct answer
17. After minutes from the Big Bang , the temperature becomes million degrees .
 a . 100 b . 1000 c . 10000 d . 100000
18. are originated after about 2000 : 3000 million years of the Big Bang .
 a . Galaxies b . Stars c . Planets d . Ancestral galaxies
- 19 began to form after 3000 million years of the Big Bang . Sohag 2019
 a . Galaxies b . Stars c . Planets d . Ancestral galaxies
20. The two gases which produced galaxies , stars and universe over millions of years are (Cairo Kalyoubia 2020)
 a . oxygen and helium . b . oxygen and carbon dioxide .
 c . hydrogen and helium . d . hydrogen and carbon dioxide .
21. Within minutes after Big Bang , hydrogen gas was formed by a percentage of (Menia 2020)
 a . 25 % b . 50 % c . 75 % d . 100 %
22. Within minutes after Big Bang , helium gas was formed by a percentage of
 a . 75 % b . 65 % c . 55 % d . 25 %
23. According to the Big Bang theory , within minutes from the origin of the universe , the ratio of hydrogen to helium is (Fayoum . Beni Suef 2020) .
 a . 75 : 1 b . 25 : 1 c . 3 : 1 d . 1 : 3
24. The Milky Way galaxy took its disc form after about million years from the Big Bang _____ (Qena 2019)
 a . 1000 b . 3000 c . 5000 d . 10000
25. The Sun was born after about million years from the Big Bang , (Luxor2018)
 a 3000 b . 2000 c . 15000 d . 10000
25. The earliest life forms began to appear on the Earth after about million years from Big Bang
 a. 15000 b. 13000 c.12000 d. 10000
27. Planets state around the Sun by the effect of the gravity of
 a. the Sun b. Jupiter c. the Earth d . the moon
28. The biggest start that can be seen clearly by people on the Earth is
 a. Saturn b . the Sum c. Uranus d. Neptune
29. The theory which explains how the universe originated istheory
 a. crossing star b. nebular c. solar nebular d. Big Bang
30. From the oldest theories which is explained the evolution of the solar system is
 a. the crossing star b. the nebula c. the Big Bang d . Fred Hoyle
31. The scientist who established the nebular theory is
 a. Newton b . Chamberlain. c. Laplace d . Moulton
32. According to Laplace assumptions , the nebula gradually lost its heat , so
 a. its size contracted only b. its revolving speed and itself increased only .
 c. it is vanished d. (a) & (b) are correct
33. Laplace theory assumed that the gaseous rings separate from nebula after its cooling and freezing forming the

- a. Sun b. planets of the solar system c. gaseous ball d. universe
34. Theory assumed that the solar system was originally a glowing gaseous sphere .
 a. Nebular b. Crossing star c. Modern d . No correct answer
35. The scientist(s) who established the crossing star theory is are
 a. Chamberlain and Moulton b . Laplace
 c. Newton d . Fred Hoyle .
- 36..... theory assumed that the origin of the solar system was from the explosion of the expanded part of the Sun forming a gaseous line of a great length from the Sun due to a huge star approached to it .
 a. Nebular b . Big Bang c . Crossing star d . Modem
37. The founder of modern theory to explain the origin of the solar system is.....
 a. Chamberlain b. Moulton c . Fred Hoyle d . Laplace
38. In the modern theory , bombing the star nucleus away was due to.....
 a. the force of `gravity b . collision by asteroids
 c. drop in temperature , d . huge nuclear reactions
- 39 : Fred Hoyle assumed that the Sun controls in the orbits of planets around it due to of the Sun
 a. the temperature b . rotational speed c. the attraction forced d. glowing
40. Astronomers use special equipment to study the Sun , this equipment is the
 a. glasses .b . telescope c. lens . d . no correct answer
41. The Hubble telescope was launched in April in
 a. 1905 b . 1990 c . . 1995 d . 1959

2. Choose from column (B) , what suits those in column (A)

1	(A)	(B)
1.	The Sun	a . is the space that contains galaxies
2.	The galaxy	b . form galaxies
3.	The solar system	c . is the greatest unit that form the universe
4.	The universe	d . is the measuring unit of the distances between stars
5.	The light year	e , contains the Sun and eight planets revolving around it
6.	The Milky Way	f . is the galaxy that our solar system belongs to
7.	Stars	g . is the star of our solar system

2	(A)	(B)
1.	The crossing star theory	a . explains that the origin of the solar system is a glowing gaseous rotating sphere
2.	The nebular theory	b . assumes that the origin of the solar system is a star rather than the Sun.
3.	The modern theory	c . assumes that the origin of the solar system is the Sun
		d . thinks that the origin of the solar system is the Earth

3. Put (√) or (x) in front of the following sentences and correct the false ones :

1. The Earth is the space that contains all the galaxies , stars . planet , moons and living organisms ()
2. Galaxies move away in the cosmic space . ()
3. Galaxies rotate in a system around the centre of the universe . ()
4. The universe contains various galaxies that move away from each other organisms ()
5. Each group of stars is gathered in the solar system , ()
6. The solar system is located at the edge or Milky Way galaxy ()
- 7 . The solar system contain a lot or star ()
8. Eight planets including the Earth rotate around the galaxy ()
9. Nine planets rotate around the Sun ()
10. The universe emerged from the particles of oxygen and nitrogen ()
11. The universe is in a state of continuous expansion ()
12. Galaxies emerged from the Big Bang . ()
13. The matter of the universe was a gaseous ball of high pressure and high temperature ()
14. Galaxies began to form after about 2000 million years from the Big Bang ()
15. Our galaxy took its disc form after about 5000 million years from the Big Bang ()

4. Correct the underlined words :

1. Each galaxy has a distinctive shape according to the harmony and order of the groups of planets in it (Cairo 2013)
2. The solar system lies in Andromeda galaxy
3. The galaxy is the distance covered with light in one year . (Share 2015)
4. The old stars gather in the edges of the galaxy
5. The solar system lies in one of the circular arms of the Milky Way galaxy .
6. The solar system contains many stars .
7. The crossing star is a big star can seen from the Earth .
8. The unit for measuring distances between galaxies is kilometer.
9. The Sun takes about 100 million years to complete one rotation around the center of the galaxy
10. The Sun and the surrounding planets revolve around the center of the solar system.

5. Write the scientific term of each of the following statements

1. • The space which contains all the galaxies , stars , planets , moons , living organisms and everything(.....)
2. • The greatest units that form the universe (.....)
3. The group of galaxies which revolves together in the universe space due to the gravity(.....)
4. • It contains all the stars we see at night in the sky (.....)

5. • It is located in one of the spiral arms of the Milky Way galaxy on the edge of the galaxy(.....)
6. • The unit that is used to measure the distances between the celestial bodies .
7. The continuous separation between galaxies in the universe due to their regular motion (.....)
8. • The expansion of the universe and merging of atomic particles forming helium and hydrogen gases (.....)
- 9 . The biggest star that can be seen clearly by people on the Earth (.....)
10. The force that controls in the orbits of planets around the Sun according to modern theory (.....)

6. Give reasons for the following:

1. Our galaxy is called the Milky Way galaxy
2. • The difference in the shapes of galaxies that form the universe .
 - Each galaxy in the universe has a distinctive shape .
3. Astronomers don't measure the distances between stars in kilometers.
 - The distances in the universe are measured in light year.
4. The continuous expansion of the space (universe) .
- 5 . Galaxies move away from each other
6. The stability of the Earth rotation in an orbit around the Sun .
7. The constancy of the planets in their orbit around the Sun
8. • The nebula lost its sphere form and became in form of a flat eating dick
 - Separation of parts of nebula and formation of gaseous rings rotate in the same direction in which the nebula routes
9. Explosion of some stars suddenly
10. The Sun escaped from the gravity of the huge star in the crossing star theory

7. What are the results based on ...

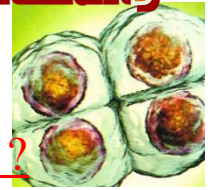
1. • Galaxies move away from each other as time passes
 - Separation distances of galaxies .
2. Groups of stars are gathered in the universe
3. The merge of the atomic particles together within minutes of the Big Bang
4. Occurrence of Big Bang
5. The nebula lost its temperature in Laplace's opinion .
6. The expanded gratis between the sun and the crossing star explodes de cording Chamberlain and Moon
7. The explosion of the star nearer to the Sun according to Fred Hoyle. "
8. Approaching of a huge star to the Sun according to the crossing star theory,
9. The gaseous cloud is cooled in Fred Hoyle theory)

8. What happens... ?

1. • If the gravity between the Sun and planets which rotate around is vanished.
 - When there is no gravity in the solar system.
 - When the force of the Sun gravity doesn't control the orbits of planets around

Unit (4) Reproduction and Species Continuity

Chapter (1) Cell Division



What are the types of cells in multicellular living organisms ?

Not all cells of multicellular organisms are similar, but they have some differences, from which how they divide to increase their number.

The cells of multicellular living organisms are two types which are

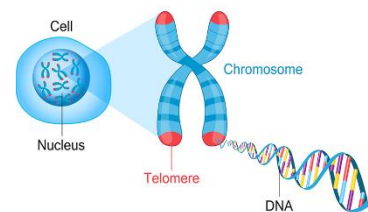
<u>1-Somatic cells</u>	<u>2-Reproductive cells</u>
All body cells (except reproductive cells), Such as:	Such as
Such as: <u>humans and animals</u> The cells of (liver, skin, kidney, <u>plants</u> The cells of roots, stem, leaves	<u>humans and animals</u> sperms –ova Testes and ovaries <u>plants</u> cell of anther . ovary in flowering plants

Chromosomes

Most types of cells contain nucleus, which contains thread like bodies called chromosomes that have the main role in cell division.

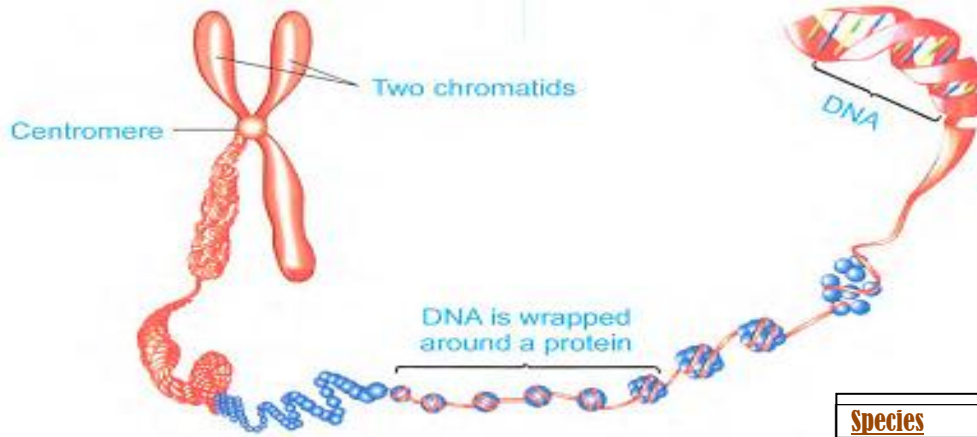
Chromosomes

They are thread-like bodies present in cells' nuclei and they represent the genetic material of the living organism.



Structure of chromosomes:

<u>General structure of chromosomes:</u>	<u>Chemical structure of chromosomes</u>
Each chromosome consists of	Each chromatid consists of:
- <u>Two connected threads</u> , each thread is called "Chromatid". -The two chromatids are connected at a point known as " <u>Centromere</u> ".	(a) A nucleic acid called " <u>DNA</u> " which carries the genes that carry the genetic traits of the living organism. (b) <u>Protein</u>
<u>Centromere</u> It is the point of connection of the two chromatids of chromosome	<u>DNA</u> It is the nucleic acid that carries the genetic traits of the living organism.



The chemical structure of chromosome

Species	No. of chromosomes
Dog	78 (39 pairs)
Onion	16 (8 pairs)
Peas	14 (7 pairs)
Maize	20 (10 pairs)
Human	46 (23 pairs)
Rabbit	44 (22 pairs)
Wheat	42 (21 pairs)
Mosquito	6 (3 pairs)

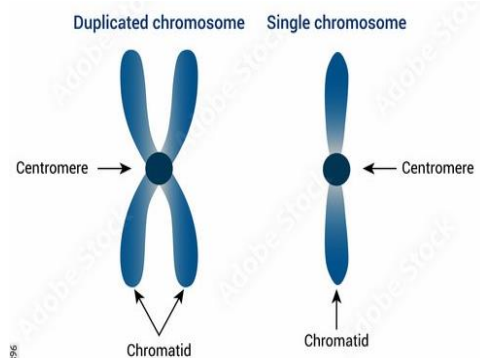
Number of chromosomes:

- The number of chromosomes in living organisms differs from one species to another.
- The number of chromosomes is fixed among the members of the same species.
- The number of chromosomes in somatic cells and reproductive cells differs from the number of chromosomes in gametes for the same organism as follows:

A- <u>Somatic cells and reproductive cells</u>	B- <u>Gametes (male gametes (sperms) and female gametes (ova))</u>
Each one of them <u>contains a complete number of chromosomes</u> (complete two sets of chromosomes, one from male gamete and the other from female gamete).	- Each one of them contains a <u>half number of chromosomes</u> present in reproductive cell or in somatic cell.
-The number of chromosomes is a <u>diploid number</u> (2N).	-The number of chromosomes is a <u>haploid number</u> (N).

Importance of chromosomes:

- They represent the genetic material of the living organism.
- They have the main role in cell division.
- Knowing the number of chromosomes helps in identifying the animal and plant species.



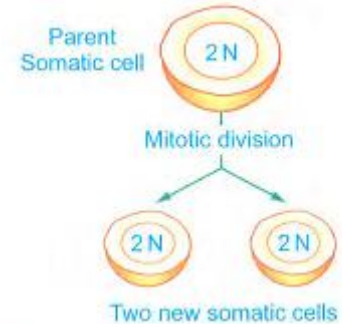
Cell division

There are two types of Cell division Mitosis and Meiosis

<u>Mitosis</u> (Mitotic cell division)	<u>Meiosis</u> (Meiotic cell division)
(Direct cell division)	(Reduction cell division)

First: Mitosis division

Mitosis division It is a type of cell division at which a somatic cell divides into two new somatic cells, each of them contains the same number of chromosomes of the parent somatic cell.



Site of occurrence

It occurs in somatic cells only such as:

- Cells of pancreas, skin, liver and kidney (in humans and animals).
- Cells of roots, stems, leaves and seeds (in plants).

Some cells in the human body are not divided at all:

- neural cells (as they don't contain centrosome, which plays a role in cell division).
- adult red blood cells (as they don't contain nucleus, which contains chromosomes).

Important of Mitosis it play an important role in

- 1-Growth of the living organisms (growth of seeds to complete plant)
- 2-Compensation of the damaged cells.
- 3-Complete the asexual reproduction process



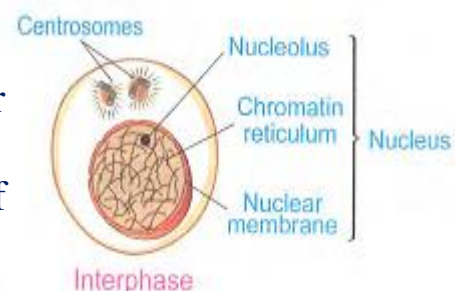
The growth of a seed by mitosis to a complete plant

Phases of mitosis:

Before starting mitosis, the cell passes through a phase called interphase.

Interphase:

It is the phase which is occurred before starting the cell division process, at which the cell prepares for division by the occurrence of some important biological processes and duplicating the amount of the genetic material (DNA).



Interphase has an Important role before starting mitosis. G.R.

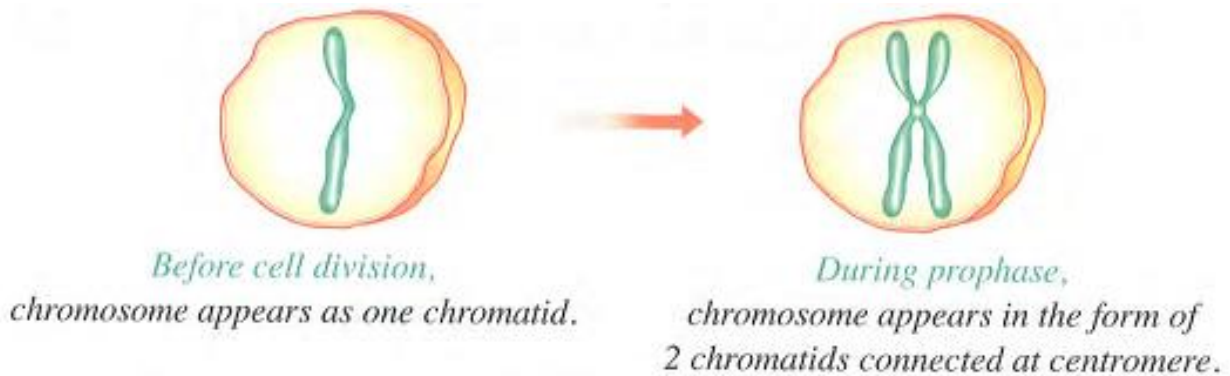
As interphase prepares the cell for division by:

1. Occurrence of some important biological processes.
2. Duplicating the amount of the genetic material (DNA).

For illustration only Duplicating the genetic material, doesn't mean increasing its number, but it means copying it several times before the cell division, and so each new resulting cell obtains its complete copy of genetic material of the parent cell.

Note

Chromosomes which consist of 2 chromatids, do not appear before cell division.



Phases of mitosis division are:



Phases (stages) of mitosis:

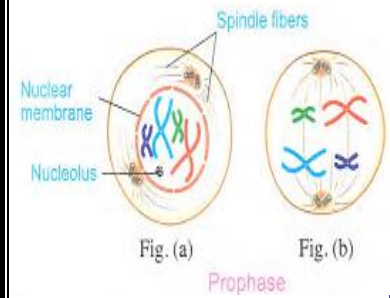
Prophase

In this phase

Chromatin reticulum condenses (intensifies). then appears in the form of long, thin and double strings chromosomes

-At the end of this phase:

- Nucleolus and nuclear membrane disappear.
- A network of filamentous fibers called "spindle fibers" is formed at the centrosomes extending between the two poles of the cell.
- Each chromosome is connected with one of the spindle fibers by the centromere



Metaphase

In this phase

The chromosome which are connected with the spindle fibers are arranged in cell equator



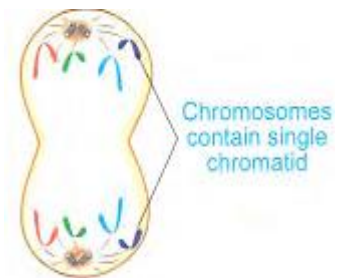
Metaphase

Anaphase

In this phase

The centromere of each chromosome splits lengthwise into two halves, so the chromatids separate from each other.

The spindle fibers begin to shrink and two identical groups of chromosomes (each contains single chromatids) are formed. Each group of chromosomes migrates towards one of the cell's poles.



Anaphase

Telophase

In this phase

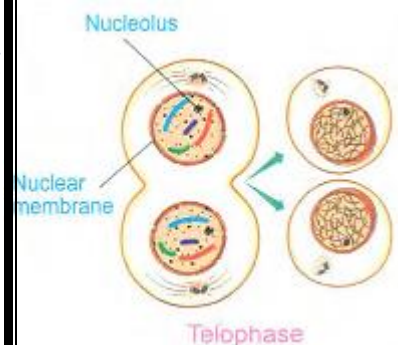
- The spindle fibers disappear.
- A nuclear membrane is formed around the chromosomes at each of the cell's poles leading to the formation of two new nuclei.

A nucleolus is formed at each pole of the cell.

- The chromosomes inside each nucleus convert into a chromatin reticulum again..

At the end of this phase:

the cell divides into two new cells, the nucleus of each of them contains complete number of chromosomes (2N) of the parent cell.



Telophase

G.R. The changes which occur in telophase are called the adverse changes. Because the changes that occur in telophase are adverse to that occur in prophase.

Compare between?

P.O.C	Animal cell	Plant cell
Formation of <u>spindle fibers</u>	The spindle fibers are formed by the <u>centrosomes</u>	The spindle fibers are from condensing the <u>cytoplasm</u> at two poles of the cell (Because in plant cell there is no centrosomes)

Liver Transplantation:

-Some somatic cells such as liver cells are not divided in normal conditions but they retain the ability to divide under certain circumstances.

For example, if the liver gets injured or a part of it is cut, the remaining cells undergo many mitotic divisions to compensate the missing part.

This is the scientific basis used in liver transplantation process.

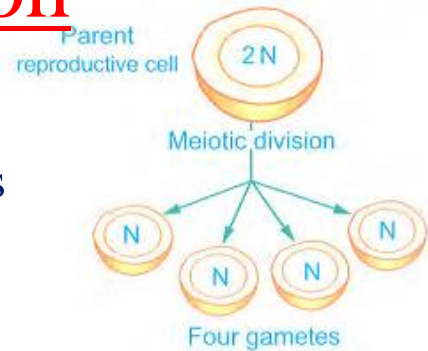
Liver transplantation process is performed to replace the infected patient's liver with a part of a healthy donor's liver, as time passes, the liver of each of them is completed due to the occurrence of mitosis divisions.



Second: Meiosis division

Meiotic cell division (Meiosis):

It is a type of cell division at which a reproductive cell divides into four new cells (gametes), each of them contains half the number of chromosomes of the parent reproductive cells.



Site of occurrence: It occurs only in the reproductive cells:

In humans and animals: It occurs in the testes [to produce male gametes (sperms)] and in the ovaries (to produce female gamete (ovum)], (pl. ova).

In flowering plants: It occurs in the anther [to produce male gametes (pollen grains)] and in the ovary [to produce female gametes (eggs or ova)].

Importance of meiosis:

- 1- Produced male and female gametes
- 2- Complete the sexual reproduction

Phases of meiosis:

* Before starting meiosis, the cell passes through interphase.

- Meiotic division takes place in two stages:

1. First meiotic division. 2. Second meiotic division.

1- First meiotic division:

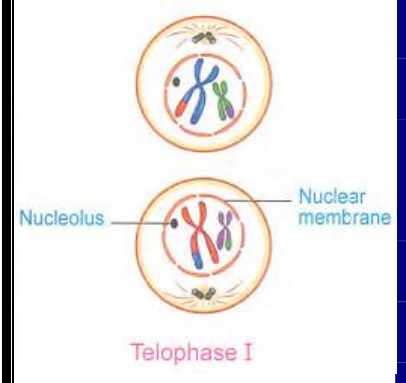
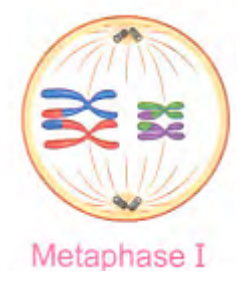
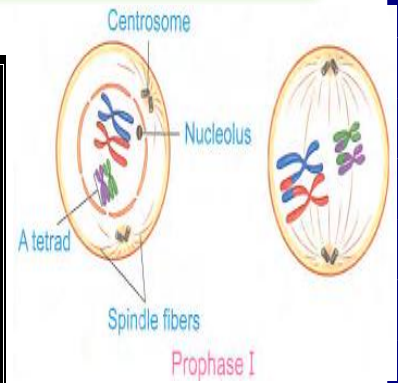
It produces two cells, each of them contains half the number of chromosomes.

Phases of first meiotic division are:



Phases (stages) of first meiotic:

<p>Prophase</p>	<p>In this phase Chromatin reticulum condenses (intensifies), then appears in the form of long, thin and double strings chromosomes. Chromosomes are arranged in homologous pairs, each pair consists of 4 chromatids which are called a tetrad.</p> <p>Tetrad: It is the arrangement of homologous pairs of chromosomes, where each pair consists of 4 chromatids.</p> <p><u>At the end of this phase:</u> <u>Crossing over phenomenon occurs</u> Nucleolus and nuclear membrane disappear. The spindle fibers are formed and connected to the chromosomes at centromere. Each two homologous chromosomes (in the tetrad) starts to move away from each other.</p>
<p>Metaphase</p>	<p>In this phase The chromosomes pairs which are connected with the spindle fibers are arranged at the cell equator.</p>
<p>Anaphase</p>	<p>In this phase - The spindle fibers begin to shrink, so every two homologous chromosomes move away from each other. Each one of the two homologous chromosomes migrates towards the cell pole, and the other one migrates towards the other cell pole.</p> <p>Therefore, each cell pole contains half the number of chromosomes of the parent cell.</p>
<p>Telophase</p>	<p>In this phase- The spindle fibers disappear.</p> <ul style="list-style-type: none"> - A nuclear membrane is formed around the chromosomes at each of the cell's poles leading to the formation of two new nuclei. - A nucleolus is formed at each pole of the cell. <p><u>At the end of this phase :</u> The cell divides into two new cells, the nucleus of each of them contains half number of chromosomes (N) of the parent cell.</p>



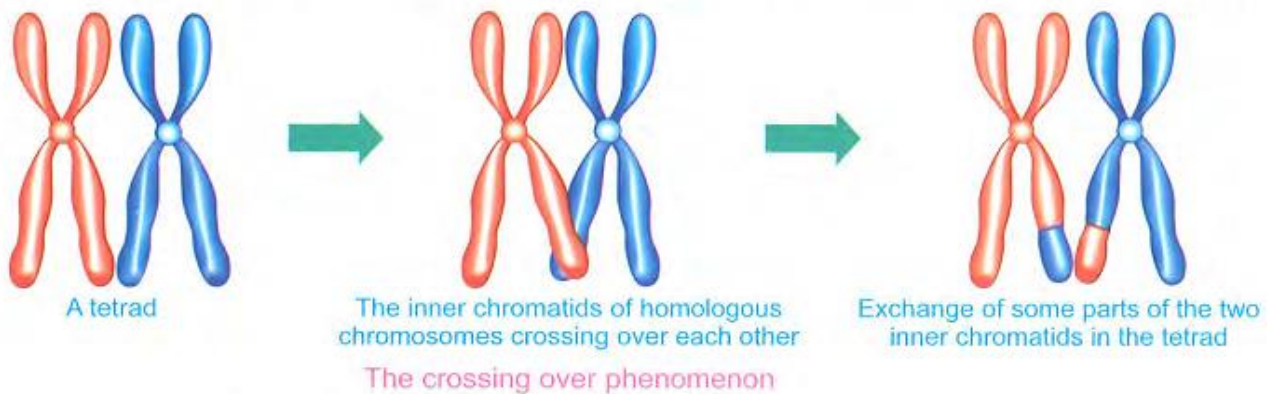
The crossing over phenomenon

Why are the traits different between members of the same species?

This is due to the crossing over phenomenon.

Crossing over phenomenon

It is a phenomenon that takes place at the end of prophase I in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangements.



The importance of the crossing over phenomenon

- 1- The variation of genetic traits among the members of the same species.
- 2- It contributes in exchange of genes (that carry genetic traits) between the two homologous chromosome's chromatids and distributing them randomly in the gametes.

2-Second meiotic division:

-It aims to increase the number of produced cells.

Each cell is called the (gamete), containing half the number of species chromosomes.

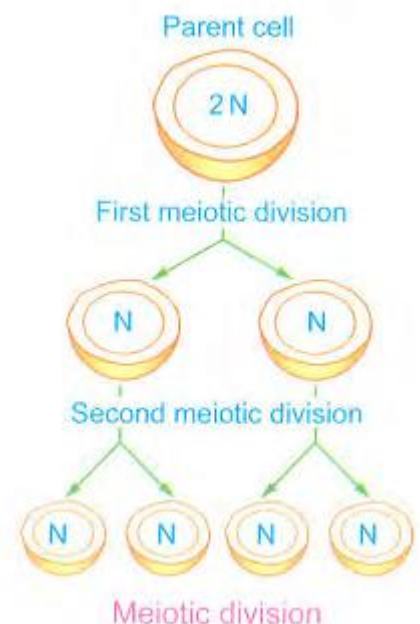
Each cell of the two cells which resulted from the first meiotic division is divided in a way similar to mitosis division phases.

2-In the final phase (telophase II) of this division, four cells are produced and each of them contains half the number of chromosomes of the parent cell.

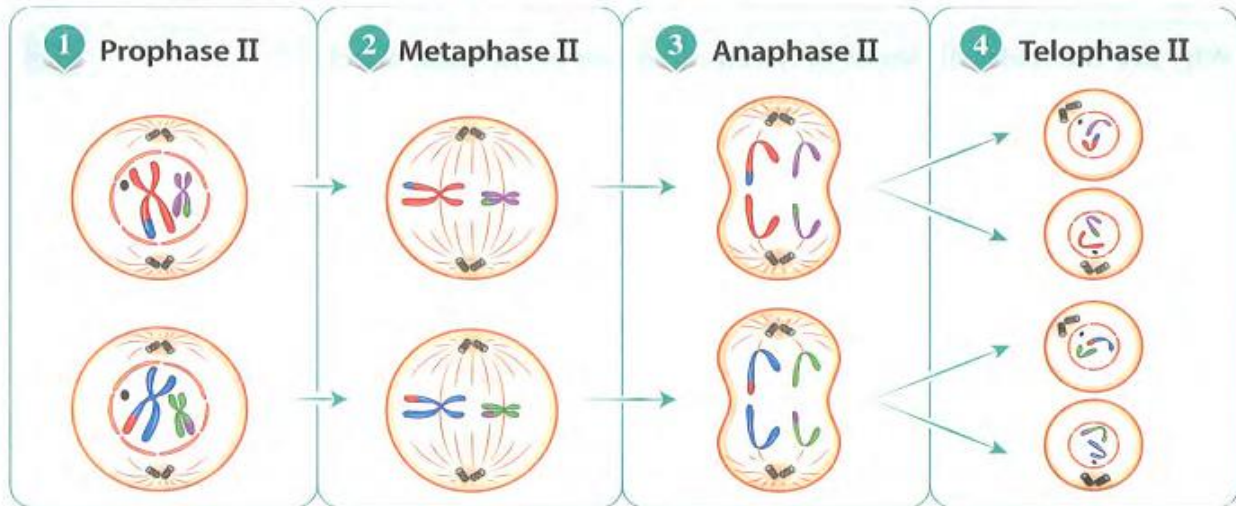
G.R.

Meiotic cell division is called by reduction division.

Because the produced cells contain half the number (haploid number) of chromosomes of the parent reproductive cell (diploid number).



* Phases of second meiotic division are :

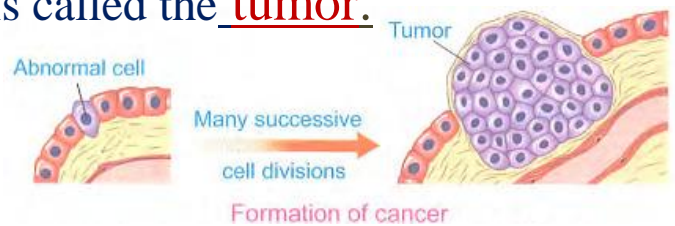


Science, Technology and Society

Nanotechnology and cancer treatment

Cancer - It occurs when the body cells are divided continually without controlling. To form mass is called the tumor.

Tumor The of mass cells produced from abnormal continuous division of cells



The Egyptian scientist Dr. Mustafa El Said

Discovered a way to detect the cancer cells and kill them by using very small molecules of Gold measuring by nanometer (NANO-molecules.) and technic called (NANO-technology)



1-Discovering cancer disease This technical starts by loading proteins (they have the ability to attach to the cancerous cell secretions) with NANO-molecules of gold and then injecting them into the patient. The infected cell surface proteins get intertwined with the golden molecules to make it possible to monitor the infected cells through a microscope; each cell separately.

Treatment cancer

1. By using loaded protein with Nano-molecules of gold as follows

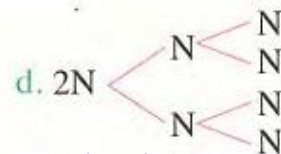
-Focusing laser to a certain degree to the Nano-molecules of gold (present on the cancer cells), then the Nano-molecules of gold absorb the light energy and convert it into heat energy which burns and kills the infected cancer cells, where the healthy cells not affected.

2. By using smart microscopic bombs:

- * Using Nano-technology, scientists have developed smart microscopic bombs that penetrate the cancer cells and explode them from inside.
- * They were used to kill the cancer cells in experimental mice. Mice suffered from cancer were able to live 300 days after this treatment. As for mice that did not receive treatment, they did not live more than 43 days.

The phase	<u>Mitosis</u>	<u>Meiosis</u>
It's important	1- <u>Growth</u> of the living organisms 2- <u>Compensation</u> of the damaged cells. 3- <u>Complete</u> the Asexual reproductive	1- <u>Produced male</u> and <u>female</u> gametes 2- <u>complete</u> the <u>sexual</u> reproduction
interphase	prepare the cell for division cell passes through interphase phase <u>The amount of DNA duplicates</u>	prepare the cell for division cell passes through interphase phase <u>The amount of DNA duplicates</u>
1-Prophase	1- <u>chromosomes appear</u> 2- <u>Spindle fibers appear</u> between the two poles of the cell. 3- <u>the nucleolus disappear</u> 4- <u>nuclear membrane disappear.</u>	1- <u>chromosomes appear</u> 2- <u>Spindle fibers appear</u> between the two poles of the cell. 3- <u>the nucleolus disappear</u> 4- <u>nuclear membrane disappear</u> 5- <u>the chromosomes are arranged in homologous pairs, each pair consists of 4 chromatids are called a tetrad</u> 6- <u>crossing over phenomenon occur</u>
Metaphase	The <u>chromosomes arranged</u> along the cell equator	<u>Chromosomes pairs arrange</u> on the cell's equator
3-Anaphase	1- <u>Centromere splits into two halves.</u> 2- <u>Spindle fibers shrink</u> and <u>two - identical groups of</u>	1- <u>Centromere don't splits</u> 2- <u>spindle fibers shrink.</u> chromosomes start to move away from each other. 3-Each pole contains <u>half</u> the number of chromosomes of the parent cell.
4-Telophase	1- <u>chromosomes disappear</u> 2- <u>Spindle fibers disappear</u> 3- <u>the nucleolus appear</u> 4- <u>nuclear membrane dappear.</u>	1- <u>chromosomes disappear</u> 2- <u>Spindle fibers disappear</u> 3- <u>the nucleolus appear</u> 4- <u>nuclear membrane dappear.</u>
Resulting cells	<u>Two cells are produced(2n)have the same number of parent chromosome</u>	<u>Four cells are produced(n) have the half number of parent chromosome</u>

- c. anaphase, prophase, metaphase and telophase.
 d. metaphase, prophase, anaphase and telophase
19. Meiotic division happens in the cells of the
 a. liver b. testes c. skin. d. bones.
20. The ratio between the number of chromosomes present in the gametes produced by meiotic cell division to the number of chromosomes present in somatic cells is...
 a. quarter. b. double. c. third. d half
21. Meiosis is different from mitotic in that each produced cell contains of the parent cell
 a. quarter. b. double. c. third. d half
22. Meiotic cell division is responsible for the
 a. growth of organisms b. compensation of damaged cells
 c. production of gametes d. duplication of cells number
23. Meiotic division occurs in flowering plants in the anther to produce
 a. ovum b. pollen grains. c. sperms. d. chromosomes.
24. Chromatin condenses and appears in form of distinct chromosomes in phasefrom meiosis division
 a. prophase I b .metaphase I. c. anaphase I. d. telophase I
25. crossing over phenomenon happens in the end of the a first prophase second
 a. first prophase. b. first anaphase. c. second metaphase. d. second anaphase
26. A tetrad consists ofchromosomes
 a. 2 b. 4 c. 6 d. 8
27. First meiotic division differs from the second meiotic division in
 b. formation of the tetrad a. formation of the spindle fibers
 c formation of the nuclear membrane d. no correct answer
28. Which of the following represents meiotic division?



29. If the chromosomal number in the somatic cell is 2N, then its number inthe reproductive cell is.
 a. $\frac{1}{2}N$. b. 4N c. 2N d. N
30. Number of chromosomes in female gamete equals the number of chromosomes in the original cell.
 a. quarter b, half c. the same d. double 1.
31. The number of the chromosomes in the human liver cell is 23 pairs, which of the following contains a haploid number ?
 a. Skin cell. b. Pancreatic cell. c. Fertilized ovum. d. Sperm
32. If the nucleus of a maize pollen grains contains 10 chromosomes, then the nucleus of somatic cell of the same plant contains chromosomes.
 a, 5 b. 10 c. 15 d. 20
33. The number of chromosomes in pollen grain is the number of chromosomes in ovum.
 a. double b. half c. equal to d. quarter

34. If the number of chromosomes in liver cells of a certain living organism is 32 chromosomes then the number of chromosomes in a reproductive cell is ... chromosomes.
a. 16 b. 64 c. 23 d. 16 pairs
35. If the cell of muscles in a female rabbit contains 22 pairs of chromosomes, so the number of chromosomes in one cell of its ovary equal
a. 11 b. 22 c. 44 d. 88
36. If the chromosomal number in the male gamete of an organism is 20 so, the chromosomal number in the liver cell equals chromosomes.
a.5 b. 10 c. 20 d. 40
37. The number of chromosome in each somatic cell and the sperm of a living organism..... respectively
a.6,12 b. 5,6 c. 8,8. d. 12,6
38. The variation of genetic traits resulted from meiosis is due to the.
a reduction of chromosomal number. b. crossing over phenomenon
c. duplication of DNA d. formation of tetrads
39. The cancerous cells can be detected by using of technological Nano-molecules ofmetal.
a. zinc b. iron c. nickel d. gold

2. Choose from column (B), what suits those in column (A) .

1	(A)	(B)
1.	The spindle fibers shrink and two identical groups of chromosomes are formed at each pole of the cell in	a. telophase
2.	Duplication of genetic material occurs in	b. prophase
3.	The nucleolus and nuclear membrane disappear in	c. interphase
4.	The chromosomes are arranged along the cell equator in	d. metaphase
		e. anaphase

2	(A)	(B)
1.	Telophase	a. occurs in reproductive cells
2.	Mitotic cell division	b. in which the chromosomes pairs arrange at the equator of the cell
3.	Meiotic cell division	c. occurs in somatic cells
4.	Metaphase	d. the nuclear membrane appears in it

3	(A)	(B)
I	Reproductive cells	a. in which mitotic division occurs
2.	Plant cells	b. produce gametes
	Somatic cells	c. in which the spindle fibers is formed from the cytoplasm
		d, contains a haploid number of chromosomes

3. Put (√) or (x) in front of the following statements and correct the false ones:

1. The chromosomes are found inside the cytoplasm of the cell. ()
2. Chromosomes are rounded bodies ()
3. The chromosome consists of two chromatids connected at the cytoplasm. ()
4. The genetic material in the nucleus consists of a number of chromosomes ()
5. The chromosome chemically composed of RNA and protein. ()
6. The number of chromosomes in somatic cells is haploid. ()
7. The number of chromosomes in plant stem equal quarter its number in the pollen grains for the same plant. ()
8. The gametes contain the diploid number of chromosomes. ()
9. Gamete is the point of connection of the two chromatids of chromosome. ()
10. Somatic cells are divided by meiosis which leads to the growth of living organisms and compensation of the damaged cells.
11. The genetic material in the cell duplicates in interphase. ().
12. The cell is prepared to enter the phases of mitosis division in the anaphase. ()
13. Chromatin reticulum condenses and appears in the form of long, thin and double strings (chromosomes) in the telophase of the mitotic division. ().
14. The spindle fibers are formed in the plant cell from the centrosome. ().
15. The nucleolus disappears during the mitotic cell division in telophase. ()

4. A write the scientific term of each of the following

1. They are thread like bodies that have the main role in cell division(.....)
2. The part in the cell which is responsible for cellular division (.....)
3. •It consists of two chromatids connected together at centromere (.....)
4. The point of connection of two chromatids together of the chromosome during the cell division(.....)
5. The nucleic acid that carries the genetic traits of the multicellular living organisms(.....)
6. A process through which the living cell divides into two cells or more to aim the growth or reproduction(.....)
7. •A cell division that occurs in the somatic cells and results in the growth of me is a the living organism(.....)
8. A phase in which some important vital processes occur to prepare the cell for division and the genetic material in the cell is doubled(.....)

5. Give a reason for each of the following sentences: .

1. Chromosome is considered as the genetic material for the cell.
2. Cellular division begins with interphase.
3. Duplicating the genetic material in interphase for cell division.
4. Somatic cell differs from reproductive cell.
5. The difference in the way of formation of spindle fibers in plant cell than in animal cell.
6. Shrinking of spindle fibers during the anaphase of mitosis division.

Chapter (2) Sexual and Asexual Reproduction

Living organisms are characterized by Their ability to reproduce.

Reproduction process It is a biological process where the living organism produces new individuals of the same kind and thus, ensuring its continuity. the genetic traits move from parents to offspring.

Types of reproduction in living organisms:

<u>1 Asexual reproduction:</u>	<u>2 Sexual reproduction</u>
It Occurs by <u>only one living</u> organism.	It occurs through <u>two living</u> organisms, one of them is a <u>male</u> and the other is a <u>female</u>
It mostly occurs in <u>single-celled</u> living organisms Such as yeast and amoeba	It occurs in <u>higher</u> living organisms of plants and animals.
Take place by <u>mitosis</u> division	Take place by <u>meiosis</u> division
The <u>genetic traits</u> move from parents to offspring	The <u>genetic traits</u> of offspring resulting combines the two sources

First: Asexual reproduction:

Asexual reproduction It is a process where the living organism produces new individuals with genetic traits indicate to those of their parent

Occurs in

1. Unicellular (single-celled) living organisms (As Yeast- bacteria)
2. Some multicellular (Hydra- Star-fish)

Properties of asexual reproduction:

1. It takes place by only one living organism.
2. It does not require special systems or structures in the living organism.
3. It depends on mitotic division.
4. It keeps the genetic structure of the living organism. G.R.

Because it produces new individuals (offspring) identical in genetic structure to the original living organism during mitotic division.

So, these new offspring get a full copy of the parent genetic traits without the occurrence of any genetic variation.

And thus, there are no differences in the resulting offspring from the original organism.

G.R. Asexual reproduction includes mitosis that does not require special systems or structures in the living organism.

Because it take place by mitosis through one individual

Types of asexual reproduction

1- Binary

2 -

3 -

4 -Spore

5 -Vegetative

1- Binary fission

Binary fission It Is a type of asexual reproduction where the nucleus is divided by mitosis and then the cell splits into two identical cells

It occurs in

1-Unicellular protozoans *such as (amoeba -paramecium – euglena)*

2- Simple algae and bacteria.



How does the reproduction by binary fission occur?

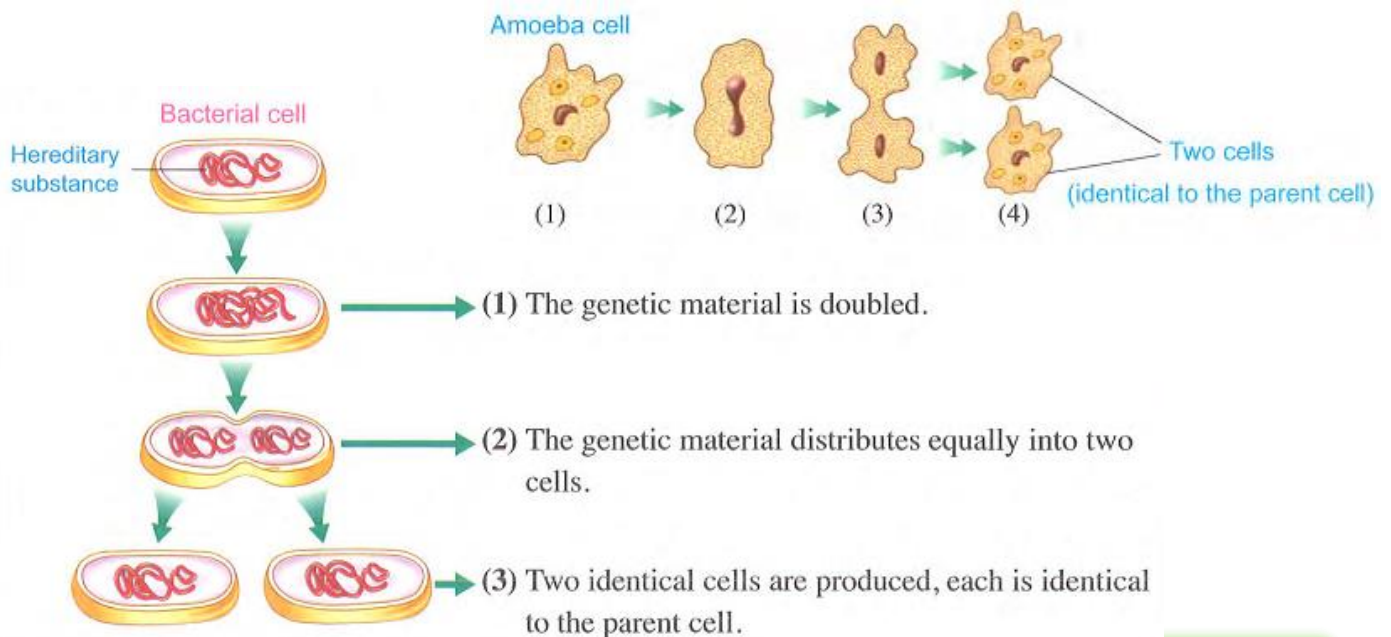
- 1-The nucleus is divided by mitosis and then the cell splits into two cells
- 2- Each one becomes a new individual.

G.R. the cells that are result by binary fission are similar to the parental cells?

Because they are resulted by asexual reproduction (mitotic division)

G.R. the parental cells that are reproduces by binary fission dissappear?

Because it split into two identical cells

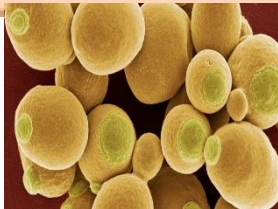


2 - Budding

Budding It Is a type of asexual reproduction that produces new individuals by formation of buds in the parents' cell

It occurs in

1-Unicellular living organisms
(such as yeast fungus)



2-Multi-cellular organisms (such as hydra and sponges)



Activity

How does reproduction by Budding occur in yeast fungus.

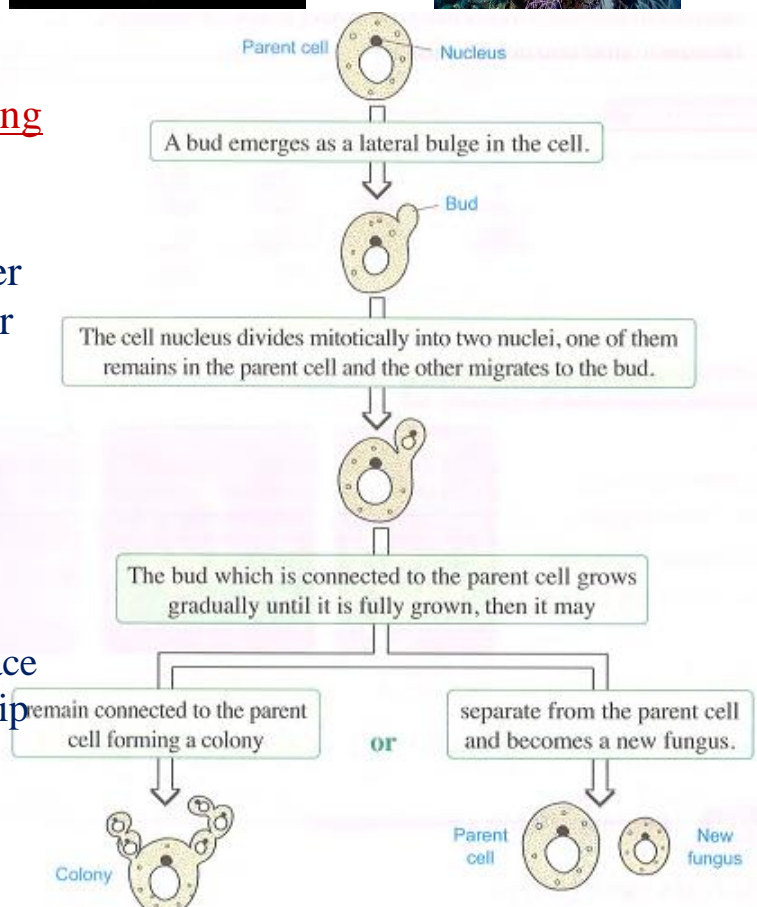
Materials and tools : Piece of yeast - sugar solution- warm water - microscope - a glass slide -cover slips – a teeth stick).

Procedures:

- 1- Add the 1 ml sugar solution and 1 ml of warm water to 2 ml yeast in a plate and leave them for ten minutes in a warm dark place.
- 2- Take some of the mixture and place it on a glass slide. Place the cover slip gently.
- 3-examine the slide under the microscope

Observation

- 1-Bud in yeast emerges as a lateral bulge in the cell then
- 2- The cell nucleus is divided (mitosis) into two nuclei. One of them remains in the parental cell and the other immigrates to the bud.
- 3-A bud grows gradually and remains connected to the parental cell until it is fully grown then separates from it or remains to form a colony



3 -Regeneration

Regeneration is the ability of animals to compensate their missing parts. The living organism can reproduce by one of its parts.

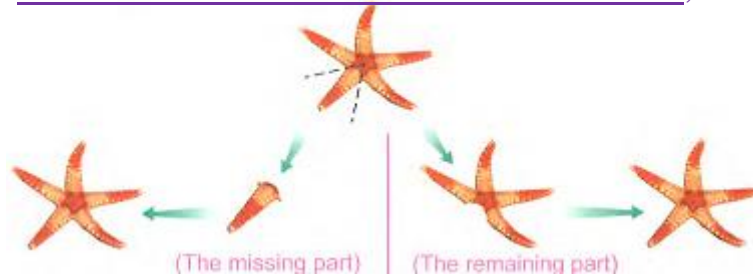
Starfish arms could be revived and give out a complete animal if they contain a part of the central disc of the animal.

How does reproduction by regeneration occur...?

It occurs by growing of a cut part from the body of living organism by mitotic division forming a new complete organism.

Regeneration and reproduction by regeneration in starfish

When a starfish loses one of its arms, SO



The missing part of the animal can grow forming a complete animal, if it contains a part of the and this is known as reaction by regeneration

The remaining part of the animal can form a new arm instead of the missing one, and this is known as regeneration

Reproduction by regeneration

It is the ability of the missing part in some living organisms to grow forming a complete organism identical to the parent individual

Regeneration is the ability of animals to compensate their missing parts

If the number of chromosomes in a starfish mother cell is (2N), how many chromosomes are there in the cells resulted by regeneration?

Why?

(2N). Because it reproduce asexual by Regeneration by mitotic division

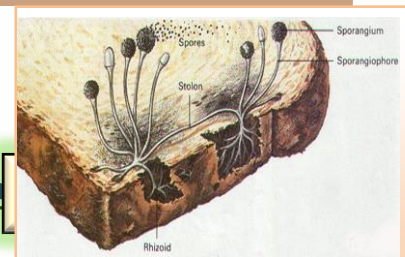
4 -Spore propagation

Spore propagation It Is a type of asexual reproduction occur in fungus and by producing spores It occurs in

1-Some fungi such as *bread mould -mushrooms*

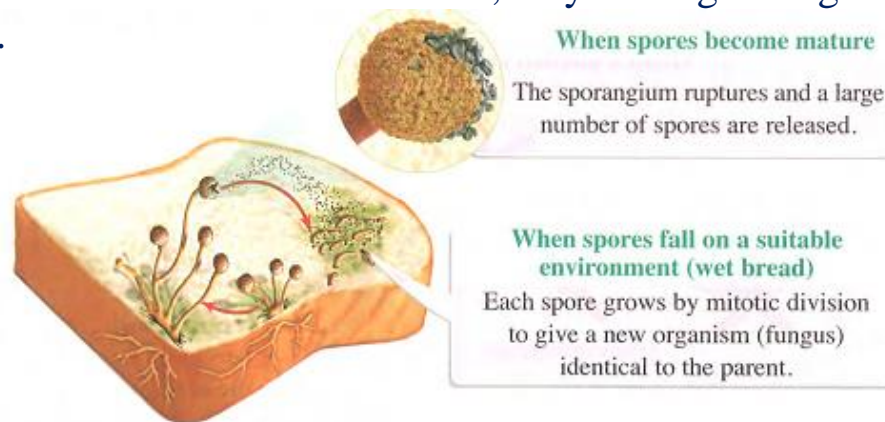


2-Some Algae



How does the reproduction by Spore propagation occur?

- 1- Each sporangium (special organs) has a large number of spores that release after rupturing its wall.
- 2-When spores find a suitable environment, they starts growing to gives out a new organism.



Spore propagation in bread mould fungus.

What each spore cell will give if it placed on wet bred again? New fungus

What is the type of cell division in this reproduction? Mitotic

5 -Vegetative propagation

Vegetative propagation -Plants reproduce vegetative without needing seeds by the plant's vegetative organs (leaves- stems – roots)

Artificially - The cells (tissues culturing) in order to produce new plants very similar to the parent plant.

Naturally - by the plant's vegetative organs (leaves- stems – roots) cell's mitotic division.



Each potato tuber can form a new plant

Information

- 1-Asexual reproduction produces individuals identical in genetic structure the original organism.
- 2-The similarity in the genetic structure of the resulted offspring is caused by (mitosis).
- 3-The new offspring gets a full copy of the parental individual's genetic traits.

Thus, no genetic variations occurred causing difference in the resulting offspring from the original organism.

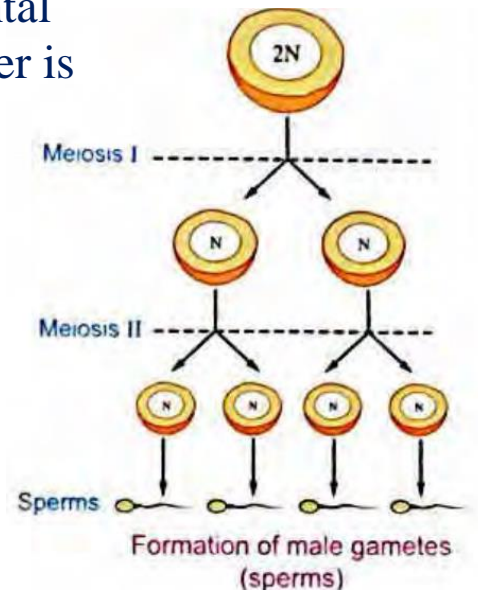
Second: Sexual reproduction

- It is the most common type of reproduction especially in the higher living organisms.

Sexual reproduction occurs between two parental individuals. One of them is a male and the other is a female. Sexual reproduction depends on two main processes: formation of gametes and fertilization.

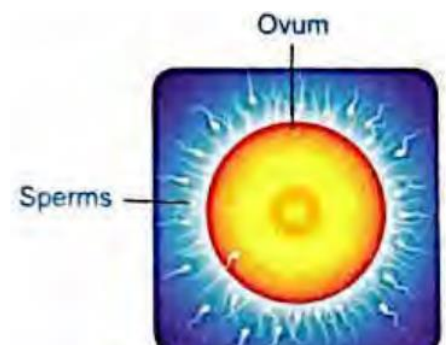
Formation of gametes

- 1-Gametes cells known as reproductive cells
- 2- It produces by the meiotic division (reduction division).
- 3-Gametes resulted from this division contain half the number of chromosomes (N) in organism's somatic cells.



Fertilization

Fertilization - It is the combination of a male gamete (N) and a female gamete (N) to form a zygote which contains the normal number of chromosomes of the organism.



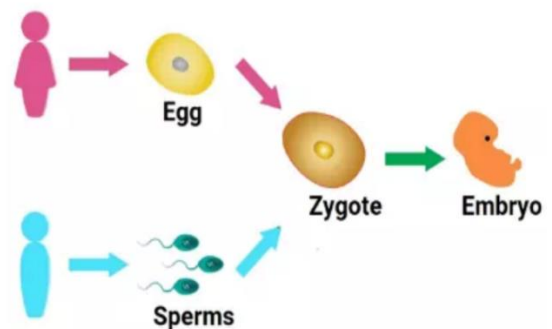
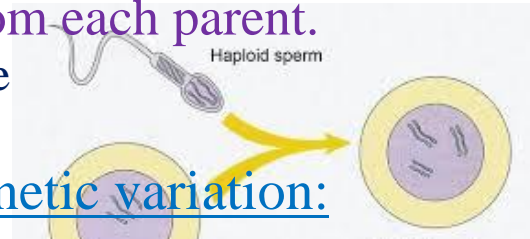
This zygote contains genetic material from each parent.

When it grows it gives a new offspring whose traits combine each parent's traits.

Sexual reproduction is a source of genetic variation:

- The offspring resulting from sexual reproduction combines the genetic traits from two sources one of them is the male parent and the other is the female parent.
- This means that the resulted offspring have new genetic traits that combine the parent's traits.

Sexual reproduction is a source of genetic variation.



? Questions **Unit four Lesson two**

1- Choose the correct answer:

1. Through reproduction process..... Transfer from parents to their offspring.
a. genetic traits b. organs c. gametes d. hormones
2.reproduction mostly occurs in single-celled living organisms
a. Sexual b. Asexual c. Mitotic d. (a) and (b)
3. Asexual reproduction takes place by... .. division
a. meiotic b. reduction c. mitotic. d. (a) and (b)
4. Bacteria reproduce by
a sexual.. b. spores c. vegetative d. binary fission.
5. Binary fission, budding, spore propagation and regeneration take place by
a. mitosis. b. meiosis c. fission d. sexual.
6. The binary fission of asexual reproduction occurs in ..
a, mammals, b. euglena c. reptiles d. the flowering plants.
7. Asexual reproduction occurs in the yeast fungus by
a. budding b. Sporogony. c. regeneration. d. binary fission.
8. Amoeba reproduce by
a. binary fission b. gametes. c regeneration. d. budding
9. The reproduction by budding occurs in
a. mushroom. c. bread mould fungus c. yeast fungus d. bacteria.
10. The parental individual disappears when the reproduction occurs in the
a. bacteria b. yeast. c. bread mould fungus. d.. d mushroom
11. The parental individual disappear during reproduction by
a. sporangium. . b. regeneration. c. binary fission. d. budding.
12. Asexual reproduction in hydra occurs by
a. regeneration b. budding c. spore formation d. cutting.
13. The ability of some animals to compensate their missing parts is called
a. budding. b. sporangium. C. sexual reproduction. d. regeneration.
14. The unicellular protozoans such as amoeba and paramecium reproduce by
a. binary fission b. budding c. regeneration d. spores
15. A colony of yeast may be formed as a result of
a budding. b. mitosis. c. regeneration d. (a) & (b) are correct
16. The type of asexual reproduction that occurs in some fungi and algae is the
a. regeneration. b. spore propagation.
c. budding. d. vegetative reproduction
17. Starfish reproduces asexually by
a regeneration. . b. binary fission c. budding. d. spores
18. If the chromosomal number in cells of starfish is (2N), the number of chromosomes in resulted cells is
a. N b. 2N c. ½N . d. no correct answer,
19. Starfish arms could be regenerated and give a new animal if they contain a part of the
a. bud. b. zygote c. sporangium d. central disc... ()

20. Bread mould fungus reproduces asexually by ...

- a. Sporogony b. spore propagation. c. binary fission. d. regeneration.

21. Reproduction by spores occurs in all of the following organisms except ...

- a. starfish b. algae. c. bread mould d. mushroom

22. Asexual reproduction by spore propagation in fungi and algae occur by producing

- a. spores. b. suckers. c. cilia d. whips (Behira 2018) (Red Sea 2019)

23. The reproduction by spores occur in this living organisms, except

- a. amoeba. b. bread mould fungus.
c. mushroom. d. no correct answer.

24. In the vegetative reproduction, the produced individuals are similar to their.. ..

- a. parent individual. b. both parents. c. the zygote d. no correct answer.

25. Spores are formed in some fungi inside a structure called

- a. bud b. zygote. c . sporangium d. central disc.

26. The vegetative reproduction occurs in plants without need of

- a. stems. b. seeds. c. leaves. d. roots. (Ismailia 2017/ Matrouh 2018)

27. The process by which the living organism produces new individuals with genetic properties similar (identical) to the parent individual is called.....

- a. sexual reproduction. b. asexual reproduction
c. vegetative reproduction. d. (b) and (c)..

2. Choose from columns (B) & (C) what suits it in column (A)

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(A)	(B)	(C)
1. Asexual reproduction	a. occurs in unicellular living organisms	A. as bacteria and amoeba
2. Sexual reproduction	b. occurs in multicellular living organisms	B. as yeast fungus and hydra.
3. Reproduction by binary fission	c. occurs in higher living organisms	C. as human and flowering plants
	d. occurs in unicellular and multicellular living organisms	. D. as mushroom fungus

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(A)	(B)	(C)
1. Euglena	a. A higher animal	A. Reproduces by binary fission
2. Sponge	b. A fungus	B. Reproduces by spores
3. Mushroom	c. A multicellular organism	C. Reproduces by budding
	d. A unicellular protozoan	D. Reproduces sexually

3. Put (√) or (x) in front of the following statements and correct the false ones:

1. Respiration process is a process of producing new individuals of the same kind()
2. The types of reproduction are meiosis and mitosis. ()
3. Asexual reproduction occurs by only one living organism. () (Qena 2014)

4. The unicellular protozoans reproduce by binary fission. ()
5. Simple algae are divided by binary fission ()
6. D Sexual reproduction maintains the genetic structure of the living organisms()
7. D Amoeba is divided by the binary fission into two identical cells. each is similar the parental cell. ()
8. A bud emerges as a lateral bulge in the cell, then the cell nucleus divides meiotically into two nuclei, one of them remains in the parental cell and the other one immigrates to the bud. ()
9. The starfish reproduces by regeneration. ()
10. Yeast reproduces asexually by binary fission. ()

4. Correct the underlined words:

1. Euglena reproduces asexually by budding.
2. Euglena reproduces asexually by budding.
3. Yeast fungus reproduces asexually by regeneration.
4. The starfish reproduces by binary fission.
5. The binary fission is considered as meiotic division.
6. Amoeba is divided by the budding into two identical cells, each cell is similar to the parental cell.
7. Reproduction by spore propagation occurs in paramecium.
8. The reproduction by budding occurs in the unicellular living organisms only.
9. From unicellular living organisms that reproduces by budding is hydra.
10. The parent individual disappears during the reproduction by sporogony.

5. Write the scientific term of each of the following:

1. A biological process, where the living organisms produce new individuals of the same kind to ensure their continuity.(.....)
2. A process in which living organisms produce new individuals with genetic traits identical to those of their parents.(.....)
The type of reproduction that takes place by only one living organism.
3. A type of asexual reproduction occurs in unicellular living organisms.(... ..)
4. The type of asexual reproduction in which a colony may be formed.(.....)
5. A structure emerges as a lateral bulge from the mother's cell and contains a nucleus. (.....)
6. The ability of some animals to compensate their missing parts. (.....)
7. The ability of the missing part in some living organisms to grow forming complete organism. (.....)

6. Give reasons for:

1. Reproduction is the way of living organisms to ensure the continuity of their species
2. All types of asexual reproduction take place by only one individual.
3. Asexual reproduction needs neither special systems nor structures to occur.
4. * Asexual reproduction keeps the genetic structure of the living organism.