

CRADLE PUBLIC HIGH SCHOOL

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Unit-10: Simple Harmonic Motion And Waves

CONCEPTUAL QUESTIONS

10.1 If the length of a simple pendulum is doubled what will be the change in its time period?

Ans. As we know $T = 2\pi \sqrt{\frac{L}{g}}$ (i)
When $L' = 2L$, $T' = ?$
Therefore, $T' = 2\pi \sqrt{\frac{L'}{g}}$
Putting $L' = 2L$
 $T' = 2\pi \sqrt{\frac{2L}{g}}$
 $T' = \sqrt{2} [2\pi \sqrt{\frac{L}{g}}]$
Using eq. (i) $T' = \sqrt{2}T$ (Ans)

This equation shows that if the length of pendulum is doubled, then time period increases four times.

10.2 A ball is dropped from a certain height onto the floor and keeps bouncing. Is the motion of the ball simple harmonic? Explain.

Ans. No, the motion of a bouncing ball is not simple harmonic motion because
(i) Acceleration is not directly proportional to displacement.
(ii) Acceleration is not always directed toward mean position.

10.3 A student performed two experiments with a simple pendulum. He / She used two bobs of different masses by keeping other parameters constant. To his / her astonishment the time period of the pendulum did not change! Why?

Ans. We know that time period T of a simple pendulum of length l is given by the following equation:

$$T = 2\pi \sqrt{\frac{l}{g}}$$

This equation shows the relation of time period with other factors. It shows that time period of pendulum is independent of mass of bob, but depends on the length of the thread. This is the reason that time period of two pendulums of bobs of different masses do not change.

10.4 What types of waves do not require any material medium for their propagation?

Ans. Electromagnetic waves do not require any material medium for their propagation. Examples of such waves are light waves, heart waves, etc.

10.5 Plane waves in the ripple tank undergo refraction when they move from deep to shallow water. What change occurs in the speed of the waves?

Ans. We know that the wave speed (v) and wavelength (λ) are related by the following equation:

$$v = f \lambda$$

When also know that when water waves enter the region of shallow water their wavelength decreases but frequency remains same. So the above equation becomes;

$$v \propto \lambda$$

This equation shows that wave speed is directly proportional to wavelength. It means of wavelength decreases, waves speed also decreases and vice versa. Thus, in shallow region the wave speed will decrease, while in deep water the wave speed will increase.

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Unit-11: Sound

CONCEPTUAL QUESTIONS

11.1 Why two tin cans with a string stretched between them could be a better way to communicate than merely shouting through the air?

Ans. When we communicate via two tin cans connected through a string, then our sound is carried by a string which is solid. It is 15 times a better conductor of sound than air.

11.2 We can recognize persons speaking with the same loudness from their voice. How is this possible?

Ans. We can recognize persons speaking with the same loudness. This is due to the difference in the quality of their sounds.

11.3 You can listen to your friend round a corner, but you cannot watch him/her. Why?

Ans. Like light and other waves, sound waves also exhibit the phenomenon of diffraction. Diffraction of sound waves is the bending or spreading of sound waves around the sharp edges or corners of an obstacle. This is the reason we can listen to our friends round a corner although we cannot watch them.

11.4 Why must the volume of a stereo in a room with wall-to-wall carpet be tuned higher than in a room with wooden floor.

Ans. The carpet is soft and absorbs the sound wave. On the other hand, a wooden floor is hard and reflects the sound waves instead of absorbing them. So we have to keep the volume of the stereo high in the room with wall-to-wall carpet.

11.5 A student says that the two terms speed and frequency of the wave refer to the same thing. What is your response?

Ans. Speed is the distance covered by the waves in unit time but frequency is the number of waves passing through a point in unit time. So, speed and frequency are two different quantities although time factor is common in both.

11.6 Two people are listening to the same music at the same distance. They disagree on its loudness. Explain how this could happen?

Ans. Loudness also depends upon the physical condition of the listener. A sound appears louder to a person with sensitive or normal ears than to a man with defective ears. Thus is the reason that two people disagree with the loudness of the sound.

11.7 Is there any difference between echo and reflection of sound? Explain.

Ans. Reflection is just the bouncing of the sound after striking from a hard or denser surface. Echo is also the bouncing of sound from the hard or denser surface. But it must also satisfy the following two conditions.

(i): distance between listener and reflective surface should be at least 17m.

(ii): time difference between original sound and echo must be 0.1s.

11.8 Will two separate 50dB sounds together constitute a 100dB sound? Explain.

Ans. Yes, two separate 50dB sounds together constitute a 100dB sound only when in constructive interference.

11.9 Why are ultrasounds useful in a medical field?

Ans. Ultrasonic waves are made to enter the human body through transmitters. These rays are reflected differently from different organs, tissues or tumors, etc. The reflected waves are then amplified to form an image of the internal organs of the body on the screen. Such an image helps in detecting the defects in these organs.

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Unit-12: Geometrical Optics

CONCEPTUAL QUESTIONS

12.1 A man raises his left hand in a plane mirror; the image facing him is raising his right hand. Explain why?

Ans. Mirror image is always laterally inverted. So, if a man raises his left hand in a plane mirror, the image will show as he has raised his right hand.

12.2 In your own words, explain why light waves are refracted at a boundary between two materials.

Ans. The speed of light waves is different through the different mediums because of different densities of the mediums. It is the characteristic of light waves that when they meet at the boundary of two mediums, their speed and direction changes and they are refracted.

12.3 Explain why a fish under water appears to be at a different depth below the surface than it actually is. Does it appear deeper or shallower?

Ans. When the light rays come out from the water (denser to rare medium) after striking on the body of fish, they bend away from the normal. So for the observer the fish appears to be at less depth than the actual depth.

12.4 Why or why not concave mirrors are suitable for make up?

Ans. If the object is placed at a focal point, then its magnified and real image is formed. In this case it is suitable for make up. But when the object is placed behind the focal point, then a clear image is not obtained. In this case it is not suitable for make up.

12.5 Why is the driver's side mirror in many cars convex rather than plane or concave?

Ans. The convex mirrors are used in vehicles so that the drivers can see a wider rear view of the road behind the vehicle. These mirrors give accurate pictures of the road and the position of the vehicles following him.

12.6 When an optician's testing room is small, he used a mirror to help him test the eye sight of his patients. Explain why?

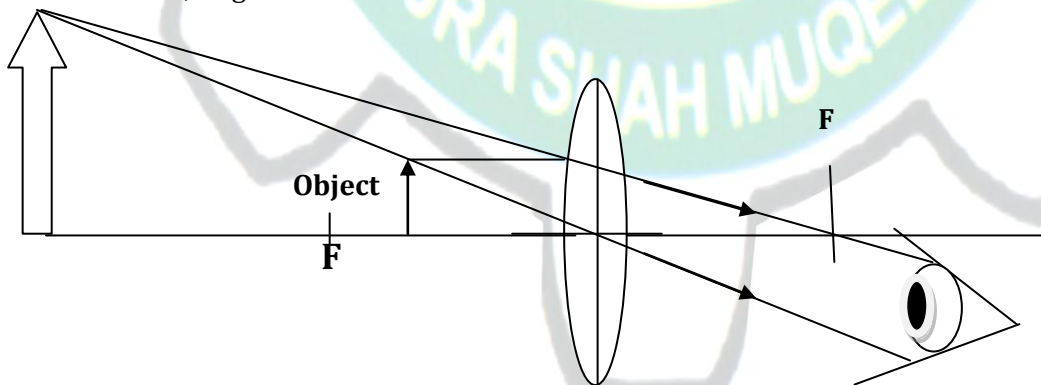
Ans. The image that a patient sees through the plane mirror is at double distance from his eyes because the distance of the object and the image formed behind the mirror is equal. So, by linear magnification of the lens, the optician decides about the normality of the patient's eye sight.

12.7 How does the thickness of lens effect its focal length?

Ans. Focal length of the lens depends upon the thickness of the lens. Lenses with large thickness have short focal lengths and the lenses with less thickness have large focal lengths.

12.8 Under what conditions will a converging lens form a virtual image?

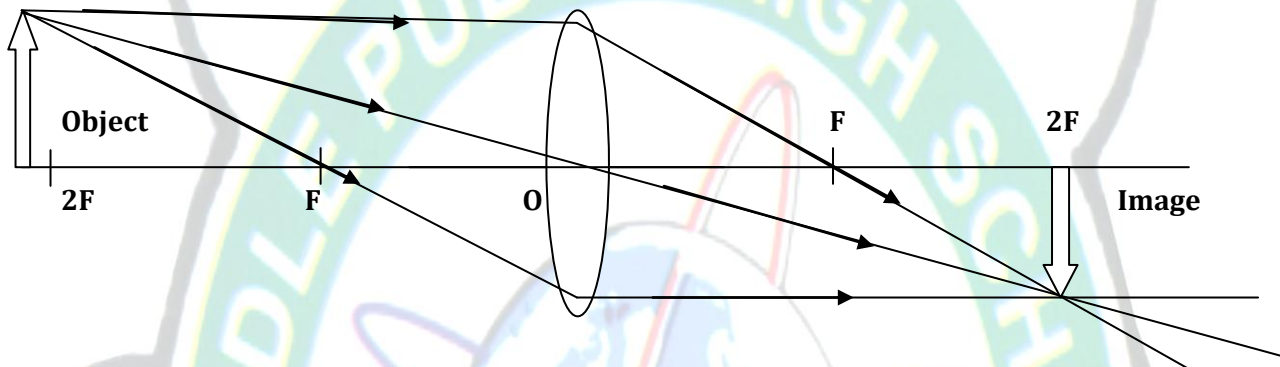
Ans. When the object is between the lens (pole of the lens) and the focal point F , then the image of the object would be virtual, larger and erect.



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12.9 Under what conditions will a converging lens form a real image that is same as the size of the object?

Ans. When the object is placed at $2F$ of the converging lens then the real, inverted and the image of the same size to the object is formed.



12.10 Why do we use refracting telescope with large objective lens if large focal length?

Ans. Refracting telescope is used to see distant objects. Thus, the large objective lens, with large focal length helps to see the distant object clearly and easily.

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Unit-13: Electrostatics

CONCEPTUAL QUESTIONS

13.1 An Electric field rod attracts pieces of paper. After a while these pieces fly away! Why?

Ans. The Rod bears induced charge pole due to which opposite charge pole induced on the paper. The paper will stick to the rod due to attraction b/w two opposite charges. After a while the induced pole get neutralized and paper will fall away.

13.2 How much negative charge has been removed from positive charged electroscope If it has a charge of $7.5 \times 10^{-11} \text{C}$?

Ans. The amount of negative charge remove from the positively charged electroscope will be equal in magnitude i.e. $7.5 \times 10^{-11} \text{C}$.

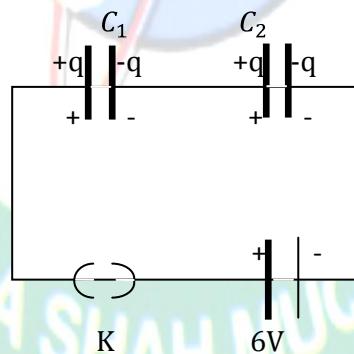
13.3 In what direction will a positively charged move in an electric field?

Ans. A positively charged particle move along the direction of electric field i.e. from positive terminal potential to negative potential terminal.

18.4 Does each capacitor carry equal charge in series combination? Explain.

Ans. Yes, in series combination of capacitor, each capacitor carries equal charge.

Explanation: If the battery supplies charge $+Q$ to the left plate of the parallel plate capacitor C_1 , then due to electrostatic induction $-Q$ charge is induced on its right plate and $+Q$ charge on left plate of the capacitor C_2 and so on. It shows on diagram given below:

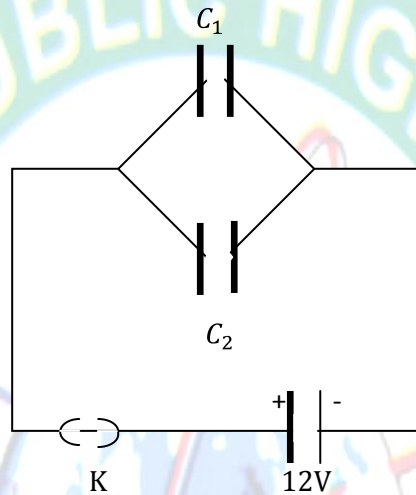


Mathematically: $Q = Q_1 = Q_2$

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13.5 Each capacitor in parallel combination has equal potential difference b/w its two plates. Justify the statement.

Ans. In parallel combination of capacitor, one plate of each capacitor is directly connected with the positive terminal of battery and the other with the negative terminal of the battery, so each capacitor has equal potential difference between its plates. It is shown in the diagram on next page:



13.6 Is the presence of charge necessary for the existence of electrostatic potential?

Ans. We know that,

$$Q=CV$$

Where,

Q=Charge, **V**=potential difference, **C**=capacitance

This equation shows that potential difference is directly proportion to the quantity of charge. Thus, presence of charge is necessary for the existence of electrostatic potential.

13.7 Rubber tires get charged from friction with the road. What is the polarity of charge?

Ans. The rubber and road will get **opposite charges**.

13.8 Perhaps you have seen a gasoline truck trailing a metal chain beneath it. What purpose does the chain serve?

Ans. Due to air friction, charge is induced on the body of gasoline truck. The metal chain trailing beneath the truck serves to release electrostatic charge to the ground.

13.9 If a high-voltage power line fell across your car while you were in the car, why should you not come out of the car?

Ans. If a high-voltage power line falls across your car, you should not come out. Because if you will come out, your body will become a conductor and current will start flow through your body, which would be dangerous.

13.10 Explain why a glass rod can be charged by rubbing when held by hand but an iron rod cannot be charged by rubbing, if held by hand?

Ans. A glass rod being non-conductor can hold the electric charges in it. But iron is a conductor which cannot hold charges in it.

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Unit-14: Current Electricity

CONCEPTUAL QUESTIONS

14.1 Why in conductors charge is transferred by free electrons rather than by positive charges?

Ans. In conductors charge is transferred by free electrons because they can travel inside the conductor in a specific direction when an external electric potential is applied. On the other hand positive charges (protons) are enclosed within the nucleus and are not free to move.

14.2 What is the difference between a cell and a battery?

Ans. Cell: A cell is a single unit at the base voltage.

Battery: A battery can be a single cell or multiple cells connected together in series or parallel to make the voltage/current rating as required.

14.3 Can current flow in a circuit without potential difference?

Ans. In any circuit current flows from higher potential to lower potential. It means potential difference is responsible for the flow of current in any circuit. If there is no potential difference then current will not flow.

14.4 Two points on an object are at different electric potentials. Does charge necessarily flow between them?

Ans. Two points of an object are at different potentials necessarily will flow between them because the condition that in any circuit current flows from higher potential to lower potential is satisfied.

14.5 In an order to measure current in a circuit why ammeter is always connected in series?

Ans. In order to measure the current in the circuit the ammeter is always connected in the series, so that the current flowing through the circuit also flows through the ammeter.

14.6 In order to measure voltage in a circuit voltmeter is always connected in parallel. Discuss.

Ans. Voltmeter is always connected in parallel to the circuit to setup same voltage across the terminals of the voltmeter.

14.7 How many watt-hours are there in 1000 joules?

Ans. We know that.

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

$$1 \text{ Wh} = \frac{3.6 \times 10^6}{10} \text{ J}$$

$$1 \text{ Wh} = 3.6 \times 10^5 \text{ J}$$

$$1 \text{ J} = 0.000278 \text{ Wh}$$

$$1 \text{ J} = 0.27 \text{ Wh}$$

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14.8 From your experience in watching cars on the roads at night, are automobile headlamps connected in series or parallel?

Ans. Head light glow with equal intensity i.e. they set equal voltage. Equal voltage can only be supplied to each resistor when they are connected in parallel circuit. Thus; head light of automobiles are connected in parallel.

14.9 A certain flash-light can use a 10 ohm bulb or a 5 ohm bulb. Which bulb will discharge the battery first?

Ans. (i): Both bulbs get equal brightness because brightness of the bulb depends upon the voltage of the battery.

(ii): We also know that $v = IR$

This equation shows that bulb with greater resistance i.e. 10 ohm will discharge the battery first.

14.10 It is impracticable to connect an electric bulb and an electric heater in series. Why?

Ans. In series combination, same current passes through each resistor. Thus, when a heater and a bulb are connected in series, the heater will draw more current than needed by the bulb. That is why a heater and electric bulb are not connected in series.

14.11 Does a fuse in a circuit controls, the potential difference or the current?

Ans. Fuse is a current controlling device. Thus, It will control electric current in the circuit rather than the potential difference.

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Unit-15: Electromagnetism

CONCEPTUAL QUESTIONS

15.1 Suppose someone handed you three similar iron bars and told you one was not magnet but the other two were. How would you find the iron bar that was not magnet?

Ans. The two iron bars which feel repulsion/attraction b/w their two ends are magnet.

The bar which is only attracted by the other bars is not a bar magnet.

15.2 Suppose you have a coil of wire and a bar magnet. Describe how you could use them to generate an electric current?

Ans. Take a rectangular coil of wire and connect its two ends with galvanometer. Now hold the coil stationary/move it parallel to the magnetic field of a strong bar magnet. Now move the bar magnet towards the coil and the away from the coil. When the magnet is moved towards the coil, the needle of the galvanometer deflects towards right, indicate that a current is being induced in the coil.

15.3 Which device is used for converting electrical energy into mechanical energy?

Ans. Electrical motor is a device which is used to convert electrical energy into mechanical energy.

15.4 Suppose we hang a loop of wire so that it can swing easily. If we now put a magnet into the coil, the coil will start swinging. Which way it swing relative to the magnet and why?

Ans. When a bar magnet is put into a coil, the flux will increase. According to faraday's law, it will oppose the change. So, same pole will be produced. Hence, there is force of repulsion due to which the coil swings.

15.5A conductor wire generates a voltage while moving through a magnetic field. In what direction should the wire be moved, relative to the field to generate the maximum voltage?

Ans. The conductor wire and magnetic field should be perpendicular to each other to produce maximum voltage.

15.6 What is difference b/w a generator and a motor?

Ans. Generator converts mechanical energy into electrical energy while a motor convert electrical energy into mechanical energy.

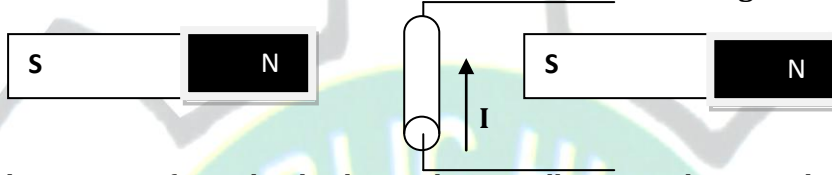
15.7 What reverses the direction of electrical current in the armature coil of D.C Motor?

Ans. The split ring and brushes system in used to reverse the direction of the current of the electric current in the D.C motor.

When brushes shift from first half ring to second half ring, the coil will connect to oppose terminals of the battery. In this way the direction of the electric current reversed.

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15.8 A wire lying perpendicular to an external magnetic field carries of a current in the direction shown in the diagram below. In what direction will the wire move due to the magnetic force?



Ans. According to Flemmings Left Hand Rule, the conductor will move to downwards direction.

15.9 Can a transformer operate on direct current?

Ans. Transformer is used to increase or decrease A.C. voltage. Therefore, a transformer cannot be operates on D.C Current.

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Unit-16: Basic Electronics

CONCEPTUAL QUESTIONS

16.1 Name two factors which can enhance thermionic emission.

Ans. Thermionic emission can be enhanced by:

- (i): increasing strength of the battery and voltage.
- (ii): by creating vacuum.
- (iii): by increasing temperature

16.2 Give three reasons to support the evidence that cathode rays are negatively charged electrons.

Ans. Cathode rays are considered as negatively charged because.

- (i): these are produced from cathode and travel towards anode.
- (ii): these rays are deflected towards the positive pole of electric field.
- (iii): these rays are repelled by the negative pole of the electric field.

16.3 When electrons pass through two parallel plates having opposite charges are deflected towards the positively charged plate. What important characteristic of the electron can be inferred from this?

Ans. When electrons on passing through two parallel plates are deflected towards positively charged plate it can be inferred that they are negatively charged particles. Because we know that like charges repel each other and unlike charges attract each other.

16.4 When a moving electron enters the magnetic field, it is deflected from its straight path. Name two factors which can enhance electron deflection.

Ans. When a moving electron enters a magnetic field, it is deflected from its straight line path. Following factors enhance their deflection.

- (i): the strength of magnetic field
- (ii): speed of electrons

16.5 In what ways is an oscilloscope a voltmeter?

Ans. The cathode ray oscilloscope is used to display the magnitude of varying electric current or electric potential. It is also the function of galvanometer, whose deflection varies with the change of potential.

16.6 Who can you compare the logic operation $X=A.B$ with usual operation of multiplication?

Ans. The logic operation $X=A.B$ will show following results by the varying input of A and B

$$X = 0.1 = 0$$

And $X = 1.1 = 1$

Similarly, in multiplication, we get

If $X = 0 \times 1 = 0$

And $X = 1 \times 1 = 1$

So both operations are same almost.

16.7 NAND gate is the reciprocal of AND gate. Discuss

Ans. NAND gate is formed when AND and NOT gate are connected one after the other. If And gate give = 0 output, then NAND gate will give = 1 output. So we can say NAND gate is reciprocal of AND gate.

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16.8 Show that the circuit given as below acts as OR gate.

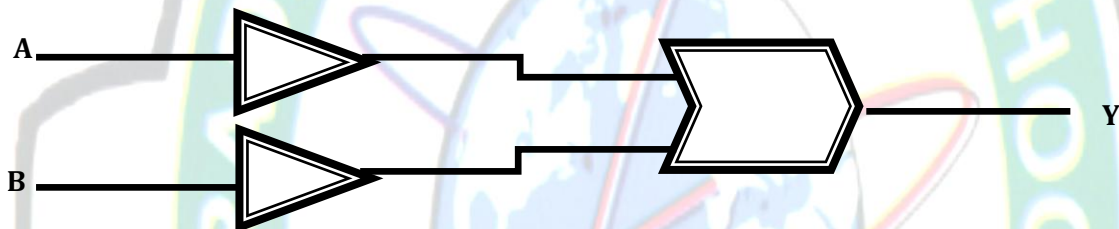


Ans. For OR gate, the Boolean expression is

$X = A+B$
How, if $A = 1, B = 1$
Then $X = A+B = 1 + 1 = 1$
Or $X = 1$
And $X = 0$

In the above given circuit, NOR gate is followed by NOT gate.

16.9 Show that the circuit given as below acts as AND gate.



Ans. For AND gate

$A = 1, B = 1$
 $A = 0, B = 0$
Or $Y = A + B$

The given circuit gives state '1' with input $A = 1$ and $B = 1$.
So, it acts as an AND gate.

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Unit-17: Information Technology

CONCEPTUAL QUESTIONS

17.1 Why optical fiber is more use full tool for the communication process?

Ans. Waves of visible light has much higher frequency than that of radio waves. This means, rate of sending information with light beam is greater than that with radio waves or micro waves.

17.2 Which is more reliable floppy disk or a hard disk?

Ans. Hard disk is more reliable than floppy disk because it can store data in Giga bytes while floppy disk can store up to 3 Mega Bytes. And data is more save in Hard disk than floppy disk.

17.3 What are difference b/w RAM and Rom memories?

Ans. RAM: Ram stands for **Random Access Memory**. It works only when computer is on. It brings data from the hard disk, and do processing. So, we can say that the data which is processed is kept by RAM.

ROM: ROM stands for **Read Only Memory**. It is reliable storage device. It is based on **Laser Technology**. It is read-only device. It means we can only read data from it but cannot write to it.

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Unit-18: Atomic and Nuclear Physics

CONCEPTUAL QUESTIONS

18.1 Is it possible for an element to have different types of atoms? Explain

Ans. All atoms of an element have same atomic no. **Z**. However, some atoms of an element (**Isotopes**) have different atomic mass no. **A**. Thus, it is not possible for an element to have different types of atoms.

18.2 What nuclear reaction would release more energy, the fission reaction or the fusion reaction? Explain.

Ans. There always a fission reaction which is required to start a fusion reaction. Fusion reaction releases many times more heat energy than fission reaction. Fusion reaction is the source of heat energy on the planets and sun.

18.3 Which has more penetrating power, alpha particle or gamma particle?

Ans. Gamma rays have hundreds times greater penetrating power than alpha particles. Gamma rays has high energy and low mass, due to which these can penetrate into concrete walls

18.4 What is the difference between natural radioactivity and artificial radioactivity?

Ans. Natural Radioactivity: Spontaneous emission of radiations by unstable nuclei is called natural radioactivity.

Artificial Radioactivity: Stable nuclei are converted into unstable to emit radiations by the bombardment of alpha particles or neutrons, etc. is called artificial radioactivity

18.5 How long would you likely have to wait to watch any sample radioactive atoms completely decay?

Ans. A radioactive substance never under goes a complete radioactive decay. The substance becomes half after completing its **Half-Life** period. Hence some amount of the substance always remains as and does not under go complete decay.

18.6 Which type of natural radioactivity leaves the number of protons and the number of neutrons in the nucleus unchanged?

Ans. Gamma decay leaves the number of protons and neutrons unchanged. For example,



During this decay, *Gamma Rays* are emitted at the same moment as either an alpha or a beta particle may decay.

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18.7 How much of a 1g sample of pure radioactive mater would be left after four half-lives?

Ans.

Total amount = 1g

After 1st half-life = $\frac{1}{2}$ g = 0.50g

After 2nd half-life = $\frac{1}{2}$ (0.50)g = 0.25g

After 3rd half-life = $\frac{1}{2}$ (0.25)g = 0.125g

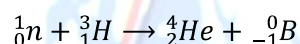
After 4th half-life = $\frac{1}{2}$ (0.125)g = 0.063g

So, 0.063g sample of a radioactive element will be left after 4 half lives.

18.8 Tritium ${}^3_1\text{H}$ is radioactive isotope of Hydrogen. If decays by emitting an electron. What is the daughter nucleus?

Ans. In beta-decay, the parent nuclide has its proton number **Z** increase by 1 but its mass number **A** remains the same.

Thus, after beta-decay Tritium ${}^3_1\text{H}$ will be converted into ${}^3_2\text{He}$.



18.9 What information about the structure of the nitrogen atom can be obtained from its nuclide ${}^{14}_7\text{N}$? In what way atom in ${}^{14}_7\text{N}$ is different from atom in ${}^{16}_7\text{N}$?

Ans. ${}^{14}_7\text{N}$ is a stable isotope of nitrogen. It shows that nitrogen has 7 protons, 7 neutrons and 7 electrons. ${}^{16}_7\text{N}$ is the unstable radioisotope of nitrogen while ${}^{14}_7\text{N}$ is stable atom.

Also ${}^{14}_7\text{N}$ have 7 neutrons in its nucleus while ${}^{16}_7\text{N}$ being an isotope of nitrogen has 9 neutrons.