

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

CPS

UNITY FAITH DISCIPLIN

10th Physics Conceptual Questions Notes

By Sir Ijaz Ali (BS Mathematics & Statistics)

Available on

- *www.goggle.com*
- *U tube.com*

Contact No: 0318-5107675

Contents

<i>Ch#10(Simple Harmonic Motion & wave)</i>	3
<i>Ch#11(Sound)</i>	6
<i>Ch#12(Geometrical Optics)</i>	9
<i>Ch#13(Electrostatics)</i>	11
<i>Ch#14(Current Electricity)</i>	14
<i>Ch#15(Electromagnetism)</i>	16
<i>Ch#16(Introductory Electronics)</i>	18
<i>Ch#17(Information and communication Technology)</i>	20
<i>Ch#18(Radio Activity)</i>	22

Student Name:

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts there of is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from CPS. Permissions for use may be obtained through Rights Link at the Copyright Clearance Center.

Ch#10(Simple Harmonic Motion & wave)

Q.1 Give an example of vibratory motion, which is not simple harmonic motion. Give a reason of your selection.

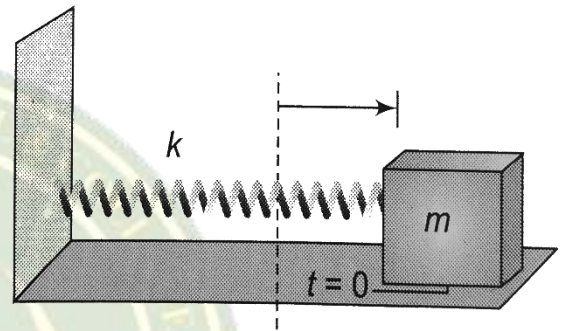
Ans: When a ball is dropped from an altitude on a perfectly elastic surface then the motion is vibratory motion as well as oscillatory but not simple harmonic because the restoring force F is equal to mg which is a constant and not $F \propto x$, Which is an essential condition for S.H.M where in an oscillation the acceleration is proportional to the displacement.

Q.2 At extreme position, velocity is zero but acceleration is maximum in simple harmonic motion. How can you theoretically explain it?

Ans: Velocity is zero: In Simple Harmonic Motion when object moves towards extreme position then its velocity decreases and becomes zero at extreme position. The object is at rest for instant so the velocity is zero at extreme position. Acceleration is maximum:

According to Hooke's law $F = -x$

Its means restoring force is maximum at extreme position. Newton's second of motion tells us that acceleration is directly proportional to the force. So at extreme position when restoring force is maximum then acceleration is maximum.



Q.3 what will happen to acceleration of mass spring system if its mass is doubled?

Ans: According to Newton's second law of motion, the acceleration of the body is given by

$$a = \frac{F}{m}$$

Its mean

$$a \propto \frac{1}{m}$$

This shows that when the mass of mass spring system is doubles then its acceleration becomes half.

Q.4 A simple pendulum has time period 'T'. What will happens to its time period if its thread length is shorten to half?

Ans: Time period of simple pendulum is given by

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

Thread length is shorten to half $l' = \frac{l}{2}$

$$T' = 2\pi \sqrt{\frac{l'}{g}}$$

Put $l' = \frac{l}{2}$

$$T' = 2\pi \sqrt{\frac{l}{2g}}$$

$$T' = 2\pi \sqrt{\frac{l}{2g}}$$

$$T' = 2\pi \sqrt{\frac{l}{2}} \sqrt{\frac{1}{g}}$$

$$T' = \sqrt{\frac{l}{2}} \left(2\pi \sqrt{\frac{l}{g}} \right)$$

$$T' = \frac{1}{\sqrt{2}} T$$

$$T = 0.707T$$

If the thread length is shorten to half then the time period will be 0.707 time the original time period

Q.5 *A simple pendulum has time period of 4 second. Will its time period remain same or change, if its steel bob is replaced by wood bob of same size?*

Ans: Time period of simple pendulum is given by

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

This shows that time period of simple pendulum does not depends upon mass. So whatever the mass of the bob is, the time period will remain same. Its mean the time period will remain same if its steel bob of simple pendulum is replaced by wood bob of same size.

Q.6 *Same masses are attached to different springs, one is vibrating faster why?*

Ans: Frequency of mass spring system is given by

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}}$$

This equation shows that frequency depends upon the mass and spring constant. Same masses are attached, which means mass is constant then spring constant will be different for both springs. As spring constant k is directly proportional to the frequency of mass spring system. So, the spring system which has greater mass comparatively, must have greater frequency. Hence mass spring system which have greater mass is vibrating faster.

Q.7 *A simple pendulum has time period "T" in Murree. In Karachi, it has different time period. What would you do to make its time period same as it was in Murree?*

Ans: Time period of the simple pendulum is given by

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

It shows that time period of simple pendulum depends upon length of string and gravitational acceleration. Both places have different time periods due to variation in the value of g . We cannot change the value of gravitational acceleration. So to make the time period same on both places, we have to change the length of string of simple pendulum.

Q.8 What will happen to the frequency of waves in a ripple tank if time period of electrical vibrator is decreased? What will happen to the wave speed?

Ans: We know that time period is the reciprocal of the frequency of the wave.

$$T = \frac{1}{f}$$

This shows that if the time period of electrical vibrator is decreased then the frequency will increase. Now, we know that

$$v = f\lambda = \left(\frac{1}{T}\right)\lambda = \frac{\lambda}{T}$$

This shows that time period is inversely proportional to the speed of the wave. So, if time period of electrical vibrator is decreased then the speed of the wave will increase.

Q.9 Why do water waves refract at the boundary of shallow water and deep water in ripple tank experiment?

Ans: The speed of water waves depends on the depth of water. Its speed is reduced when it enters shallow water. Their wavelength changes (decrease) but the frequency remains constant. The deeper the water, the faster the waves travel and so waves will refract (change direction) when they enter deeper or shallower water at an angle.

Q.10 Under what conditions are the waves diffracted the most?

Ans: The diffraction of waves depends upon the opening of the obstacles.

A Waves are diffracted most strongly when the size of the opening of obstacle is less than or equal to the size of the wavelength of generated waves.

Ch#11(Sound)

Q.1 Why does sound travel faster in solids than liquids and gases?

Ans: Sound travels more quickly through solids than through liquids and gases because the molecules of a solid are closer together and, therefore, can transmit the vibrations (energy) faster. Sound travels slowly through liquid because the molecules of a liquid having space more than solid but less than gases. And sound travels most slowly through gases because the molecules of a gas are farthest apart.

Q.2 Why are we able to distinguish between two sounds having same loudness?

Ans: Sounds of same loudness will have same amplitude and sound of same pitch will have same frequency. So, quality helps to distinguish the sound waves having same loudness and same pitch. The quality of sound is that characteristic which enables us to distinguish one sound from another having the same pitch and loudness. The sound which is more pleasant is said to be of a rich quality.

Q.3 Vibrating mobile phone on wooden table sounds louder than held in hand. Why?

Ans: We know that loudness of the sound depends upon the surface area of the vibrating body. When the vibrating mobile phone is in contact with the table, the vibration of the mobile phone is being transmitted to the surface of table whose surface area is very large as compared to the surface area of hand. Hence vibrating mobile phone on wooden table sounds louder due to large surface area.

Q.4 During a match in cricket stadium, you see a batsman striking the ball but we hear stroke sound slightly later. Explain this time difference?

Ans: Speed of light in air is larger than the speed of sound.

During a match in cricket stadium, when the batsman strikes the ball then we can see it but we hear the stroke slightly later. This is because the speed of sound is less than the speed of light in air. That's why the stroke seems first but we hear it slightly later.

Q.5 How much intensity level increases when intensity of louder sound is double the intensity of faintest audible sound?

Ans: As we know that

$$\text{Intensity level} = \beta = 10 \log \frac{I}{I_0}$$

$$\beta_1 = 10 \log \frac{I}{I_0} \dots \dots \dots (i)$$

According to condition, $I = 2I$, So

$$\beta_2 = 10 \log \frac{2I}{I_0} \dots \dots \dots (ii)$$

Subtracting eq. (i) from (ii)

$$\beta_2 - \beta_1 = 10 \log \frac{2I}{I_0} - 10 \log \frac{I}{I_0}$$

$$\beta_2 - \beta_1 = 10 \left(\log \frac{2I}{I_0} - \log \frac{I}{I_0} \right)$$

$$\beta_2 - \beta_1 = 10(\log 2I - \log I_0 - \log I + \log I_0)$$

$$\beta_2 - \beta_1 = 10(\log 2I - \log I)$$

$$\beta_2 - \beta_1 = 10 \left(\log \left(\frac{2I}{I} \right) \right)$$

$$\beta_2 - \beta_1 = 10(\log 2)$$

$$\beta_2 - \beta_1 = 10(0.3010)$$

$$\beta_2 - \beta_1 = 3\text{dB}$$

Thus the sound level increase by 3dB.

Q.6 Two singers are singing together simultaneously with intensity level 60dB of each in a hall.

a. Is intensity of sound in the hall is doubled? b. Is the intensity level of sound is doubled?

Ans: (a) Sound level is defined on a non-linear scale. If two singers are singing together and each creates an intensity level of 60dB (corresponding intensity = 1×10^{-6}), then total intensity level at that point is 120dB.

(b) As we know that $\Delta\beta = 10 \log \frac{I}{I_0}$ dB

Here I is the combined intensity of the two sounds, while I_0 is the reference intensity and is taken as the intensity of the single sound.

$$\Delta\beta = 10 \log \frac{2 \times 10^{-6}}{1 \times 10^{-6}} \text{ dB}$$

$$\Delta\beta = 10 \log 2 \text{ dB}$$

$$\Delta\beta = 10(0.3010) \text{ dB}$$

$$\Delta\beta = 3 \text{ dB}$$

Thus intensity of sound will increase three times.

Q.7 If pitch of sound is increased then that is its effect on:

a) Frequency of sound b) Speed of sound C) Intensity of sound

d) Loudness of sound e) Wavelength

a) Frequency of sound: Pitch of sound is directly proportional to frequency, so when pitch increases then frequency also increases.

b) Speed of sound: Speed of sound remains same because speed of sound depends on the medium and not on pitch.

c) Intensity of sound: Intensity of sound remains same because intensity of sound depends on the medium and not on pitch.

d) Loudness of sound: Loudness of sound remains same because loudness of sound depends on the medium and not on pitch.

e) Wavelength: Wavelength will decrease with increase in pitch of sound. As m

Q.8 Vibrating bodies produce sound. When a pendulum vibrates, we do not hear its sound. Why?

Ans: A sound is heard only if the body vibrates at a frequency more than 20 Hz and less than 20,000 Hz. The pendulum oscillates at a frequency less than 20 Hz. Hence, no sound is heard.

Q.9 Two students are talking in the corridor of your school, you can hear them in your class room but you cannot see them. Why?

Ans: It happens due to diffraction. Diffraction is a phenomenon of bending of a wave on corners, having size of the order of wavelength of the wave. Sound waves can bend at the corners but light waves cannot. So when two students talk in the corridor of school, sound is diffracted by corner and we are able to hear it but cannot see them.

Q.10 How do curtains help to reduce loudness of sound?

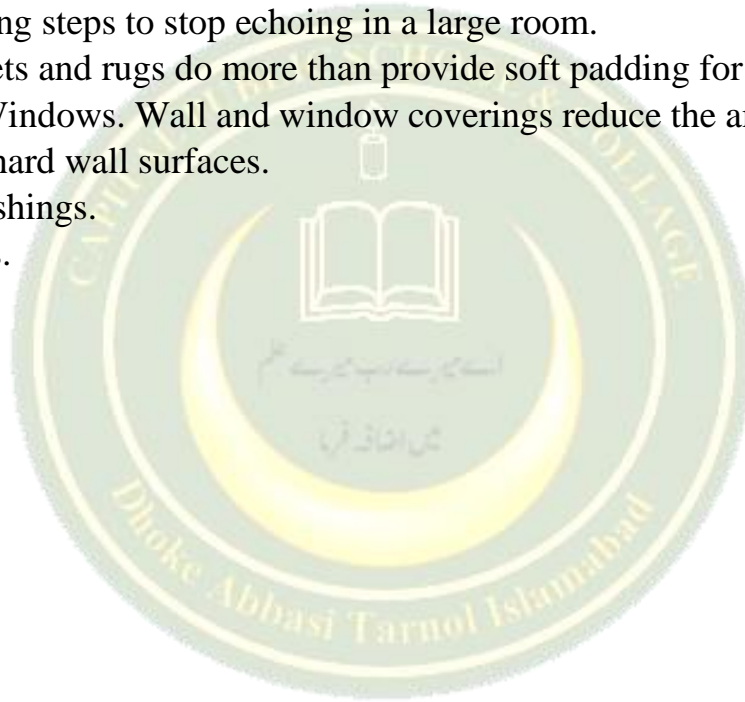
Ans: Curtains can absorb sound from coming into home, or even control the sound within a room to reduce echoes and reverberation. However, not all curtains will work towards absorbing sound, so there are factors to consider in order to get the best results:

- ❖ Sound absorbing vs soundproofing
- ❖ Material
- ❖ Density
- ❖ Coverage

Q.11 What steps would you take to stop echoing in a large room?

Ans: We can take following steps to stop echoing in a large room.

- ❖ Cover the Floor. Carpets and rugs do more than provide soft padding for your feet.
- ❖ Cover the Walls and Windows. Wall and window coverings reduce the amount of sound reflecting off window glass and hard wall surfaces.
- ❖ Fill Rooms with Furnishings.
- ❖ Install Acoustic Panels.



Ch#12(Geometrical Optics)

Q.1 When you look at the front side of polished spoon, your image is inverted and from back of spoon, your image is erect. Explain why?

Ans: The inner surface of a spoon acts like a concave mirror. When we look at front of spoon we see an inverted image of our self. This is because the inner reflected curved surface of the metal spoon acts as a converging mirror. The outer surface acts as a convex mirror. When we look at the back of spoon we see an erect image of our self. This is because the outer reflective curved surface of the metal spoon acts as a diverging mirror.

Q.2 Which mirror is used by girls for makeup and why?

Ans: Concave mirror is used by girls for makeup. An object when placed in front of a concave mirror between the mirror and its focus, a virtual, magnified and erect image is formed behind the mirror. When face is placed between the concave mirror and its focus, it produces a magnified image. This enlarged image of face is helpful in makeup as even pores of skin are clearly visible.

Q.3 Why are large convex mirrors fixed at blind turns of mountains?

Ans: Convex mirrors are fixed on very sharp turns of the roads of mountains. Because convex mirror diverges the image and due to divergence it covers large area. Hence we can know about the car coming from the other side of the turn as the image reflected is greater.



Q.4 Which mirrors are used for rear view of vehicles and why?

Ans: Convex mirrors are used in rear view mirrors of motor vehicles. This is because they give an erect, virtual, full size diminished image of distant objects with a wider field of view. Due to this we can see a wider area on a small mirror.



Q.5 If a person is walking in pool, why do his legs appear shorter in water?

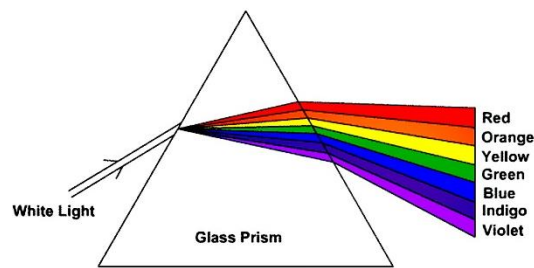
Ans: A person legs appear shorter in the water due to refraction of light. When the rays passing through the water to air then the reflected ray bent away from the normal. We know that, the refractive index of water is greater than that of air. So, a person legs appear to be short while walking in the tank due to refraction.

Q.6 Why do diamonds sparkle brightly?

Ans: Critical angle for diamond is quite less and is only 24° . Besides these diamonds are cut very sharp, making a large number of the refracting surfaces. Hence when a ray of light enters a diamond, it suffers a series of total internal reflections on account of a very small critical angle. This makes a ray of light literally trapped within the diamond for a little time and this trapped light energy makes a diamond sparkle.

Q.7 When white light passes through a prism, it disperses into its seven colours. Why does dispersion take place in prism?

Ans: The phenomenon due to which white light splits into seven colours on passing through a prism is called dispersion. White light is made up of seven bands of colors each having different wavelengths. Upon passing through a medium, each of the colors travels at different speeds and hence has different angles of refraction leading to the splitting of the light i.e. dispersion.



Q.8 Magnifying glass can burn the paper. How is it possible?

Ans: Magnifying glass can burn the paper. This happens because magnifying lens is a converging lens, so it converges the rays of sunlight falling on it to a single point on the paper. Since the rays of sun are heat radiation, so it raises the temperature of the paper and thus it starts burning.



Q.9 Your grandfather uses spectacles to read newspaper. You see through the spectacles and you observe that objects behind it were inverted. Why was it so observed?

Ans: Grandfather uses spectacles to read newspaper but when I see through it, the objects behind it were inverted. As the images were inverted so the lens used in spectacles is convex lens. Because only convex lens have the ability to form inverted image. And grandfather had the problem of foresightedness in his eyes so he is using spectacles of convex lens so they can see clearly through spectacles. But i don't have any problem in my eyes so objects behind it were inverted.

Q.10 Under what condition, is a convex lens nearly act as diverging lens?

Ans: The ability of a lens to act as converging or diverging depends upon its refractive index. The refractive index n of the material of a lens depends upon the medium in which the lens is placed. Generally the lens is in air so n gives refractive index of material of lens with respect to air. If you place the convex lens in a medium other than air, then due to change in n , the focal length f of lens changes. if n decreases, f increases. So if you immerse the convex lens in a liquid whose refractive index is greater than refractive index of material of lens then it will change its nature and become concave lens and thus it will start diverging the rays rather than focusing them on a single point.

Ch#13(Electrostatics)

Q.1 Rub plastic ruler with your hair. Place it near running water from tap. You see that thin stream of water is deflected. Explain why?

Ans: It is just because of Electrostatic Force. Electrostatic forces are non-contact forces, they pull or push an objects without touching them. When we rub a plastic ruler with our hair, friction is produced which charges the ruler. Now, if we place this charged ruler near running water from tap, it applies a pull (electrostatic force) on the water and it gets deflected.

Q.2 Two identical spheres have same masses. Then we charge both sphere oppositely N charged. After charging, will there be both bodies have same masses or different masses? Explain.

Ans: If a sphere gains a negative charge it means it gains number of electrons in the sphere. Hence the mass is increased in that sphere. And if a sphere gains a positive charge it means it loses number of electrons in the sphere. Hence the mass is decreased that sphere. An atom can gain only electrons which is the negatively charged particles. They become positively charged just by the loss of electrons. They never gain a positive charge. Thus an increase in electrons, the mass of the sphere increases.

Q.3 You take your car to service station to get it polished. After a while, you observe that your car attracts the dust. Why is dust attracted by the car?

Ans: The reason behind the attraction of dust particles is the presence of charged particles in paint that is applied to the car. The process of attraction takes place between the charged particles present in the paint and the particles of dust. Thus the dust particles are stick to the paint of the car.

Q.4 Take two oppositely charged rods, place them separately near small pieces of paper. Why do they both attract small pieces of paper? Is there any third type of charge on papers which attracts both positive and negative charges?

Ans: The pieces of paper are not initially charged. They either have a charge induced on them by the rod, or they are polarized by the electric field of the rod. This works the same way whether the rod is positive or negative. For example a positive rod would induce a negative charge on the paper, and the opposite charges attract. Likewise a negative rod would induce a positive charge on the paper, and again the opposite charges attract.

Q.5 The force between two point charges is 10N. If their charge is doubled and distance N between them is reduce to half, what will be magnitude of force between them?

Data: $F = 10\text{N}$, $q'_1 = 2q_1$, $q'_2 = 2q_2$, $r' = \frac{r}{2}$, $F' = ?$

Solution: $F = k \frac{q_1 q_2}{r^2}$, Putting the values

$$F' = k \frac{q'_1 q'_2}{r'^2} = k \frac{(2q_1)(2q_2)}{\left(\frac{r}{2}\right)^2}$$

$$F' = k \frac{4q_1 q_2}{\frac{r^2}{4}}$$

$$F' = k \frac{4 \times 4 q_1 q_2}{r^2}$$

$$F' = 16k \frac{q_1 q_2}{r^2}$$

$$F' = 16F$$

$$F' = 16(10)$$

$$F' = 160\text{N}$$

Q.6 A 100C charged body of mass 20kg repels 1C charged body of 10g with a force of 2000N. Will smaller charged body apply force same/smaller/greater force on 20kg charged body?

Ans: The smaller body will exert the same amount of force on the 20kg charged body. The forces between two point charges are action and reaction forces and according to Newton's 3rd law of motion, action and reaction are equal in magnitude but opposite in direction. Therefore, both the charged masses will exert same forces on each other. However, the smaller mass will accelerate more as compared to the heavy mass in accordance with Newton's 2nd law of motion.

Q.7 Why is it dangerous for construction workers to hold long workers steel pole upright during lightning weather condition?

Ans: During lightning weather conditions, the taller structures are more prone to thunder and lightning because they are closer to clouds. Hence it is dangerous for construction workers to hold long steel pole upright during lightning weather condition. Because the charge is carried to the ground via the long steel pole, so it may cause of death of the worker.

Q.8 According to equation of capacitance of capacitor, capacitance is numerically equal to ratio between charge store on one of its plates and potential difference between its plates. Does its value depend upon amount of charge and potential difference?

Ans: We have capacitance, $C = Q/V$

Where Q = charge on capacitor, V = potential difference across the plates. When the potential difference V is increased, charge on capacitors also increases such that remains constant. Because depends upon plate area medium between plates and distance between plates.

Q.9 Do two capacitors of different plate area gain same or different amount of charge if connected with the same battery?

Ans: The capacitor with large plate area will gain more amount of charge than the capacitor with small plate area.

As $C = \frac{A\epsilon_0}{d}$, then $C \propto A$ ($\frac{A\epsilon_0}{d} = \text{constant}$)

For constant separation and medium between the plates, capacitance of capacitor is directly proportional to the area of the plate. Therefore, the capacitor with large plate area will store more charge as compared to the capacitor with small plate area.

Q.10 A device has capacitance of 250nC. You are asked to decrease its capacitance to 50nC. How can you get it by connecting another capacitor with it?

$C_1 = 250\text{nC}$, $C_e = 50\text{nC}$, $C_2 = ?$

Solution:

Capacitance of series combination of capacitors is given by

$$\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$\frac{1}{C_2} = \frac{1}{C_e} - \frac{1}{C_1}$$

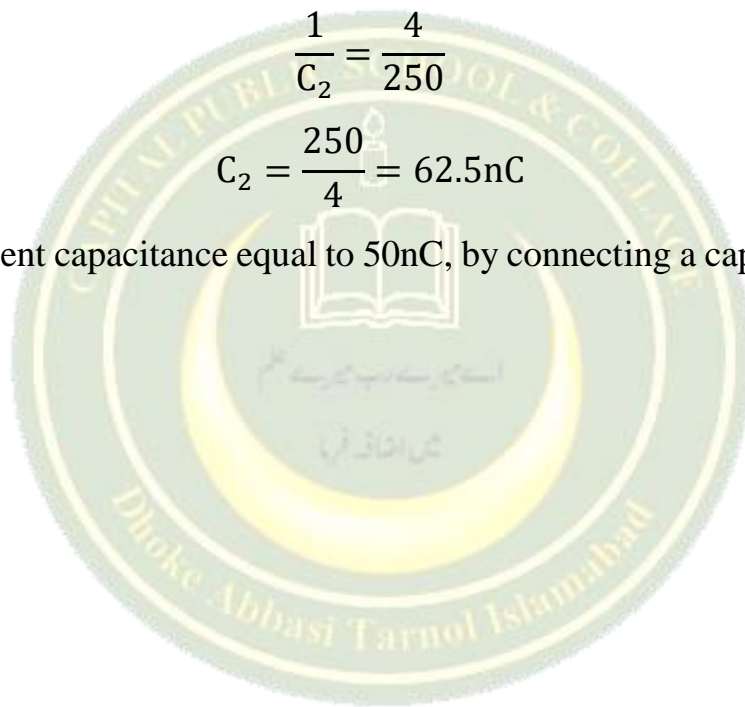
$$\frac{1}{C_2} = \frac{1}{50} - \frac{1}{250}$$

$$\frac{1}{C_2} = \frac{5 - 1}{250}$$

$$\frac{1}{C_2} = \frac{4}{250}$$

$$C_2 = \frac{250}{4} = 62.5\text{nC}$$

Hence, we can get equivalent capacitance equal to 50nC, by connecting a capacitor of 62.5nC in series with 250nC capacitor.



Ch#14(Current Electricity)

Q.1 Can current flow through a circuit without potential difference? Explain.

Ans: If no potential difference then no work is being done on charge so there should be no net displacement of charge but we know that the current flows. Current flows from higher potential to lower potential but across two ends potential is same its mean potential difference is zero, so no current should flow through the circuit.

Q.2 If aluminum and copper wires of the same length have the same resistance, which has the larger diameter? Why?

Ans: Resistance of any material is given as: $R = \rho \frac{L}{A}$

Where R is the resistance, A is the cross sectional area, L is the length and ρ is the resistivity of material. Now, resistance and length is same, so the area will depend on the resistivity of the material.

Area (A) \propto Resistivity (ρ)

Resistivity of copper = $1.68 \times 10^{-8} \Omega\text{m}$, Resistivity of aluminum = $2.65 \times 10^{-8} \Omega\text{m}$ Since, resistivity of aluminum is higher than resistivity of copper so the area is higher for aluminum.

Q.3 What is resistance across open switch and close switch of a circuit?

Ans "Short circuit" is usually equivalent to "closed switch" whereas "open circuit" is equivalent to "open switch". The resistance of a closed switch is considered to be zero as current will flow without any opposition. Whereas, the resistance of an open switch is considered to be infinity as no current will flow.

Q.4 A bird is sitting on a high voltage transmission line, but it is not electrocuted. Why? When it tries to fly, it touches another bird that is sitting on second transmission line of the pole. Now, it is heavily electrocuted. Why?

Ans: A bird sitting on a high voltage transmission line do not electrocuted because the bird is sitting on a wire don't touch the ground (or anything in contact with the ground), so electricity does not flows through the bird.

When the bird tries to fly and it touches another bird that is sitting on second transmission line of the pole then electricity gets the path to flow from the bird hence it is heavily electrocuted.

Q.5 You are given five resistances of different magnitudes. But you are asked to form a circuit whose resistance is smaller than any given resistance. How can you make such circuit with given resistances ?

Ans: For the resultant resistance to be smaller than the given resistances, we should connect the given resistance in a parallel combination. Because the equivalent resistance is smaller than smallest of individual resistance in parallel combination of the resistances. The resistances are connected in parallel to decrease resistance.

Q.6 You are given n wires, each of resistance R. What is the ratio of maximum to minimum resistance obtainable from these wires?

Ans: Maximum resistance can be obtained when the resistance are connected in series and minimum resistance can be obtained when the resistances are connected in parallel.

$$R_{\text{series}} = R + R + R \dots \dots \dots = nR$$

$$\frac{1}{R_{\text{parallel}}} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} \dots \dots \dots = \frac{n}{R}$$

$$R_{\text{parallel}} = \frac{R}{n}$$

Therefore; $\frac{R_{\text{series}}}{R_{\text{parallel}}} = \frac{nR}{\frac{R}{n}} = \frac{n^2 R}{R} = n^2$

Q.7 Two electric bulbs marked 100W, 220V and 200W, 220V have tungsten filaments of the same length. Which bulb will have thicker filament?

Ans: $P = VI = V \left(\frac{V}{R} \right) = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P}$, putting the values

$$R_1 = \frac{V^2}{P} = \frac{(220)^2}{100} = \frac{48400}{100} = 484\Omega$$

$$R_2 = \frac{V^2}{P_2} = \frac{(220)^2}{200} = \frac{48400}{200} = 242\Omega$$

$$R = \rho \frac{L}{A}$$

If both have same length and made of same material.

$$R \propto \frac{1}{A}$$

$$R_1 > R_2, \text{ then } A_2 > A_1$$

Hence 200W, 220V bulb has more thickness of filament.

Q.8 Why are we advised not to touch electric switches with wet hand, first dry your hands?

Ans: One should not touch electrical appliances with wet hands. When we wash our hands with tap water which contains a lot of salt and ions this gets transmitted to our hands. Small amounts of mineral salts present naturally in water are beneficial for human health. However, these salts make water conducting. So, we should never handle electrical appliances with wet hands

Q.9 Why is it dangerous to touch a live wire while standing on earth bare footed?

Ans: The live wire is dangerous one because it is at 230V. If you touch a live wire while standing on earth with bare footed, you may complete a circuit between the live wire and the earth. As the current flows when two points are at different potential so the current will flow from body which will results a shock.

Q.10 Sometimes, if your one of the car's head lamp is burnt or not working but second lamp still gives light. What do you conclude about connection of head lamps from this observation?

Ans: The head lights in a car are connected in parallel. So, if one of the car's head lamp is burnt or not working then second lamp will gives light. The alternative of connecting bulbs in series would be that if one failed then all those in series would go out.

Q.11 Show that volt ampere is equal to watt (SI unit of power).

Ans: Watt is a SI unit of power. If a machine or any entity is producing one Joule of work or energy in one second, then we'll say that power of the machine is 1 watt. As

$$P = VI$$

$$\text{Watt} = \text{Volt Ampere}$$

Ch#15(Electromagnetism)

Q.1 Two parallel straight conductors carrying current in same direction, attract each other? Explain why. What will you conclude if direction of current in conductors is opposite?

Ans: Whenever current flows, it creates magnetic field around the wire which can be obtained by right hand thumb rule. Magnetic field can be expressed in terms of lines of force. Then we will apply Fleming's left hand rule to see forces applying on the wires. We will observe that two current carrying conductors attract each other when the current is in the same direction and repel each other when the current is in opposite direction.

Q.2 Bar magnets are dropped in long pipes made up of plastic and copper (of same length) simultaneously. Bar magnet comes out later through copper pipe than through plastic pipe, why?

Ans: The moving magnet in the copper pipe induces a current in the copper pipe. The change in magnetic flux determines the induced current (Faraday's Law), in the pipe. The currents in the copper pipe then circulate, creating closed loops called eddy currents. The eddy current itself creates a magnetic field, one that opposes the falling magnet's field, slowing it down. While plastic pipe is an insulator so such currents or magnetic fields do produced in it.

Q.3 What is direction of magnetic force on this current carrying conductor placed in magnetic field? Also Label the diagram, with current, magnetic field and force.

Ans: The direction of this force is always right angles to the plane containing both the conductor and the magnetic field, and is predicted by Fleming's Left-Hand Rule.



Q.4 What is direction of rotation of coil (shown in figure) when the switch is closed? Label the diagram with direction of forces forming couple and rotation of coil.

Ans: When a steady current flows through the circuit, a magnetic field is set up by the rectangular coil due to the passage of current. The magnetic field in the coil is at right angles to the magnetic field of the permanent magnet. Thus, a magnetic couple acts, which rotates the coil.

By Fleming's left hand rule, we can see that the coil rotates in clockwise direction.

Q.5 A bar magnet is moving the ring, what is direction of induced current in the ring when:

(a) Magnet is moving towards ring (b) Magnet is moving away from the ring

Ans: (a) When we bring a north pole of the bar magnet near a metallic ring applying Lenz's law the ring will behave as north pole so that repulsion occurs. So according to right hand rule direction of current induced in it will be anticlockwise.

Ans: (b) When south pole of the bar magnet moving away from the metallic ring applying Lenz's law the ring will behave as north pole so that attraction occurs. So according to right hand rule direction of current induced in it will be clockwise.

Q.6 Why output of a transformer is zero if DC voltage is applied on its primary coil?

Ans: When a DC voltage is applied to the transformer, the core becomes an electromagnet and the polarity does not change, and the magnetic flux through the secondary winding remains unchanged. Consequently, electromagnetic induction does not occur, and no current is generated in the secondary winding. Hence the output of a transformer will be zero if DC voltage is applied on its primary coil.

Q.7 Why are coils of transformer wound on iron core?

Ans: The central iron core of most transformers is made of a highly permeable material, which is typically thin silicon steel laminations. These thin laminations are joined together to provide the necessary magnetic path while minimizing magnetic losses. Thus, iron is used in transformers to provide the necessary magnetic path and to minimize magnetic losses.

Q.8 Why step-up transmission is used for long distance transmission?

Ans: Use of transformers in transmission and distribution of energy over long distance. The voltage output of the generator is stepped up, so the current is reduced and consequently I^2R loss is cut down. It is then transmitted over long distances to an area substation near the consumers. There the voltage is stepped down. It is further stepped down at the distributing substations and utility poles before a power supply of 240V reaches at homes.

Q.9 When you are pushing a bar magnet towards coil of single turn, you feel and opposing force on your hand. If this magnet is pushed towards coil of many turns, now you will feel greater opposing force. Why?

Ans: By pushing the bar magnet towards the coil a current would be induced into the coil by the physical movement of the magnetic flux inside it. This induced current depends upon the area of the coil and the change in magnetic field.

If we push the magnet towards the coil of single turn, we feel opposing force on our hand due to Lenz's law. If we increase the number of turns in the coil this will increase the area of the coil and it induces more current in the coil hence we will feel more opposing force on our hand.

Q.10 In what way split rings (commutators) in DC motor differ slip rings in AC motor in working?

Ans: The split ring in the electric motor also known as a commutator reverses the direction of current flowing through the coil after every half rotation of the coil. Due to this the coil continues to rotate in the same direction. Whereas slip rings provide a continuous transfer of power in AC motors.

Ch#16(Introductory Electronics)

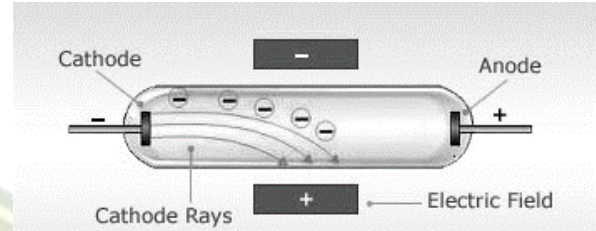
Q.1 What are free electrons?

Ans: The electrons that are not bound within the atom and free to move are called free electrons. Electrons in the valence shell of an atom, generally known as valence shell electrons, are loosely bound with the nucleus of the atom.

As we know that the movement of electrons is the electric current. So, the free electrons tend to move freely and can conduct electricity. Metals are good conductors of electricity and thus they possess free electrons.

Q.2 How can you say that cathode rays are negatively charge?

Ans: A beam of electrons emitted from the cathode of a high vacuum tube is known as cathode rays. When voltage is applied to two electrodes fitted in an evacuated glass tube, it shows deflection of the cathode ray. The cathode rays are negatively charged, they will get deflected away from the negatively charged electrode and will move towards the positively charged electrode.



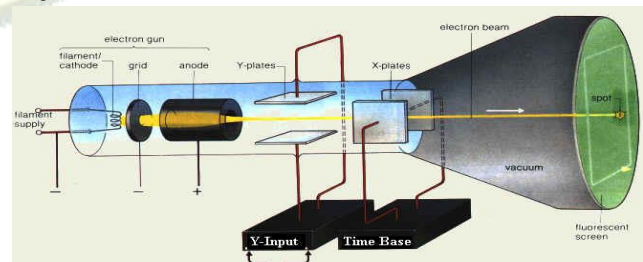
Q.3 Why image is distorted when a magnet is brought close to old television screens or monitors with cathode ray tube (CRT) inside?

Ans: When a magnet is brought close to the picture tube, the interaction between the flying electrons and the magnetic field creates a force that throws the electrons off course. Now the electrons are hitting the screen in places they were not intended to strike and the picture becomes distorted. Hence the image is distorted when a magnet is brought close to old television screens or monitors with cathode ray tube (CRT) inside.



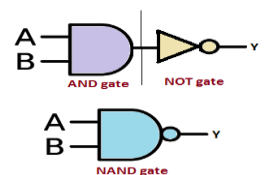
Q.4 How can you control brightness of waveform on screen of CRO?

Ans: By changing the negative potential of the grid, we can control the number of electrons per unit time or the current in the cathode ray tube which changes the brightness.



Q.5 All modern devices e.g. mobile phone, calculators, laptops etc use digital signals for their working. Why is digital signal used?

Ans: Digital signals can convey information with less noise, distortion, and interference. Digital signals are a more reliable form of transmitting information because an error in the amplitude or frequency value would have to be very large in order to cause a jump to a different value. So all modern devices e.g. mobile phone, calculators, laptops etc use digital signals for their working.



Q.6 Is NAND gate reciprocal of AND gate?

Ans: An AND gate is connected to NOT gate in series. The bubble at the output of the NAND gate is the symbol of NOT gate. A NOT gate is used for inverting the output results. Thus, A NAND gate is reciprocal of an AND gate.

Q.7 What is the difference to produce a LOW (0) output for an OR gate and NAND gate?

The output of an OR gate will be LOW (0) if its both inputs are LOW (0).

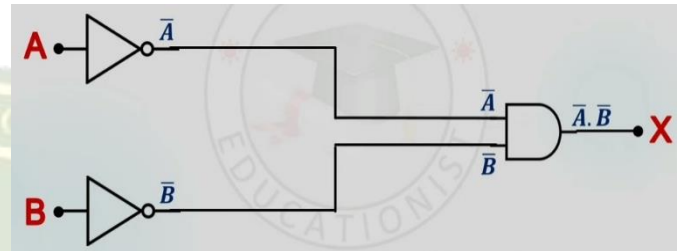
While the output of a NAND gate will be LOW (0) if its both inputs are HIGH (1).

Q.8 What is the difference to produce a HIGH (1) output for an AND gate and NOR gate?

Ans: The output of an AND gate will be HIGH (1) if its both inputs are HIGH (1). While the output of a NOR gate will be HIGH (1) if its both inputs are LOW (0).

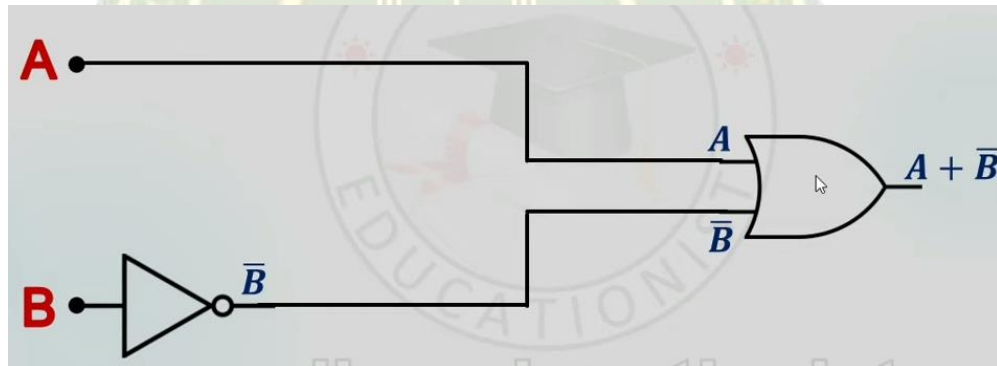
Q.9 What is the output of the following circuit?

Ans: So the output of the given circuit will be $X = \bar{A} \cdot \bar{B}$



Q.10 Draw a logic circuit for the logic equation $X = A + \bar{B}$.

Solution:



Ch#17 ICT(Information and communication Technology)

Q.1 What is the difference between data and information?

	Data	Information
1	The word 'data' is derived from the Latin word 'datum', which means something that is given.	The word 'information' is derived from the Latin word 'information', which means 'formation or conception'.
2	Data refers to raw facts that have no specific meaning	Information refers to processes data that has a purpose and meaning
3	The data is independent of the information.	Information is dependent on data.
4	Data or raw data is not enough to make a decision	The information is sufficient to help make a decision in the respective

Q.2 Briefly explain the process of transfer of information via radio waves through air.

Ans: Radio waves are generated artificially by an electronic device called a transmitter. A transmitter encodes or modulates messages by varying the amplitude or frequency of the wave. Transmitter is connected to an antenna which radiates the waves. They are received by another antenna connected to a radio receiver. Receiver tuned to the same wavelength picks up the signal and 'decodes' it back to the desired form.

Q.3 What is the difference between primary and secondary memory? Why do we need both in computers?

Ans: Primary memory is known as computer's main memory and stores data temporarily. It is quite fast. It is the region in a computer system where data is stored by the computer's CPU for quick, easy and direct access, for example hard disk, etc.

Secondary memory is external memory and saves data permanently. It is very slow in contrast to primary memory. It is stored on secondary storage devices such as hard drives, DVDs, CD-ROMs, and so on.

Computer uses its memory (primary memory) to run programs, and it uses storage (secondary memory) to save files, programs, & other data. That's why we need both primary memory and secondary memory to use a computer.

Q.4 What is difference between RAM and ROM of computers?

	RAM	ROM
1	RAM is a temporary storage.	ROM is a permanent storage.
2	RAM stores data in MBs.	ROM stores data in GBs.
3	It is a volatile memory.	It is a non-volatile memory.
4	It is used in normal operations.	It is used for startup process of computer.
5	Writing data is faster in RAM.	Writing data is slower in ROM.

Q.5 Why optical fiber is better than electric wire for communication process?

Ans: Optical fiber transmits data in the form of light. Optical fibers transmit information over large distances via light, with minimum loss of energy. One of the most important reasons to choose fiber optics over regular wire cables is that they offer much higher data speeds. Fiber optic cables are capable of transmitting data at speeds of up to 100 Gbps, which is significantly higher than the best that regular cables can manage (around 30 Gbps).

Q.6 Why is the storage capacity of hard disk greater than a floppy disc or DVD usually?

Ans: Hard disks store much more data per square inch of recording surface. Because aluminum platters are less sensitive than floppy disk or DVD to variations in temperature and humidity and to mechanical stress. This allows the hard disks to have more tracks per radial inch and to write more bits per inch along each track.

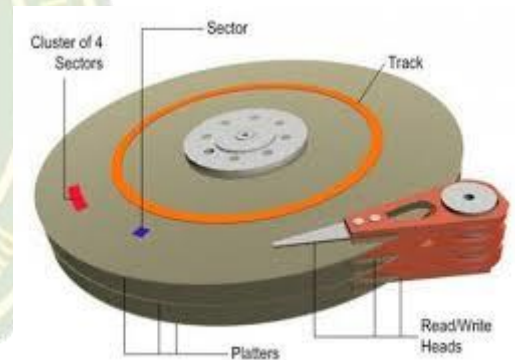
Q.7 What is the main difference between telephone and cellular phone?

Ans: Landlines use electrical currents to send the sound of voice to the receiver, while cellphones use wireless technology. Cellphones use only electromagnetic radio waves to send and receive the sound but telephones use wires for this purpose. Telephone is fixed on a place but we can carry cellular phone anywhere.



Q.8 How is data stored in a Hard disk? Describe briefly.

Ans: Data is stored on the hard disk in the form of 0 and 1. The part of the hard disk that stores the data is known as platters, each accessed via read/write head on a moveable arm. Platters are circular disk made of a nonmagnetic material (aluminum alloy, glass or ceramic) coated with a thin layer of a magnetic material. Platters are further separated in to the tracks and sectors. Hard disk stores information in the form of magnetic fields. Data is stored digitally in the form of tiny magnetized regions on the platter where each region represents a bit. To write a data on the hard disk, a magnetic field is placed on the tiny field.



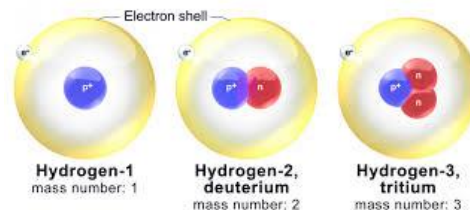
Ch#18(Radio Activity)

Q.1 What is common in isotopes of an element and what is different in them?

Ans: Isotopes are members of a family of an element that all have the same number of protons but different numbers of neutrons.

So protons are common in isotopes of an element and neutrons are different in isotopes of an element.

Example: $^{12}_6\text{C}$, $^{13}_6\text{C}$, $^{14}_6\text{C}$ 12,13,14 are Mass Number and 6 are Atomic Number



Q.2 It happens that a nuclear radiation emits from an atom of element, it moves one step ahead in periodic table? Explain

Ans: It happens that a nuclear radiation emits from an atom of element, if it moves one step ahead in periodic table then it is a beta decay. During a β – decay, atomic number of the nucleus increases by 1 units. So, the nucleus shifts to the right in the periodic table.

When beta particle emits, the atomic number increases by 1 and the mass number remains unchanged

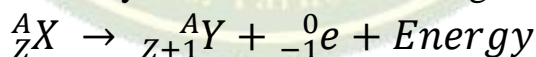
Example: $^{14}_6\text{C} \rightarrow ^{14}_7\text{N} + ^0_{-1}\text{e} + \text{Energy}$

Q.3 Why nuclei of atoms with atomic number greater than 82 emit radiations?

Ans: The isotopes of elements with the atomic number (Z) greater than 82 are said to be radioisotope. The nucleus of an atom becomes radioactive when the number of neutrons exceeds the number of protons in the nucleus. They undergo radioactive decay and are also known as the 'Unstable isotopes'. The stability of the atoms of different elements is dependent on their nuclear binding energy. If the nuclear binding energy of an atom is more than the repulsive forces between the nucleons, it is stable; else unstable.

Q.4 β – particle is emitted from the neutron of the nucleus. Write nuclear equation for this reaction.

Ans: In β decay, the original 'parent' nuclide is converted to a daughter nuclide by the emission of a β particle. The atomic number increases by one, whereas no change in the mass number Equation:



Parent nuclide \rightarrow Daughter nuclide + Beta particle

Q.5 Why range of β – particle is greater than α - particle in air with same energy?

Ans: β – particle has smaller mass and charge, so it interacts less with electrons of matter as compared to a particle. Therefore, its penetration power is more which increases its energy. As

$$E = \frac{1}{2}mv^2 \quad \Rightarrow \quad \frac{2E}{m} = v^2$$

$$v = \sqrt{\frac{2E}{m}}$$

$$v \propto \sqrt{\frac{1}{m}}$$

This shows the greater mass will have smaller velocity.

Q.6 Why ionization power of α – particle is greater than β – particle in solid with same energy?

Ans: Alpha particles are highly ionizing because of their double positive charge, large mass (compared to a beta particle) and because they are relatively slow. They can cause multiple ionizations within a very small distance.

Q.7 What fraction of a radioactive element will be left after 4 half-lives have elapsed?

Ans: If original radioactive element is N_o then after $n = 4$ half-lives the remaining fraction can be calculated by n

$$N = N_o \times \left(\frac{1}{2}\right)^n$$

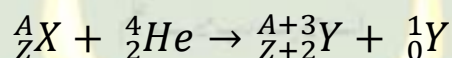
$$N = N_o \times \left(\frac{1}{2}\right)^4$$

$$N = N_o \times \frac{1}{16}$$

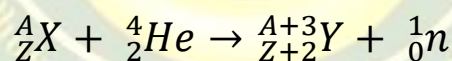
$$\frac{N}{N_o} = \frac{1}{16}$$

Q.8 In a nuclear reaction ${}_Z^AX + {}_2^4He \rightarrow {}_{Z+2}^{A+3}Y + W {}_0^1Y$ What particle does W denote?

Ans: Balancing the given equation



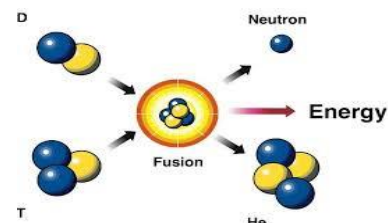
The resulting element has atomic number equal to 0 which shows that it is neutron ${}_0^1n$



Hence $W = 1n$ which is neutron.

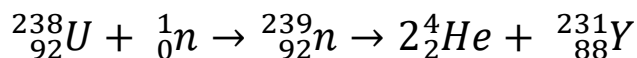
Q.9 Why is energy released when lighter nuclei fuse with heavier nuclei?

Ans: In a fusion reaction, two light nuclei merge to form a single heavier nucleus. The process releases energy because the total mass of the resulting single nucleus is less than the mass of the two original nuclei. The leftover mass becomes energy.



Q.10 When a nucleus ${}_{92}^{238}U$ absorbs a slow neutron, it subsequently emits two α - particles. ${}_{92}$ What is resulting element?

Ans: Writing the equation



The resulting element has atomic number equal to 88 which shows that it is Radium ${}_{88}^{233}Ra$

Q.11 How long will a radioactive element take to decay completely?

Ans: A radioactive element will take infinite time to decay completely.

For example: Let original quantity is 1000g So

$$1000g \xrightarrow{\text{1st Half life}} 500g \xrightarrow{\text{2nd Half life}} 250g \xrightarrow{\text{3rd Half life}} 125g \xrightarrow{\text{4th Half life}} 62.5g \dots \dots \dots \text{Continue}$$

So the life time of any radioactive element is unlimited and is difficult to measure.

