**Q1) Answer the following question with reference to the Audio**

[**https://drive.google.com/file/d/16vj6wyamJ1XxTZ6AaUFFbFn2vsIijCMT/view?usp=share\_link**](https://drive.google.com/file/d/16vj6wyamJ1XxTZ6AaUFFbFn2vsIijCMT/view?usp=share_link)

**Type: Audio**

**Which of the following materials is a good dielectric?**

a) Copper

b) Aluminum

c) Glass

d) Iron

Correct Answer: Option (c)

Explanation: A dielectric material is an insulating material that is used in capacitors to increase their capacitance. The dielectric material is placed between the conductive plates of the capacitor, and it helps to reduce the electric field strength between the plates, allowing the capacitor to store more charge.

Copper and Aluminum are conductive materials and not good dielectrics. Iron is also not a good dielectric material, as it has a low dielectric constant and high conductivity.

Glass, on the other hand, is a good dielectric material because it has a high dielectric constant and low conductivity.

Thus, the correct answer is option (c).

Difficulty Level-Easy

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**Q2) What is the dielectric breakdown voltage?**

a) The voltage at which a dielectric material breaks down and conducts electricity

b) The voltage at which a capacitor discharges completely

c) The voltage at which a capacitor starts to store energy

d) The voltage at which a capacitor reaches its maximum charge

Correct Answer: Option (a).

Explanation: The dielectric breakdown voltage is the voltage at which a dielectric material breaks down and begins to conduct electricity. This happens when the electric field strength applied to the dielectric material exceeds its dielectric strength, which is the maximum electric field that the material can withstand before breaking down.

This is an important consideration when designing capacitors, as exceeding the dielectric breakdown voltage can lead to the capacitor being damaged or destroyed.

Thus, the correct answer is option (a).

Difficulty Level-Medium

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**Q3) What is a polarized capacitor?**

a) A capacitor with a dielectric material that is polarized in an electric field

b) A capacitor with a variable capacitance

c) A capacitor with a high dielectric constant

d) A capacitor with a low dielectric constant

Correct Answer: Option (a)

Explanation: A polarized capacitor is a type of capacitor that uses a polarized dielectric material, which is a material that has a permanent electric dipole moment. This means that one end of the dielectric material is positively charged, while the other end is negatively charged.

Polarized capacitors have a specific polarity, meaning that they must be connected in the correct orientation to function properly. If they are connected incorrectly, they can become damaged or even explode. Therefore, it is important to check the polarity markings on the capacitor before connecting it to a circuit.

Thus, the correct answer is option (a).

Difficulty Level-Medium

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**Q4) Which of the following quantities represents the energy stored in a capacitor?**

a) Voltage

b) Current

c) Power

d) Electric charge

Correct Answer: Option (d)

Explanation: The energy stored in a capacitor is represented by its electric charge. A capacitor is an electrical component that stores electrical energy in an electric field. The amount of charge stored in the capacitor is directly proportional to the voltage applied across its plates and the capacitance of the capacitor. Therefore, the greater the voltage and capacitance, the more energy can be stored in the capacitor.

Thus, the correct answer is option (d).

Difficulty Level-Easy

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**Q5) What is capacitance?**

a) The ability of a capacitor to store charge.

b) The ability of a capacitor to discharge charge.

c) The ability of a capacitor to conduct electricity.

d) The ability of a capacitor to resist charge.

Correct Answer: Option (a)

Explanation: A capacitor is an electrical component that consists of two conductive plates separated by a dielectric material. When a voltage is applied across the plates, charge accumulates on the surfaces of the plates, and an electric field is established in the dielectric material between the plates. The amount of charge that a capacitor can store for a given voltage is proportional to its capacitance. Capacitance plays an essential role in many electrical and electronic systems, including power supplies, filters, and communication circuits.

Thus, the correct answer is option (a).

Difficulty Level-Medium

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**Q6) What is the purpose of a capacitor in a circuit?**

a) To regulate the flow of current

b) To increase the voltage of the circuit

c) To store electric charge

d) To produce magnetic fields

Correct Answer: Option (c)

Explanation: A capacitor is an electronic component that is used to store electric charge in a circuit. When a voltage is applied to the capacitor, it charges up by storing electric charge on its plates. When the voltage is removed, the capacitor discharges and releases the stored charge. Capacitors are commonly used in electronic circuits for a variety of purposes, such as smoothing out power supply voltages, filtering out unwanted signals, and coupling different parts of a circuit. Capacitors can also be used in timing circuits, oscillators, and filters.

Thus, the correct answer is option (c).

Difficulty Level-Medium

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**Q7)What is the major limitation of a capacitor in an AC circuit?**

a) High resistance

b) Low capacitance

c) Self-discharge

d) Inability to block DC current

Correct Answer: Option (d)

Explanation: A capacitor is an electronic component that stores electrical charge and energy in an electric field. It is commonly used in AC circuits as a filter, to remove unwanted frequencies from the signal. However, one of the major limitations of a capacitor is its inability to block DC current. This means that if a DC voltage is applied to a capacitor, it will charge up to the same voltage as the source and then act like a short circuit, allowing the DC current to flow through it. This can be a problem in circuits where DC voltage needs to be blocked or eliminated. Therefore, it is important to use other components such as diodes or inductors in conjunction with capacitors to achieve the desired results.

Thus, the correct answer is option (d).

Difficulty Level-Medium

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**Q8) What is the capacitance of a capacitor with a charge of and a voltage of ?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The capacitance of a capacitor is defined as the ratio of charge stored on each plate to the potential difference between the plates. Mathematically,

So, using the given values of charge and voltage, we get

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Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q9) What is the capacitance of a capacitor that stores a charge of when a potential difference of is applied across it?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The capacitance of a capacitor is determined by the ratio of the charge stored in it to the potential difference applied across it.

Using the formula ,

where C is the capacitance in Farads, Q is the charge in Coulombs, and V is the potential difference in Volts, we can find the capacitance of the given capacitor.

Given,

Therefore

Thus, the correct Answer is option (a).

Difficulty Level-Hard

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**Q10) What is the charge stored in a capacitor with a capacitance of when a potential difference of is applied across it?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The formula for calculating charge in a capacitor is ,

where Q is the charge, C is the capacitance, and V is the potential difference.

Using the given values of and , we can calculate the charge as,

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q11) What is the capacitance of a capacitor that stores a charge of when a potential difference of is applied across it?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The capacitance of a capacitor is given by the formula

where Q is the charge stored in the capacitor and V is the potential difference across it. In this case, the charge stored is and the potential difference is . Therefore, the capacitance can be calculated as

Thus, the correct answer is option (a).

Difficulty level-Hard

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**Q12) The energy stored in a capacitor is given by:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The energy stored in a capacitor is given by the formula ,

where U is the energy stored, C is the capacitance of the capacitor and V is the potential difference across the capacitor. The formula indicates that the energy stored in a capacitor is directly proportional to the capacitance and the square of the potential difference across the capacitor. Thus, a higher capacitance or potential difference will result in a higher energy stored in the capacitor.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q13) A parallel-plate capacitor with air as the dielectric has a capacitance of. What will be the capacitance if a dielectric material of dielectric constant is inserted between the plates?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The capacitance of a parallel-plate capacitor with air as the dielectric can be calculated using the formula:

where C is the capacitance, is the permittivity of free space, A is the area of the plates, and d is the distance between the plates. Since the capacitance is given as, we can write:

When a dielectric material of dielectric constant 5 is inserted between the plates, the capacitance increases by a factor of 5.

The capacitance with the dielectric material can be calculated using the formula:

where is the new capacitance, is the relative permittivity or dielectric constant of the material.

Substituting the given values, we get:

Since the area and distance between the plates are not changing, we can write:

Therefore, the new capacitance is:

Thus, the correct answer is option (b).

Difficulty Level-Hard

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**Q14) Which of the following statements best describes equivalent capacitance?**

a) The capacitance of a single capacitor in a circuit.

b) The sum of the capacitance of all capacitors in a circuit.

c) The capacitance of a circuit containing multiple capacitors, simplified into a single equivalent capacitor.

d) The capacitance of a circuit containing multiple capacitors, added together in parallel.

Correct Answer: Option (c)

Explanation: Equivalent capacitance refers to the effective capacitance of a circuit that contains multiple capacitors. When capacitors are connected in a circuit, their capacitance values can affect the overall behavior of the circuit. In order to analyze the circuit and understand its behavior, it is often useful to simplify the circuit by calculating an equivalent capacitance.When capacitors are connected in series, the equivalent capacitance is less than any of the individual capacitances. This is because the total voltage across the capacitors is divided among them, leading to a decrease in the overall charge stored. The formula for calculating the equivalent capacitance of capacitors in series is:

Thus, the correct Answer is Option (c).

Difficulty Level-Easy

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**Q15) Two capacitors of capacitances 3μF and 6μF are connected in series. What is the equivalent capacitance of the combination?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The equivalent capacitance of capacitors connected in series is given by the formula

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In this case, the two capacitors have capacitances of 3μF and 6μF, so we can substitute these values into the formula:

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Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q16) A capacitor of capacitance is charged to a potential difference of . What is the energy stored in the capacitor?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The energy stored in a capacitor is given by the formula,

, where C is the capacitance and V is the potential difference. Therefore, the energy stored in the capacitor is,

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q17) What happens to the capacitance of a parallel plate capacitor if the distance between the plates is doubled while keeping the plate area and charge on the plates constant?**

a) It doubles

b) It halves

c) It quadruples

d) It remains unchanged

Correct Answer: Option (b)

Explanation:

The capacitance of a parallel plate capacitor is given by the formula:

where is the capacitance, is the permittivity of the material between the plates, A is the area of the plates, and d is the distance between the plates.

From this formula, we can see that the capacitance is inversely proportional to the distance between the plates. That is, as the distance between the plates increases, the capacitance decreases.

So, if the distance between the plates is doubled, the capacitance of the capacitor will be halved.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q18) Two capacitors of capacitances and are connected in parallel. What is the equivalent capacitance of the combination?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: When capacitors are connected in parallel, the equivalent capacitance is the sum of the individual capacitances.

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So, the equivalent capacitance of the combination of two capacitors of capacitances and connected in parallel is:

Thus, the correct answer is Option (a)

Difficulty Level-Medium

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**Q19) The maximum charge that can be stored in a capacitor of capacitance C and breakdown voltage V is given by:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The capacitance equation, states that the charge (Q) stored in a capacitor is equal to the product of its capacitance (C) and the voltage (V) applied across it. Mathematically, it can be expressed as:

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q20) A capacitor is charged by connecting it to a battery of voltage V and then disconnected from the battery. If a dielectric slab is now inserted between the plates of the capacitor, what will happen to the potential difference across the capacitor?**

a) Increases

b) Decreases

c) Remains the same

d) Depends on the dielectric constant of the slab

Correct Answer: Option (b)

Explanation: If a dielectric slab is inserted between the plates of a charged capacitor, the potential difference across the capacitor decreases due to the increased capacitance. The decrease in potential difference is directly proportional to the increase in capacitance, which is determined by the dielectric constant of the slab.

Thus, the correct Answer is option (b).

Difficulty Level-Medium

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**Q21) The unit of capacitance is:**

a) Ohm

b) Henry

c) Farad

d) Tesla

Correct Answer: Option (c)

Explanation: The unit of capacitance is named after the British scientist Michael Faraday and is represented by the symbol F. One farad is defined as the capacitance of a capacitor that, when charged with one coulomb of charge, has a potential difference (voltage) of one volt across its plates. Ohm (Ω) is the unit of electrical resistance. Henry (H) is the unit of inductance. Tesla (T) is the unit of magnetic field strength.

Thus the correct answer is Option (c).

Difficulty Level-Easy

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**Q22) A parallel plate capacitor of capacitance C is connected across a battery of voltage V. A dielectric material of dielectric constant K is now ins erted between the plates. What will happen to the energy stored in the capacitor?**

a) Increases by a factor of

b) Decreases by a factor of

c) Increases by a factor of

d) Decreases by a factor of

Correct Answer: Option (a)

Explanation: When a dielectric material of dielectric constant K is inserted between the plates of a parallel plate capacitor of capacitance C, the capacitance of the capacitor increases by a factor of .

The new capacitance is .

Since the voltage across the capacitor, V, is held constant, the energy stored in the capacitor is given by the formula .

Substituting the new capacitance C' into this equation, we get

So, the energy stored in the capacitor after the dielectric is inserted increases by a factor of .

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q23) The capacitance of a parallel plate capacitor with a dielectric material of dielectric constant K between the plates is given by:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The capacitance of a parallel plate capacitor with a dielectric material of dielectric constant between the plates is given by the formula

Rearranging to get as,

where is the permittivity of free space, A is the area of the plates, and d is the distance between them.

Thus, the correct answer option is (a).

Difficulty Level-Medium

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**Q24) A parallel plate capacitor of capacitance C is charged to a potential difference V and then disconnected from the battery. If the distance between the plates is now doubled, what will happen to the charge on the plates?**

a) Doubles

b) Halves

c) Quadruples

d) Remains the same

Correct Answer: Option (b)

Explanation: When the distance between the plates of a parallel plate capacitor is doubled, the capacitance becomes half of its original value. Since the charge on the plates is directly proportional to the capacitance, it will also become half of its original value.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q25) A capacitor of capacitance C is charged to a potential difference V. If the separation between the plates of the capacitor is increased by a factor of 2, what will be the new potential difference across the capacitor?**

a)

b)

c)

d)

Correct answer: Option (a)

Explanation: The capacitance C of a parallel plate capacitor is given by ,

where is the permittivity of the medium between the plates, A is the area of the plates, and d is the separation between the plates. If the separation between the plates is increased by a factor of , the capacitance becomes .

Therefore, the new capacitance is .

ince the charge on the capacitor remains constant, the new potential difference across the capacitor is .

Thus, the correct answer is Option(a)

Difficulty Level-Easy

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**Q26) Two identical parallel plate capacitors, each of capacitance C, are connected in series. What will be the equivalent capacitance of the combination?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation:When two identical capacitors are connected in series, the equivalent capacitance is given by:

where, and are the capacitances of the two capacitors. In this case, we have two identical capacitors of capacitance C, so the equation becomes:

Simplifying this equation, we get:

Multiplying both sides by Ceq, we get:

Thus, the correct answer is Option(a).

Difficulty Level-Hard

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**Q27) A parallel-plate capacitor has a capacitance of and is connected to a battery with a voltage of . The plates of the capacitor are separated by a distance of . What is the charge on each plate of the capacitor?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: To solve this problem, we can use the same formula as before:

where is the charge, is the capacitance, and V is the voltage.

Substituting the given values, we get:

Since the two plates of the capacitor have equal but opposite charges, each plate has a charge of half of the total charge, i.e., .

Thus, the correct answer is option (b)

Difficulty Level-Very Hard

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**Q28) A capacitor of capacitance is charged to a potential difference of . If the plates of the capacitor are now brought closer together until the distance between them is halved, what will be the new potential difference across the capacitor?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: Capacitance is inversely proportional to the distance between the plates. It is given as,

where C is the capacitance, ε is the permittivity of free space, A is the area of the plates, and d is the distance between them.

When the distance is halved, the capacitance becomes double. Since the charge on the capacitor remains the same, the potential difference across the capacitor will also become double, i.e.,

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q29) A parallel-plate capacitor has a capacitance of. If the distance between the plates is doubled and the dielectric constant is also doubled, what will be the new capacitance of the capacitor?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The capacitance of a parallel-plate capacitor is given by: ,

where ε is the permittivity of the dielectric material between the plates, A is the area of each plate, and d is the distance between the plates. If the distance between the plates is doubled, and the dielectric constant is also doubled, then the capacitance of the capacitor can be calculated as follows:

where ε' is the new permittivity of the dielectric material.

Since the dielectric constant has doubled, .

Substituting this into the above equation gives:

Therefore, the new capacitance is the same as the original capacitance, which is .

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q30) A charged capacitor is connected in parallel with an uncharged capacitor. The energy stored in the charged capacitor is U. After the capacitors are connected, the total energy stored in the capacitors is:**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: When two capacitors are connected in parallel, the total capacitance is the sum of the individual capacitances. Let the capacitances of the charged and uncharged capacitors be and , respectively. The energy stored in the charged capacitor is , where V is the voltage across the capacitor. When the capacitors are connected in parallel, the charge on both capacitors is the same, and the voltage across both capacitors is the same as the voltage across the charged capacitor before connection. Therefore, the total energy stored in the capacitors is

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Thus, the correct Answer is Option(d).

Difficulty Level-Very Hard

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**Q31) What is the formula for calculating power in an electrical circuit?**

a)

b)

c)

d) All of the above

Correct Answer: Option (d)

Explanation: The formula for calculating power in an electrical circuit is used to determine the rate at which electrical energy is being transferred or consumed by the circuit.

where P represents power, V represents voltage, and I represents current. This formula is used when both the voltage and current are known.

where P represents power, V represents voltage, and R represents resistance. This formula is used when the voltage and resistance of the circuit are known.

, where P represents power, I represents current, and R represents resistance. This formula is used when the current and resistance of the circuit are known.

Thus, the correct answer is Option (d).

Difficulty Level-Easy

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**Q32) What is the resistance of a superconductor?**

a) Infinite

b) Zero

c) One

d) Ten

Correct Answer: Option (b)

Explanation: Superconductivity is a phenomenon where certain materials exhibit zero electrical resistance when cooled below a critical temperature. This means that an electric current can flow through a superconductor without any loss of energy due to resistance.

In conventional materials, resistance to electrical current flow is caused by the collisions between the electrons and the atoms in the material. In a superconductor, however, the electrons form pairs and move in unison, creating a state of coherence known as a "Cooper pair". This coherence allows the electrons to flow without experiencing any resistance.

Thus, the correct answer is Option (b).

Difficulty Level-Easy

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**Q33) What is the relationship between voltage, current, and resistance?**

a)

b)

c)

d) All of the above

Correct Answer: Option (d)

Explanation: The relationship between voltage, current, and resistance can be expressed by Ohm's Law, which states that the current through a conductor between two points is directly proportional to the voltage across the two points, and inversely proportional to the resistance between them. Mathematically, this can be written as:

where V represents voltage (measured in volts), I represents current (measured in amperes), and R represents resistance (measured in ohms). Using algebra, we can rearrange this equation to solve for any of the three variables. So:

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Thus, the correct answer is Option (d).

Difficulty Level-Medium

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**Q34) Which of the following materials is a good conductor of electricity?**

a) Rubber

b) Glass

c) Copper

d) Wood

Correct Answer: Option (c)

Explanation: A conductor is a material that allows electric charges to flow freely through it. Copper is one of the best conductors of electricity because it has a low resistance to the flow of electric current. This means that electric charges can move easily through copper with minimal loss of energy.

Thus, the correct answer is Option (c).

Difficulty Level-Easy

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**Q34) What is the direction of the conventional current flow?**

a) From positive to negative

b) From negative to positive

c) In both directions

d) In no direction

Correct Answer: Option (a)

Explanation: When an electric circuit is powered by a voltage source, such as a battery, the positive terminal of the battery is connected to the positive terminal of the circuit, and the negative terminal of the battery is connected to the negative terminal of the circuit. This means that current flows from the positive terminal of the battery through the circuit, and back to the negative terminal of the battery.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q35) What happens to the resistance of a wire when its length is increased?**

a) Increases

b) Decreases

c) Remains the same

d) Depends on the material of the wire

Correct Answer: Option (a)

Explanation: Resistance is the measure of opposition to the flow of electric current in a conductor, and it depends on the dimensions of the conductor, such as its length, cross-sectional area, and material. The longer the wire, the more resistance it will have, assuming all other factors are constant. This is because when the length of the wire increases, the electrons that carry the current have to travel a longer distance and will experience more collisions with atoms in the wire, resulting in a greater resistance to the flow of current.

This relationship between resistance and wire length is described by the formula: where R is the resistance of the wire, ρ is the resistivity of the material, L is the length of the wire, and A is the cross-sectional area of the wire. This formula shows that as the length of the wire increases (L), the resistance (R) will also increase, assuming the resistivity (ρ) and cross-sectional area (A) of the wire are constant.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q36) Answer the following question with reference to the Audio**

<https://drive.google.com/file/d/1uDK5WuoMfnfhv48DReBYVh2DELmX3RBj/view?usp=share_link>

**Type:Audio**

**What is the SI unit of electric charge?**

a) Coulomb

b) Ohm

c) Volt

d) Ampere

Correct Answer: Option (a)

Explanation: The SI unit of electric charge is Coulomb (C). One Coulomb is defined as the amount of electric charge carried by a current of one Ampere in one second. It is a fundamental unit of measurement in the study of electricity and magnetism, and is used to quantify the amount of electric charge involved in various physical phenomena such as electrostatics, electromagnetism, and electric circuits.

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q37) A current of 1.5 A flows through a resistor of resistance 20 ohms. The voltage across the resistor is:**

a)

b)

c)

d)

Correct answer: Option (a).

Explanation: According to Ohm's law, the voltage (V) across a resistor is directly proportional to the current (I) flowing through it and the resistance (R) of the resistor. This can be expressed as

In this case, the current through the resistor is 1.5 A, and the resistance of the resistor is 20 ohms. So, using Ohm's law, we can calculate the voltage across the resistor as:

Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q38) Answer the following question with reference to the Audio**

<https://drive.google.com/file/d/13AzPu0xql7DMxpvSBQaiO8VdcT_YirB7/view?usp=share_link>

**Type: Audio**

**Kirchhoff's second law (Kirchhoff's loop rule) states that:**

a) The total current entering a junction is equal to the total current leaving the junction.

b) The total resistance of a circuit is equal to the sum of the resistances of its individual components.

c) The algebraic sum of the potential differences in any closed loop in a circuit is zero.

d) The power dissipated in a circuit is equal to the product of the voltage and current.

Correct Answer: Option (c)

Explanation: Kirchhoff's second law, also known as Kirchhoff's loop rule or Kirchhoff's voltage law, states that the algebraic sum of the potential differences in any closed loop in a circuit is zero. In other words, the sum of the voltage drops across all the components in a closed loop is equal to the sum of the voltage rises, or sources, in the same loop.

This law is based on the principle of conservation of energy, which states that energy cannot be created or destroyed, only transferred or converted from one form to another. In a closed loop, the potential energy supplied by the sources is equal to the potential energy consumed by the components.

Thus, the correct answer is Option (c).

Difficulty Level-Medium

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**Q39) The resistance of a wire is directly proportional to:**

a) The length of the wire

b) The voltage across the wire

c) The square of the current through the wire

d) The cross-sectional area of the wire

Correct Answer: Option (a)

Explanation: The resistance of a wire refers to the opposition that the wire offers to the flow of electric current through it. The resistance of a wire is affected by several factors, including the length of the wire, the material of the wire, the temperature of the wire, and the cross-sectional area of the wire.

where R is the resistance of the wire, ρ is the resistivity of the material, L is the length of the wire, and A is the cross-sectional area of the wire.

The resistance of a wire is directly proportional to its length and inversely proportional to its cross-sectional area.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q40) Which of the following statements about electric power is correct?**

a) It is the rate at which charge flows through a conductor.

b) It is the amount of charge stored in a capacitor.

c) It is the product of voltage and resistance.

d) It is the rate at which work is done by an electric current.

Correct Answer: Option (d)

Explanation: It is the rate at which work is done by an electric current. Electric power is the rate at which energy is transferred or work is done by an electric current. It is measured in watts (W) and is given by the formula,

, where P is the power, V is the voltage, and I is the current.

Thus, the correct answer is Option (d).

Difficulty Level-Medium

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**Q41) What is the unit of measurement for current in an ammeter?**

a) Volts

b) Watts

c) Ohms

d) Amperes

Correct Answer: Option (d)

Explanation: The unit of measurement for current in an ammeter is amperes (A). An ammeter is a device used to measure the electric current in a circuit, and it is designed to measure the current in amperes.

Other units that are commonly used to express electric current include milliamperes (mA) and microamperes (μA), which are equivalent to and , respectively. However, in most cases, amperes are the preferred unit of measurement for electric current because they are more convenient and easier to work with.

Thus, the correct answer is Option (d).

Difficulty Level-Easy.

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**Q42) What happens to the reading on an ammeter if it is connected in parallel to the circuit?**

a) The reading is accurate

b) The reading is lower than the actual current

c) The reading is higher than the actual current

d) The ammeter is damaged

Correct Answer: Option (c)

Explanation: If an ammeter is connected in parallel to a circuit, it can cause a short circuit in the circuit being measured. This is because an ammeter is designed to measure the current flowing through a circuit by becoming a part of the circuit itself. When an ammeter is connected in parallel to a circuit, it creates an alternate path for the current to flow, effectively bypassing the rest of the circuit.

As a result, the reading on the ammeter in this scenario would not be accurate and could be higher than the actual current flowing through the circuit. Moreover, the excessive current flow through the ammeter can damage it or cause it to fail.

Thus, the correct answer is Option (c).

Difficulty Level-Medium.

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**Q43) Which of the following is a characteristic of an ideal ammeter?**

a) Infinite resistance

b) Zero resistance

c) High sensitivity

d) Low accuracy

Correct Answer: Option (b)

Explanation: An ideal ammeter is an instrument that measures the current in a circuit without altering or disturbing the current itself. Ideally, the ammeter should have zero resistance, so that it can be connected in series with the circuit and not cause any significant change in the current flow.

Thus, the correct answer is Option (b).

Difficulty Level-Medium.

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**Q44) Answer the following question with reference to the Image**

<https://drive.google.com/file/d/13WdTqRZF2NHhnPjQdKBVvjOOMmw9Lw65/view?usp=share_link>

**Type: Image**

**What is the function of an ammeter in a circuit?**

a) To measure voltage

b) To measure current

c) To measure resistance

d) To measure power

Correct Answer: Option (b)

Explanation: The function of an ammeter in a circuit is to measure the electric current flowing through a circuit. An ammeter is a device that is designed to be connected in series with a circuit component, such as a resistor, so that it can measure the current flowing through that component. An ammeter can provide valuable information about the behavior of the circuit and can help to diagnose and troubleshoot problems in the circuit.

Thus, the correct answer is Option (b).

Difficulty Level-Medium.

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**Q45) The resistivity of a material depends on:**

a) Its length and area

b) Its temperature and pressure

c) Its composition and impurities

d) Its temperature and composition

Correct Answer: Option (d)

Explanation: The resistivity of a material is a measure of how strongly it opposes the flow of electric current. It is defined as the resistance of a material of unit length and unit cross-sectional area.

The resistivity of a material depends on several factors, including its temperature, composition, and impurities.

Thus, the correct answer is Option (d).

Difficulty Level-Easy.

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**Q46) Which of the following is not a property of superconductors?**

a) Zero resistance

b) Perfect diamagnetism

c) High conductivity

d) High melting point

Correct Answer: Option (d)

Explanation: The property of superconductors is a fascinating phenomenon in physics that occurs when certain materials exhibit zero electrical resistance and perfect diamagnetism (i.e., they expel magnetic fields from their interiors). These properties arise due to the formation of electron pairs called Cooper pairs, which allow for the flow of electricity with zero resistance.

Thus, the correct answer is Option (d).

Difficulty Level-Easy.

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**Q47) Which of the following statements is true for a metallic conductor in which an electric current is flowing?**

a) The electric field inside the conductor is zero.

b) The electric field inside the conductor is uniform.

c) The electric field inside the conductor is maximum.

d) The electric field inside the conductor is minimum.

Correct Answer: Option(b)

Explanation: In a metallic conductor, the free electrons are uniformly distributed and move randomly. When an electric field is applied, the free electrons start moving in a particular direction, but they do not gain any net velocity, so they continue to move randomly, leading to a uniform distribution of the electric field inside the conductor.

Thus, the correct answer is Option (b).

Difficulty Level-Medium.

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**Q48) Which of the following is not a property of a good conductor?**

a) Low resistivity

b) High conductivity

c) High melting point

d) Low atomic number

Correct Answer: Option (d)

Explanation: A good conductor is a material that allows the flow of electric current with minimum resistance. The properties of a good conductor include low resistivity (resistance per unit length), high conductivity (conductance per unit area), and high melting point.

The atomic number of a material is the number of protons in its nucleus. The higher the atomic number, the greater the number of protons and the more tightly bound the electrons are to the nucleus. This results in higher resistivity and lower conductivity, which is opposite to what we want in a good conductor.

Thus, the correct answer is Option (d).

Difficulty Level-Medium.

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**Q49) Which of the following is a non-ohmic conductor?**

a) Copper wire

b) Tungsten filament

c) Diode

d) Carbon resistor

Correct Answer: Option (c)

Explanation: A non-ohmic conductor is one whose resistance does not remain constant with respect to the applied voltage or current. A diode exhibits a non-linear current-voltage relationship, which means its resistance changes with the applied voltage, thus it acts as a non-ohmic conductor.

Thus, the correct answer is Option (c).

Difficulty Level-Medium.

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**Q50) What is the direction of the magnetic field around a straight conductor carrying current?**

a) Along the conductor

b) Perpendicular to the conductor

c) Radial from the conductor

d) None of the above

Correct Answer: Option (b)

Explanation: The direction of the magnetic field around a straight conductor carrying current can be determined using the right-hand rule. The right-hand rule states that if you point your right thumb in the direction of the current flow, then the direction of the magnetic field lines will wrap around the conductor in the direction that your curled fingers point.Using this rule, we can determine that the direction is perpendicular to the conductor.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q51) Which of the following is true about a capacitor in a DC circuit?**

a) It allows DC current to flow through it

b) It blocks DC current from flowing through it

c) It charges up to a fixed voltage and then stops charging

d) Its capacitance does not depend on the voltage across it

Correct Answer: Option (b)

Explanation: A capacitor allows AC current to flow through it, but blocks DC current. A capacitor charges up to a fixed voltage and then stops charging. The capacitance of a capacitor does depend on the voltage across it.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q52) What is the potential difference across a resistor if of current flows through it?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The resistance of the resistor is , and the current flowing through it is . Substituting these values into Ohm's law, we get:

Thus, the correct answer is Option (b)

Difficulty Level-Very Hard

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**Q53) The resistance of a wire is . If the wire is stretched to double its length, what is its new resistance?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The wire's resistance is initially . When the wire is stretched to double its length, the new length becomes . Using the formula for resistance, we can calculate the new resistance as follows:

Dividing this equation by the original resistance, we get:

Simplifying this expression, we get:

Therefore, the new resistance is double the original resistance. Substituting the value of the original resistance () into this equation, we get:

Thus, the correct answer is Option (c)

Difficulty Level-Hard

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**Q54) According to Kirchhoff's first law, which of the following statements is true?**

a) The total voltage drop across a circuit is equal to the sum of the individual voltage drops.

b) The total current flowing into a junction is equal to the total current flowing out of it.

c) The total resistance of a circuit is equal to the sum of the individual resistances.

d) The total power dissipated in a circuit is equal to the sum of the individual powers.

Correct Answer: Option (b)

Explanation: Kirchhoff's first law, also known as the law of conservation of charge, states that the total current flowing into a junction in a circuit is equal to the total current flowing out of it. This law is based on the principle of conservation of charge, which states that charge cannot be created or destroyed, only transferred from one location to another.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q55) How can Kirchhoff's laws be used to analyze a circuit?**

a) To calculate the power consumed by the circuit.

b) To determine the resistance of the circuit.

c) To calculate the voltage and current at any point in the circuit.

d) To determine the capacitance and inductance of the circuit.

Correct Answer: Option (c)

Explanation: Kirchhoff's laws are used to analyze electrical circuits and determine the behavior of the circuit elements, such as resistors, capacitors, and inductors. Kirchhoff's Voltage Law (KVL) is used to calculate the voltage drops and voltage gains around a closed loop in a circuit. Kirchhoff's Current Law (KCL) is used to calculate the current flowing through a junction in a circuit.

By applying KVL and KCL, we can calculate the voltage and current at any point in the circuit. This allows us to design and analyze circuits, troubleshoot circuit problems, and optimize circuit performance. For example, we can use Kirchhoff's laws to calculate the voltage and current across a resistor in a circuit, which can help us determine if the resistor is the correct value for the circuit and if it is dissipating the correct amount of power. Overall, Kirchhoff's laws are essential tools for electrical engineers and technicians working with circuits.

Thus, the correct answer is Option (c)

Difficulty Level-Hard.

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**Q56) A circuit has a voltage of and a resistance of**  **. What is the current flowing through the circuit?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The voltage is given as and the resistance is given as . Plugging these values into the formula gives:

.

This means that there is a current of flowing through the circuit.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q57) A battery has an internal resistance of and a voltage of. What is the voltage across a 4 ohm resistor connected to the battery?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: To calculate the voltage across the 4 ohm resistor, we need to first calculate the total resistance of the circuit, which is ohms.

Using Ohm's law ,

we can calculate the voltage across the resistor as

Thus, the correct answer is Option (b)

Difficulty Level-Hard

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**Q58) A circuit has a power source with a voltage of and a current of . What is the power output of the source?**

a) 12 watts

b) 24 watts

c) 48 watts

d) 96 watts

Correct Answer: Option (c)

Explanation:The power output of the source can be calculated using the formula:

where Power is measured in watts (W), Voltage is measured in volts (V), and Current is measured in amperes (A).

Substituting the given values in the formula, we get:

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q59) Which of the following statements is true about Ohm's Law?**

a) Ohm's Law states that the resistance of a circuit is directly proportional to the voltage and inversely proportional to the current.

b) Ohm's Law states that the voltage of a circuit is directly proportional to the resistance and inversely proportional to the current.

c) Ohm's Law states that the current of a circuit is directly proportional to the resistance and inversely proportional to the voltage.

d) Ohm's Law states that the current of a circuit is directly proportional to the voltage and inversely proportional to the resistance.

Correct Answer: Option (d)

Explanation: Ohm's Law states that the current flowing through a conductor is directly proportional to the voltage applied across it and inversely proportional to its resistance. Mathematically it is given as, .

Thus, the correct answer is Option (d).

Difficulty Level-Hard

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**Q60) If a circuit has a current of 2 amps flowing through it and a resistance of 6 ohms, what is the voltage across the circuit?**

a) 2 volts

b) 6 volts

c) 12 volts

d) 24 volts

Correct Answer: Option (c)

Explanation: The circuit is given as 2 amps, and the resistance of the circuit is given as 6 ohms. Using Ohm's Law, we can find the voltage across the circuit by multiplying the current by the resistance, which gives us volts.

Thus, the correct answer is Option (c)

Difficulty Level-Hard

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**Q61) Which of the following is not a property of a magnetic field?**

a) Magnetic field lines never cross each other

b) Magnetic field lines are continuous

c) Magnetic field lines are parallel to the direction of magnetic force

d) Magnetic field lines always form closed loops

Correct Answer: Option(c)

Explanation: Magnetic field lines are never parallel to the direction of magnetic force. Instead, they are perpendicular to the direction of the magnetic force.

Magnetic field lines are a useful way to visualise the direction and strength of a magnetic field. They are defined as imaginary lines that form closed loops around a magnet or a current-carrying wire. The direction of the magnetic field is tangent to the magnetic field line at any given point.

Thus, the correct answer is Option (c).

Difficulty Level-Medium

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**Q62) Which of the following is not a characteristic of a magnetic field due to a straight current-carrying conductor?**

a) Magnetic field lines form concentric circles around the conductor

b) The strength of the magnetic field decreases as the distance from the conductor increases

c) The direction of the magnetic field is given by the right-hand rule

d) The magnetic field lines are parallel to the direction of current flow

Correct Answer: Option (d)

Explanation: When a current-carrying conductor is straight, the magnetic field produced by it forms concentric circles around the conductor. The direction of the magnetic field can be determined using the right-hand rule, where if the thumb of the right hand points the direction of the current, the curled fingers indicate the direction of the magnetic field around the wire.The strength of the magnetic field decreases as the distance from the conductor increases, according to the inverse square law. The magnetic field strength at a distance from the wire is proportional to , where r is the distance from the wire. The magnetic field lines are not parallel to the direction of current flow, but instead are perpendicular to it. This is because the magnetic field is generated by the motion of charges in the wire, and the charges move perpendicular to the direction of current flow.

Thus, the correct answer is option (d).

Difficulty Level-Medium

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**Q63) Answer the following question with reference to the image**

[**https://drive.google.com/file/d/1Yq3\_AJv1q3crY\_8YSDEIY3msGeWJeBKk/view?usp=share\_link**](https://drive.google.com/file/d/1Yq3_AJv1q3crY_8YSDEIY3msGeWJeBKk/view?usp=share_link)

**Type: Image**

**Which of the following is true for a solenoid?**

a) The magnetic field inside a solenoid is zero

b) The magnetic field outside a solenoid is zero

c) The magnetic field inside a solenoid is uniform

d) The magnetic field outside a solenoid is uniform

Correct Answer: Option (c)

Explanation: A solenoid is a long coil of wire that is tightly wound in the shape of a cylinder. When a current flows through the wire, it generates a magnetic field inside the solenoid. The magnetic field inside a solenoid is uniform due to the closely spaced coils, which ensures that the magnetic field generated by each turn of the coil is in the same direction and has the same magnitude. This results in the magnetic field inside the solenoid having a constant magnitude and direction.

Thus, the correct answer is option (c).

Difficulty Level-Easy

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**Q64) Which of the following is not a factor affecting the strength of the magnetic field due to a current-carrying conductor?**

a) The magnitude of the current

b) The length of the conductor

c) The distance from the conductor

d) The direction of the current

Correct Answer: Option (d)

Explanation: The strength of the magnetic field due to a current-carrying conductor depends on several factors but, the direction of the current does not affect the strength of the magnetic field. The direction of the magnetic field around a current-carrying conductor is perpendicular to the direction of the current flow and can be determined using the right-hand rule.

Thus, the correct answer is option (d).

Difficulty Level-Easy

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**Q65) Which of the following statements is true for a charged particle moving in a magnetic field?**

a) The magnetic force on the charged particle is always in the direction of motion

b) The magnetic force on the charged particle is always perpendicular to the direction of motion

c) The magnetic force on the charged particle is always in the direction opposite to the direction of motion

d) The magnetic force on the charged particle is always parallel to the direction of motion

Correct Answer: Option (b)

Explanation: When a charged particle moves through a magnetic field, it experiences a magnetic force that is always perpendicular to both the direction of motion of the charged particle and the direction of the magnetic field. The direction of the magnetic force is given by the right-hand rule, where if the thumb of the right hand points in the direction of the charged particle's velocity, and the fingers point in the direction of the magnetic field, then the palm of the hand gives the direction of the magnetic force.

The magnitude of the magnetic force on the charged particle depends on the strength of the magnetic field, the charge of the particle, and the velocity of the particle. The magnetic force does not change the speed of the charged particle but changes the direction of its motion, causing it to move in a circular path perpendicular to the magnetic field. This circular motion is known as cyclotron motion and is used in various scientific applications, such as particle accelerators and mass spectrometers.

Thus, the correct answer is option (b).

Difficulty Level-Medium

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**Q66) Answer the following question with reference to the Image**

<https://drive.google.com/file/d/1ax5WO5cUrsPDk2axhRQjgxtsGBbDfQi_/view?usp=share_link>

**Type: Image**

**Which of the following statements is true for the motion of a charged particle in a uniform magnetic field?**

a) The charged particle moves in a straight line

b) The charged particle moves in a circular path

c) The charged particle moves in a spiral path

d) The charged particle does not move at all

Correct Answer: Option (b)

Explanation: When a charged particle moves in a uniform magnetic field, it experiences a magnetic force perpendicular to both its velocity and the direction of the magnetic field. This force is given by the equation,

,

where is the charge of the particle, is its velocity, is the magnetic field strength, and is the angle between the velocity and the magnetic field.

Since the magnetic force is always perpendicular to the velocity of the charged particle, it does not change the speed of the particle, but only its direction. This means that the charged particle moves in a circular path, with a radius given by , where m is the mass of the particle.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q67) The moving coil galvanometer is based on the principle of:**

a) Electromagnetic induction

b) Electromagnetic waves

c) Electrostatic induction

d) Ohm's law

Correct Answer: Option (a)

Explanation: A moving coil galvanometer is an instrument used for detecting and measuring small electric currents. The principle behind the operation of a moving coil galvanometer is based on the phenomenon of electromagnetic induction. When an electric current flows through a conductor, it generates a magnetic field around it. Similarly, when a magnetic field changes around a conductor, it induces an electric current in the conductor. In a moving coil galvanometer, the current passing through the coil generates a magnetic field, which interacts with the magnetic field of the permanent magnet, causing the coil to rotate.

Thus, it is based on the principle of electromagnetic induction, which is a fundamental concept in physics and is used in many other devices, such as electric generators and transformers.

Thus, the correct answer is Option (a).

Difficulty Level- Easy

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**Q68) Which of the following is a drawback of a moving coil galvanometer?**

a) It can measure both AC and DC currents with high accuracy.

b) It has a limited range of measurement.

c) It can measure high currents without getting damaged.

d) It does not require a power source to operate.

Correct Answer: Option (b)

Explanation: Moving coil galvanometers are devices used to measure electric currents. They work on the principle of the interaction between a magnetic field and a current-carrying conductor. While moving coil galvanometers have several advantages, such as high sensitivity and accuracy, they also have a few drawbacks.

One such drawback is the limited range of measurement. It is designed to measure small currents and cannot measure high currents. Exposing a moving coil galvanometer to high currents can cause permanent damage to the device.

Thus, the correct answer is option (b)

Difficulty Level-Very Hard

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**Q69) If an electric field is applied to a charged particle moving in a magnetic field, what will be the effect on the motion of the particle?**

a) The velocity of the particle will increase

b) The velocity of the particle will decrease

c) The trajectory of the particle will become straight

d) The trajectory of the particle will become a spiral

Correct Answer: Option (d)

Explanation: If an electric field is applied to a charged particle moving in a magnetic field, the motion of the particle will be affected by both the magnetic field and the electric field. The magnetic field will cause the particle to move in a circular path, while the electric field will cause the particle to accelerate in the direction of the electric field. The combined effect of the two fields will depend on the relative strength and direction of the electric and magnetic fields, as well as the initial velocity of the particle. In general, the trajectory of the particle will become a spiral, as the magnetic force causes the particle to move in a circular path while the electric force causes it to accelerate in the direction of the electric field.

Thus, the correct answer is Option (d).

Difficulty Level-Hard

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**Q70) Ampere's circuital law is a mathematical statement of which of the following principles?**

a) Conservation of energy

b) Conservation of charge

c) Conservation of magnetic flux

d) Conservation of momentum

Correct Answer: Option (c)

Explanation: Ampere's circuital law states that the line integral of the magnetic field around a closed loop is equal to the current passing through the loop multiplied by the permeability of free space. This law is a mathematical statement of the principle of conservation of magnetic flux, which states that the total magnetic flux through any closed surface is constant.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q71) A charged particle moves perpendicular to a uniform magnetic field with a velocity of . If the magnetic field strength is increased while the velocity of the particle remains constant, what will be the effect on the radius of the circular path?**

a) The radius of the circular path will increase.

b) The radius of the circular path will decrease.

c) The radius of the circular path will remain the same.

d) The effect on the radius of the circular path cannot be determined from the given information.

Correct Answer : Option (b)

Explanation: The radius of the circular path of a charged particle moving in a magnetic field can be calculated using the formula:

where r is the radius of the circular path, m is the mass of the particle, v is the velocity of the particle, q is the charge of the particle, and B is the strength of the magnetic field.

Given that the charged particle moves perpendicular to a uniform magnetic field with a velocity of and the velocity remains constant while the magnetic field strength is increased.

We can see from the formula that the radius of the circular path is inversely proportional to the strength of the magnetic field. That is, as the magnetic field strength increases, the radius of the circular path decreases.

Thus, the correct answer is option (b).

Difficulty Level-Very Hard

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**Q72) What is the unit of permeability of free space?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: Permeability of free space is a physical constant that describes the strength of the magnetic field in a vacuum. It is denoted by the symbol and has a value of approximately

The unit of permeability of free space is the tesla meter per ampere squared. This unit is derived from the basic units of the SI system: the tesla (T) for magnetic field strength, the meter (m) for length, and the ampere (A) for electric current.

The formula for the force between two parallel current-carrying conductors, known as Ampere's law, involves the permeability of free space. The unit of permeability is important in calculating the force between two current-carrying wires or in determining the magnetic field strength of a solenoid.

In contrast, the unit of

represents the magnetic moment of a current loop,

is the unit of electric permittivity, and

represents the electric potential or voltage.

Thus, the correct answer is Option (d).

Difficulty Level-Easy

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**Q73) Which of the following is true according to Ampere's circuital law?**

a) The magnetic field lines always form closed loops.

b) The magnetic field inside a solenoid is zero.

c) The magnetic field outside a solenoid is zero.

d) The magnetic field due to a current-carrying wire decreases with increasing distance from the wire.

Correct Answer: Option (a)

Explanation: Ampere's circuital law states that the magnetic field lines always form closed loops around a current-carrying wire or any closed loop of current. This law does not specify anything about the magnitude of the magnetic field inside or outside a solenoid or a wire.

Thus, the correct answer is Option(a).

Difficulty Level-Medium

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**Q74) A long straight wire carrying a current of is placed in a uniform magnetic field of . What is the force experienced by the wire per meter of its length?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The force experienced by a current-carrying wire in a magnetic field is given by

,

where is the magnetic field strength, is the current, and is the length of the wire. Therefore, the force experienced by the wire per meter of its length is

Thus, the correct answer is Option(a).

Difficulty Level-Medium

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**Q75) The unit of magnetic field strength is:**

a) Ampere

b) Coulomb

c) Tesla

d) Henry

Correct Answer: Option (c)

Explanation: Magnetic field strength, also known as magnetic flux density or simply magnetic field, is a measure of the strength and direction of a magnetic field. It is defined as the force experienced by a unit charge moving perpendicular to a magnetic field.

The SI unit of magnetic field strength is the tesla (T), named after the Serbian-American inventor and electrical engineer Nikola Tesla. One tesla is defined as the magnetic field strength that would exert a force of one newton on a charge of one coulomb moving perpendicular to the field at a speed of one meter per second.

Thus, the correct answer is Option (c).

Difficulty Level-Easy

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**Q76) Which law describe the behavior of electromagnetic fields?**

a) Faraday’s Law

b) Ampere’s Circuital Law

c) Gauss’s Law

d) Coulomb’s Law

Correct answer: Option (b)

Explanation: This law is named after the French physicist Andre-Marie Ampere and is one of the four Maxwell's equations that describe the behavior of electromagnetic fields. The law is expressed mathematically as the line integral of the magnetic field along a closed loop being equal to the permeability of free space times the current enclosed by the loop. This law is used to calculate the magnetic field produced by a current-carrying wire or a group of wires, which is useful in the design of electromagnets and other electrical devices.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q77) Answer the following question with reference to the Image**

[**https://drive.google.com/file/d/1xHTtT6hTOcZg8JnR-nnJWpBrJfIpUEGI/view?usp=share\_link**](https://drive.google.com/file/d/1xHTtT6hTOcZg8JnR-nnJWpBrJfIpUEGI/view?usp=share_link)

**Type: Audio**

**What is Ampere’s Circuital Law?**

a) A law that relates the magnetic field generated by a current to the current that produces it.

b) A law that relates the electric field generated by a current to the current that produces it.

c) A law that relates the voltage generated by a current to the current that produces it.

d) A law that relates the power generated by a current to the current that produces it.

Correct Answer: Option (a)

Explanation: Ampere's Circuital Law is a principle that establishes a relationship between the magnetic field produced by a current and the current itself. According to this law, the magnetic field's line integral around a closed loop is directly proportional to the current passing through the loop, with a constant of proportionality.

Thus, the correct answer is Option(a).

Difficulty Level-Medium

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**Q78) Answer the following question with reference to the Image**

[**https://drive.google.com/file/d/1Q\_9pv0UHplOn8ocuSXuAj6Q6FcSiUaK2/view?usp=share\_link**](https://drive.google.com/file/d/1Q_9pv0UHplOn8ocuSXuAj6Q6FcSiUaK2/view?usp=share_link)

**Type: Image**

**What is the shape of the magnetic field around a straight current-carrying wire?**

a) Cylindrical

b) Spherical

c) Conical

d) Rectangular

Correct Answer: Option (a)

Explanation: The shape of the magnetic field around a straight current-carrying wire is cylindrical. The magnetic field lines form concentric circles around the wire, with the wire at the center of the circles. The magnetic field lines are oriented perpendicular to the wire and their density decreases as the distance from the wire increases. This means that the magnetic field strength is stronger closer to the wire and weaker farther away. The shape of the magnetic field around a straight current-carrying wire is important in the design of many electromagnetic devices, such as transformers, motors, and generators.

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q79) What is the value of the constant in Ampere’s Circuital Law?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The value of the constant in Ampere's Circuital Law is , which is the permeability of free space. The law states that the line integral of the magnetic field around a closed loop is equal to the current passing through the loop multiplied by . This law relates the magnetic field generated by a current to the current that produces it. The permeability of free space is a fundamental constant of nature and is approximately equal to in SI units. This constant relates the magnetic field to the current density and is important in many applications of electromagnetism, including the design of transformers, motors, and generators.

Thus, the correct answer is Option(b).

Difficulty Level-Medium

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**Q80) Which of the following statements is correct regarding the magnetic dipole moment of a current loop?**

a) The magnetic dipole moment is proportional to the current and the area of the loop.

b) The magnetic dipole moment is proportional to the current and the distance between the loop and the magnet.

c) The magnetic dipole moment is proportional to the area of the loop and the distance between the loop and the magnet.

d) The magnetic dipole moment is independent of the current and the area of the loop.

Correct Answer: Option (a)

Explanation: The magnetic dipole moment of a current loop is proportional to the current and the area of the loop. It is given by the formula , where I is the current flowing in the loop and A is the area of the loop.

Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q81) The torque experienced by a current loop placed in a magnetic field is maximum when:**

a) The plane of the loop is parallel to the magnetic field.

b) The plane of the loop is perpendicular to the magnetic field.

c) The plane of the loop makes an angle of with the magnetic field.

d) The torque is the same for all orientations of the loop.

Correct Answer: Option (b)

Explanation: The torque experienced by a current loop in a magnetic field is given by the formula , whereis the torque, N is the number of turns in the loop, I is the current, A is the area of the loop, B is the magnetic field, and is the angle between the magnetic field and the normal to the plane of the loop.

From the formula, we can see that the torque is maximum when is maximum, which occurs when . This means that the plane of the loop must be perpendicular to the magnetic field for the torque to be maximum.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q82) A magnetic dipole is placed in a uniform magnetic field. Which of the following statements is true?**

a) The magnetic dipole will experience a net force and move along the magnetic field lines.

b) The magnetic dipole will experience a net torque and rotate.

c) The magnetic dipole will experience both net force and net torque.

d) The magnetic dipole will not experience any force or torque.

Correct Answer: Option (b)

Explanation: A magnetic dipole placed in a uniform magnetic field will experience a net torque and rotate. The torque is given by the formula, where M is the magnetic dipole moment and B is the magnetic field.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q83) The magnetic field at the center of a circular current loop is:**

a) Zero

b) Maximum

c) Minimum

d) Indeterminate

Correct Answer: Option (b)

Explanation: The magnetic field at the center of a circular current loop is found as maximum. It is given by the formula , where is the permeability of free space, I is the current flowing in the loop, and r is the radius of the loop.

Thus, the correct answer is Option (b).

Difficulty Level-Easy

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**Q84) The magnetic moment of a bar magnet is:**

a) Proportional to the length of the magnet

b) Proportional to the area of the magnet

c) Proportional to the product of the length and area of the magnet

d) Proportional to the square of the length of the magnet

Correct Answer: Option (c)

Explanation: The magnetic moment of a bar magnet is proportional to the product of the length and area of the magnet. It is given by the formula , where m is the magnetic moment per unit volume and l is the length of the magnet.

Thus, the correct answer is Option (c).

Difficulty Level-Medium

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**Q85) Answer the following question with reference to the Image**

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**Type: Image**

**The damping mechanism in a moving coil galvanometer is necessary to:**

a) Increase the sensitivity of the galvanometer

b) Decrease the sensitivity of the galvanometer

c) Reduce the oscillations of the galvanometer pointer

d) Increase the range of the galvanometer

Correct Answer: Option (c)

Explanation: The damping mechanism in a moving coil galvanometer is necessary to reduce the oscillations of the galvanometer pointer. It is achieved by providing a damping torque that opposes the motion of the pointer.

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q86) A moving coil galvanometer can be converted into an ammeter by:**

a) Connecting a shunt resistor in parallel with the coil

b) Connecting a series resistor with the coil

c) Connecting a capacitor in parallel with the coil

d) None of the above

Correct Answer: Option (a)

Explanation: A moving coil galvanometer can be converted into an ammeter by connecting a shunt resistor in parallel with the coil. This helps to divert most of the current through the shunt resistor, and only a small fraction of the current flows through the coil.

Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q87) Which of the following statements is true regarding the Lorentz force?**

a) always in the same direction as the velocity of the charged particle.

b) always in the same direction as the magnetic field.

c) always perpendicular to both the velocity of the charged particle and the magnetic field.

d) always opposite to the direction of the magnetic field.

Correct Answer: Option (c)

Explanation: The Lorentz force on a charged particle is always perpendicular to both the velocity of the charged particle and the magnetic field. This is because the Lorentz force is the vector cross product of the velocity of the charged particle and the magnetic field, which produces a force perpendicular to both of these vectors.

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q88) The sensitivity of a moving coil galvanometer is expressed in terms of:**

a) Volts per ampere

b) Ampere-turns per tesla

c) Amperes per volt

d) Teslas per ampere

Correct Answer: Option (c)

Explanation: The sensitivity of a moving coil galvanometer is expressed in terms of Amperes per volt. This is a measure of the deflection of the galvanometer needle for a given current passing through the coil. The sensitivity of a galvanometer depends on the resistance of the coil, the number of turns of wire in the coil, and the strength of the magnetic field in which the coil is placed. Galvanometer sensitivity is an important parameter in measuring instruments because it determines the minimum current or voltage that can be detected by the instrument. The higher the sensitivity of a galvanometer, the more precise the measurements that can be made.

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q89) The current through a moving coil galvanometer can be measured by:**

a) Measuring the deflection of the pointer

b) Measuring the voltage across the coil

c) Measuring the resistance of the coil

d) Measuring the power dissipated in the coil

Correct Answer: Option (a)

Explanation: The current through a moving coil galvanometer can be measured by measuring the deflection of the pointer. The deflection is proportional to the current, and the sensitivity of the galvanometer is expressed in terms of amperes per volt.

Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q90) The direction of the magnetic force on a current-carrying conductor is given by:**

a) Fleming's left-hand rule

b) Fleming's right-hand rule

c) Lenz's law

d) Ohm's law

Correct Answer: Option (a)

Explanation: The direction of the magnetic force on a current-carrying conductor is given by Fleming's left-hand rule, which states that if the thumb, forefinger, and middle finger of the left hand are held perpendicular to each other, then the thumb points in the direction of the force, the forefinger in the direction of the magnetic field, and the middle finger in the direction of the current.

Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q91) Answer the following question with reference to the image**

<https://drive.google.com/file/d/133N3LMlbm0Bzjxkjmpuf9NMVWOp9-IqU/view?usp=share_link>

**Type: Image**

**What is a bar magnet?**

a) A magnet made in the shape of a bar

b) A magnet that is only found in bars

c) A magnet that can only attract bars

d) A magnet that has a North and South Pole

Correct Answer: Option (d)

Explanation: A bar magnet is a type of magnet that is characterized by having a North and South Pole. It is a magnet made in the shape of a rectangular bar or rod, with the magnetic field flowing from one end (North Pole) to the other end (South Pole). Bar magnets are made from a ferromagnetic material, such as iron, steel, or a compound of iron, and are commonly used in compasses, electric motors, and generators. The magnetic field produced by a bar magnet can be visualized using magnetic field lines, which indicate the direction and strength of the magnetic field.

Thus, the correct answer is Option (d).

Difficulty Level-Easy

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**Q92) What is the magnetic field around a bar magnet like?**

a) It is strongest at the ends and weakest in the middle

b) It is strongest in the middle and weakest at the ends

c) It is the same strength throughout the magnet

d) It is non-existent

Correct Answer: Option (a)

Explanation: The magnetic field around a bar magnet is strongest at the poles, which are located at the ends of the magnet. The field lines emerge from the North pole and converge at the South pole, creating a closed loop. The field lines are denser near the poles, indicating a stronger magnetic field. As you move away from the poles towards the middle of the magnet, the strength of the magnetic field gradually decreases.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q93) How can you determine the North and South Pole of a bar magnet?**

a) By rubbing it against another magnet

b) By observing which end points towards the North Pole of the Earth

c) By observing which end points towards the South Pole of the Earth

d) By cutting the magnet in half

Correct Answer: Option (b)

Explanation: The Earth’s magnet, with a magnetic North Pole and a magnetic South Pole. The North Pole of a bar magnet will be attracted to the Earth's magnetic South Pole, and the South Pole of a bar magnet will be attracted to the Earth's magnetic North Pole. By using a compass or another magnet to determine which end of the bar magnet points North, one can identify the North and South poles of the magnet. Cutting the magnet in half will not work because each piece will still have a North and South pole, and in fact, cutting a magnet will only result in creating two smaller magnets, each with their own North and South poles.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q94) What happens when two bar magnets are brought close together?**

a) They repel each other

b) They attract each other

c) Nothing happens

d) It depends on their orientation

Correct Answer: Option (d)

Explanation: When two bar magnets are brought close together, their behavior depends on their orientation relative to each other. If the North Pole of one magnet is brought near the South Pole of the other magnet, they will attract each other, while if the North Pole of one magnet is brought near the North Pole of the other magnet, they will repel each other. Similarly, if the South Pole of one magnet is brought near the North Pole of the other magnet, they will attract each other, while if the South Pole of one magnet is brought near the South Pole of the other magnet, they will repel each other.

Thus, the correct answer is Option (d).

Difficulty Level-Medium

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**Q95) What is the formula for the force between two parallel conductors carrying current?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The formula for the force between two parallel conductors carrying current is where μ is the permeability of free space, and are the currents in the conductors, l is the length of the conductors, and d is the distance between them.

Thus, the correct answer is Option (c).

Difficulty Level-Easy

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**Q96) What is magnetic hysteresis?**

a) The loss of magnetism over time

b) The phenomenon of magnetization lagging behind the magnetic field

c) The production of a magnetic field in a material when an external magnetic field is applied

d) The tendency of a magnetic field to concentrate in certain areas of a magnet

Correct Answer: Option (b)

Explanation: Magnetic hysteresis refers to the lag in the magnetization of a ferromagnetic material when the external magnetic field is changed. It occurs due to the magnetic domains in the material being slow to respond to changes in the external field. When the external magnetic field is increased, the magnetization of the material also increases, but it does not reach its maximum value immediately. Similarly, when the external field is decreased, the magnetization of the material does not decrease immediately. This lag or delay in magnetization is known as magnetic hysteresis.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q97) What is the main cause of the declination of the Earth's magnetic field?**

a) Earth's rotation around the Sun

b) The magnetic field of the Sun

c) The tilt of the Earth's rotational axis

d) The movement of the Earth's magnetic poles

Correct Answer: Option (d)

Explanation: The cause of the declination of the Earth's magnetic field is the movement of the Earth's magnetic poles. The Earth's magnetic field is not static, and the magnetic poles move slowly over time. The movement of the magnetic poles affects the direction of the magnetic field lines on the Earth's surface, leading to changes in the declination, which is the angle between true north and magnetic north. Other factors such as the tilt of the Earth's rotational axis and the influence of the Sun's magnetic field can also affect the Earth's magnetic field, but the primary cause of declination is the movement of the magnetic poles.

Thus, the correct answer is Option (d).

Difficulty Level-Medium

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**Q98) What is the angle between the direction of the Earth's magnetic field and the geographic north pole?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The angle between the direction of the Earth's magnetic field and the geographic north pole is not fixed and varies depending on the location on the Earth's surface. At the geographic north pole, the angle between the Earth's magnetic field and the direction of the geographic north pole is .

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q99) What is the shape of the Earth's magnetic field?**

a) Spherical

b) Cylindrical

c) Ellipsoidal

d) Dipolar

Correct Answer: Option (d)

Explanation: The shape of the Earth's magnetic field is dipolar. This means that it has two poles, the North and South magnetic poles, which are located near the geographic poles but do not coincide with them. The magnetic field lines emanate from the North magnetic pole and converge at the South magnetic pole, forming a closed loop that extends from the Earth's interior to its outer atmosphere. The shape of the magnetic field is influenced by the motion of the molten iron in the Earth's core, which generates electric currents that create the magnetic field.

Thus, the correct answer is Option (d).

Difficulty Level-Easy

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**Q100) Answer the following question with reference to the image**

<https://drive.google.com/file/d/1tn_27TriH5K3bbXjQRupx9_o7wjj8EfU/view?usp=share_link>

**Type: Image**

**What is the name of the region around the Earth where charged particles are trapped by the magnetic field?**

a) Van Allen radiation belts

b) Aurora Borealis

c) Coriolis effect

d) Geomagnetic equator

Correct Answer: Option (a)

Explanation: The name of the region around the Earth where charged particles are trapped by the magnetic field is the Van Allen radiation belts. These belts are located in the magnetosphere, which is the region around the Earth that is influenced by its magnetic field. The belts are made up of charged particles, such as protons and electrons, that are trapped by the Earth's magnetic field and travel around the planet in a circular or elliptical orbit. The radiation belts can have a significant impact on spacecraft and human space travel, as the trapped particles can damage electronic equipment and pose a radiation hazard to astronauts.

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q101) What causes the auroras to occur?**

a) Earth's magnetic field interacting with the solar wind

b) The reflection of sunlight off the atmosphere

c) The Earth's rotation around the Sun

d) The collision of clouds in the upper atmosphere

Correct Answer: Option (a)

Explanation: Auroras occur when charged particles from the solar wind, mainly electrons and protons, are funneled towards the Earth's magnetic poles and collide with the gases in the Earth's upper atmosphere, usually oxygen and nitrogen. These collisions excite the atoms and molecules in the atmosphere, causing them to emit light in various colors, creating the aurora. The Earth's magnetic field plays a crucial role in guiding and concentrating these charged particles towards the poles, where they collide with the atmosphere and create the auroras.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q102) What is the effect of temperature on the magnetisation of a ferromagnetic material?**

a) Increases magnetisation

b) Decreases magnetisation

c) Has no effect on magnetisation

d) Increases or decreases magnetisation depending on the material

Correct Answer: Option (b)

Explanation: In general, at high temperatures, the thermal energy can disrupt the alignment of the magnetic domains within the material, reducing the overall magnetisation. This effect is known as thermal demagnetisation. Therefore, for many ferromagnetic materials, an increase in temperature leads to a decrease in magnetisation. However, some materials such as rare earth magnets can maintain their magnetisation even at high temperatures.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q103) What is the process of removing magnetisation from a magnet called?**

a) Demagnetisation

b) Magnetisation

c) Polarisation

d) Depolarisation

Correct Answer: Option (a)

Explanation: The process of removing magnetisation from a magnet is called demagnetisation. This can be done by subjecting the magnet to a magnetic field that is strong enough to disrupt the alignment of its magnetic domains, causing them to become disordered and cancelling out the net magnetic field of the magnet. Another method of demagnetisation is to heat the magnet above its Curie temperature, which causes its magnetic domains to become disordered as well. Demagnetisation is commonly used in industrial applications to remove unwanted magnetism from materials such as tools or equipment.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q104) Which of the following materials is not magnetic?**

a) Iron

b) Nickel

c) Copper

d) Cobalt

Correct Answer: Option (c)

Explanation: Copper is non- magnetic, while iron, nickel, and cobalt are ferromagnetic materials that can be magnetised, copper is diamagnetic, meaning it has a weak and temporary magnetic response when exposed to a magnetic field.

Thus, the correct answer is Option(c).

Difficulty Level-Easy

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**Q105) Which law relates magnetic field intensity to magnetisation?**

a) Faraday's Law

b) Lenz's Law

c) Ampere's Law

d) Coulomb's Law

Correct Answer: Option (c)

Explanation:The law that relates magnetic field intensity to magnetisation is Ampere's Law. It states that the magnetic field intensity at any point around a current-carrying conductor is directly proportional to the current passing through it and inversely proportional to the distance from the conductor. In the case of a magnet, the magnetisation produces a current of magnetic dipoles, which creates a magnetic field. Thus, the stronger the magnetisation, the stronger the magnetic field intensity.

Thus, the correct answer is Option(c).

Difficulty Level-Medium.

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**Q106) What is the name of the phenomenon where a material loses its magnetism when heated above a certain temperature?**

a) Hysteresis

b) Curie temperature

c) Remanence

d) Coercivity

Correct Answer: Option (b)

Explanation: The name of the phenomenon where a material loses its magnetism when heated above a certain temperature is called the Curie temperature. The Curie temperature is the temperature at which a ferromagnetic material undergoes a phase transition and loses its ferromagnetic properties. Above this temperature, thermal energy disrupts the alignment of magnetic domains, and the material loses its magnetization. Below this temperature, the material can be magnetised again. The Curie temperature is specific to each material and is determined by its atomic and molecular properties.

Thus, the correct answer is Option(b).

Difficulty Level-Medium

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**Q107) What is the relationship between magnetic susceptibility and permeability of a material?**

a) They are directly proportional

b) They are inversely proportional

c) They are not related

d) It depends on the type of material

Correct Answer: Option (a)

Explanation: Magnetic susceptibility and permeability are two related properties of a material that describe its response to an applied magnetic field.

Magnetic susceptibility is a measure of the extent to which a material can be magnetised by an applied magnetic field, while permeability is a measure of the degree to which the material can support the formation of a magnetic field within itself.

A material with a high permeability will also have a high magnetic susceptibility, and vice versa. However, the exact relationship between the two can depend on the type of material and the conditions under which the measurements are made.

Thus, the correct answer is Option (a).

Difficulty Level-Hard

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**Q108) Which of the following materials is ferromagnetic?**

a) Aluminium

b) Copper

c) Nickel

d) Zinc

Correct Answer: Option (c)

Explanation: Ferromagnetism is a type of magnetism that occurs in materials such as iron, nickel, and cobalt. These materials exhibit a strong attraction towards a magnetic field and can retain a significant amount of magnetization even after the external magnetic field is removed. Aluminium, copper, and zinc are not ferromagnetic materials.

Thus, the correct answer is Option (c).

Difficulty Level-Easy

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**Q109) What is the name of the phenomenon where a material exhibits different magnetic properties in different crystallographic directions?**

a) Magnetic permeability

b) Magnetic anisotropy

c) Ferromagnetic hysteresis

d) Magnetic induction

Correct Answer: Option (b)

Explanation: Magnetic anisotropy is a phenomenon where a material exhibits different magnetic properties in different crystallographic directions. It is caused by the presence of preferred directions for the orientation of magnetic moments in the crystal lattice of the material. This can result in different magnetic properties along different axes of the crystal, such as different coercivity or remanence. This property is important in the design of magnetic materials for specific applications, such as magnetic storage devices.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q110) Which of the following is an example of a permanent magnet?**

a) Electromagnet

b) Transformer

c) Alnico magnet

d) Solenoid

Correct Answer: Option (c)

Explanation: Alnico magnet, is an example of a permanent magnet, as it is made of a mixture of aluminium, nickel, and cobalt, which creates a strong and stable magnetic field even in the absence of an external magnetic field or electric current.

Thus, the correct answer is Option (c).

Difficulty Level-Easy

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**Q111) Answer the following question with reference to the image**

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**Type: Image**

**Which device utilizes the principle of electromagnetism to transform electrical energy into mechanical energy?**

a) Transformer

b) Motor

c) Generator

d) Solenoid

Correct Answer: Option (b)

Explanation: The device that is used to convert electrical energy into mechanical energy using the principle of electromagnetism is a motor. When a current flows through a wire that is placed in a magnetic field, a force is generated that causes the wire to move. This principle is used in electric motors, where the wire is replaced by a coil of wire, and the magnetic field is created by a permanent magnet or an electromagnet. The interaction between the magnetic field and the current in the wire causes the coil to rotate, which can be used to drive a mechanical load.

Thus, the correct answer is Option(b).

Difficulty Level-Easy

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**Q112) Answer the following question with reference to the image**

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**Type: Image**

**A coil of wire is rotated in a magnetic field. Which of the following effects will occur?**

a) The magnetic field will disappear

b) The coil will heat up

c) An electric current will be induced in the coil

d) The coil will expand

Correct Answer: Option (c)

Explanation: According to Faraday's Law of Electromagnetic Induction, when a coil of wire is rotated in a magnetic field, a change in magnetic flux through the coil induces an electromotive force (EMF) and an electric current in the coil.

Thus, the correct answer is Option (c).

Difficulty Level-Easy

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**Q113) What is the name of the phenomenon where a magnetic field induces an electric current in a nearby conductor?**

a) Magnetic induction

b) Electromagnetic induction

c) Magnetic anisotropy

d) Ferromagnetism

Correct Answer: Option (b)

Explanation: Electromagnetic induction is the phenomenon where a magnetic field induces an electric current in a nearby conductor. It was discovered by Michael Faraday in 1831 and is the basis of many electrical technologies, including generators, transformers, and electric motors. The basic principle is that a changing magnetic field generates an electric field, which causes an electric current to flow in a nearby conductor. This can occur when a magnet is moved near a stationary conductor or when a conductor is moved through a stationary magnetic field. The magnitude of the induced current depends on the strength and rate of change of the magnetic field, as well as the properties of the conductor.

Thus, the correct answer is Option (b).

Difficulty Level-Hard

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**Q114) Which of the following materials is commonly used to make permanent magnets?**

a) Copper

b) Iron

c) Aluminium

d) Neodymium

Correct Answer: Option (d)

Explanation: Neodymium is commonly used to make permanent magnets because it has a high magnetic energy product, which means it can produce a strong magnetic field even with a small volume of the material. Iron is also commonly used for permanent magnets, particularly in traditional magnet applications such as speakers and motors. Copper and aluminium are not commonly used for permanent magnets as they are not naturally magnetic materials.

Thus, the correct answer is Option (d).

Difficulty Level-Medium

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**Q115) What is the name of the device that is used to produce a strong and uniform magnetic field?**

a) Electromagnet

b) Transformer

c) Solenoid

d) Helmholtz coil

Correct Answer: Option (d)

Explanation: The name of the device that is used to produce a strong and uniform magnetic field is Helmholtz coil. It consists of two identical coils of wire, placed parallel to each other and a certain distance apart, with an electric current passing through them in the same direction. The resulting magnetic field is strong and uniform in the region between the coils, making it useful for various scientific and technical applications such as in laboratory experiments, magnetic resonance imaging (MRI), and particle accelerators.

Thus, the correct answer is Option (d).

Difficulty Level-Easy

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**Q116) What is the force experienced by a wire of length 20 cm carrying a current of 10 A when placed perpendicular to a magnetic field of strength 0.5 T?**

a) 0.5 N

b) 1 N

c) 1.5 N

d) 2 N

Correct Answer: Option (b)

Explanation: The formula for the force experienced by a current-carrying wire in a magnetic field is , where B is the magnetic field strength, I is the current, and L is the length of the wire.

Plugging in the values given, we get

Thus, the correct answer is Option(b).

Difficulty Level-Hard

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**Q117) A bar magnet of magnetic moment 4 Am² is placed in a uniform magnetic field of strength 0.2 T. Calculate the torque experienced by the magnet if it makes an angle of 30° with the direction of the magnetic field.**

a) 0.1 Nm

b) 0.2 Nm

c) 0.4 Nm

d) 0.8 Nm

Correct Answer: Option (c)

Explanation: The formula for the torque experienced by a magnetic dipole in a magnetic field is where M is the magnetic moment, B is the magnetic field strength, and θ is the angle between the direction of the magnetic moment and the magnetic field. Plugging in the values given, we get

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q118) A coil of 50 turns and radius 10 cm is placed in a magnetic field of strength 0.1 T. The current in the coil is increased from 0 to 5 A in 0.1 s. Calculate the induced emf in the coil.**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The induced emf in a coil is given by the formula,

where N is the number of turns in the coil, is the magnetic flux through the coil, and is the rate of change of magnetic flux.

The magnetic flux through the coil is given by ,

where B is the magnetic field strength and A is the area of the coil. For a coil with N turns, the total magnetic flux through the coil is .

Area is .

The total magnetic flux through the coil is therefore,

The current in the coil is increased from , so the rate of change of magnetic flux is

Substituting these values into the formula for induced emf, we get,

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q119) A long solenoid of and radius 5 cm is carrying a current of 2 A. Calculate the magnetic field strength inside the solenoid.**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The formula for the magnetic field strength inside a solenoid is where μ₀ is the magnetic constant, n is the number of turns per unit length, and I is the current. Plugging in the values given, we get

Thus, the correct answer is Option(a).

Difficulty Level-Hard

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**Q120) A magnetic dipole of magnetic moment 6 Am² is placed in a non-uniform magnetic field of strength 0.2 T. The dipole makes an angle of 45° with the direction of the magnetic field. Calculate the force experienced by the dipole.**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The force experienced by a magnetic dipole in a non-uniform magnetic field can be calculated using the formula: where m is the magnetic moment of the dipole, B is the magnetic field, and ∇ is the del operator. In this case, the magnetic moment of the dipole is 6 Am², the magnetic field strength is 0.2 T, and the angle between the dipole moment and the magnetic field direction is 45°. The force can be calculated as:

where ∇ ⋅ B is the divergence of the magnetic field, and is the cross product of the magnetic moment and the magnetic field.

Since the magnetic field is non-uniform, there will be a divergence of the field. However, assuming that the field is approximately uniform over the size of the dipole, we can neglect this term and calculate the force due to the cross product:

where θ is the angle between the dipole moment and the magnetic field direction.Plugging in the given values, we get:

Thus, the correct answer is Option (c).

Difficulty Level-Very Hard

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**Q121) Answer the following question with reference to the Audio**

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**Type: Audio**

**What is mutual induction?**

a) It is the production of an induced electromotive force in a circuit due to a change in the magnetic field.

b) It is the production of an induced electromotive force in a circuit due to a change in the current flowing through the circuit itself.

c) It is the production of an induced current in a nearby circuit due to a change in the current flowing through the original circuit.

d) It is the production of an induced current in a nearby circuit due to a change in the magnetic field.

Correct Answer: Option (c)

Explanation: Mutual induction is a phenomenon in which an induced current is produced in a nearby circuit due to a change in the magnetic field produced by the original circuit. It occurs when two coils are placed close to each other and a changing current in one coil induces an electromotive force (EMF) in the other coil. This is based on Faraday's Law of Electromagnetic Induction, which states that the induced EMF in a circuit is proportional to the rate of change of magnetic flux through the circuit. Mutual induction is used in transformers and other electrical devices to transfer energy from one circuit to another.

Thus, the correct answer is Option (c).

Difficulty Level-Medium

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**Q122) Answer the following question with reference to the Audio**

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**Type: Audio**

**What is the role of an inductor in an AC circuit?**

a) It blocks the flow of AC current.

b) It helps to maintain a constant voltage.

c) It helps to maintain a constant current.

d) It acts as a resistor.

Correct Answer: Option (b)

Explanation: The role of an inductor in an AC circuit is to oppose changes in current by storing and releasing energy in a magnetic field. In an AC circuit, the current is constantly changing direction, which means that the magnetic field in the inductor is also changing. The inductor resists these changes in current by generating a counter EMF that opposes the applied voltage. As a result, the inductor causes the current to lag behind the voltage in the circuit, which can cause a phase shift between the voltage and current. This phase shift can be useful in certain applications, such as inductive loads in motors and transformers, where it helps to maintain a constant power factor and reduce losses.

Thus, the correct answer is Option (b)

Difficulty Level-Medium

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**Q123) Answer the following question with reference to the Audio**

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**Type: Audio**

**What is an inductor?**

a) It is a device that stores energy in a magnetic field.

b) It is a device that converts electrical energy into mechanical energy.

c) It is a device that converts mechanical energy into electrical energy.

d) It is a device that stores energy in an electric field.

Correct Answer: Option (a)

Explanation: An inductor is a passive electronic component that stores energy in a magnetic field when an electric current flows through it. It consists of a coil of wire, often wrapped around a magnetic core, which creates a magnetic field when a current passes through it.

The inductor opposes changes in the current flowing through it, which means that it resists sudden changes in current. This property is known as inductance and is measured in henries (H). The higher the inductance, the more energy can be stored in the magnetic field of the inductor.

Inductors are commonly used in electronic circuits for a variety of purposes, such as filtering, tuning, and energy storage.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q124) Answer the following question with reference to the Audio**

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**Type: Audio**

**What is self-induction?**

a) It is the production of an induced electromotive force in a circuit due to a change in the current flowing through the circuit itself.

b) It is the production of an induced electromotive force in a circuit due to a change in the magnetic field.

c) It is the production of an induced current in a nearby circuit due to a change in the current flowing through the original circuit.

d) It is the production of an induced current in a nearby circuit due to a change in the magnetic field.

Correct Answer: Option (a)

Explanation: Self-induction is a phenomenon in which an induced electromotive force (EMF) is produced in a circuit due to a change in the current flowing through the same circuit. It occurs when a changing current in a coil induces a magnetic field in the same coil, which in turn induces a counter EMF that opposes the applied voltage. This is based on Faraday's Law of Electromagnetic Induction, which states that the induced EMF in a circuit is proportional to the rate of change of magnetic flux through the circuit. Self-induction is an important property of inductors and is used in a variety of electronic devices, such as transformers, generators, and motors.

Thus, the correct answer is option (a)

Difficulty Level-Medium

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**Q125) Which law states that the induced emf in a closed circuit is equal to the rate of change of magnetic flux through the circuit?**

a) Ampere's law

b) Faraday's law

c) Lenz's law

d) Coulomb's law

Correct Answer: Option (b)

Explanation: Faraday's law of electromagnetic induction states that the induced emf in a closed circuit is equal to the rate of change of magnetic flux through the circuit. This means that a changing magnetic field will induce an electric field and thus an electric current in a nearby conductor. The law is fundamental in understanding the working of devices such as transformers, motors, and generators.

Thus, the correct answer is Option (b)

Difficulty Level-Easy

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**Q126) The direction of the induced current in a closed loop due to a change in magnetic flux is given by:**

a) Ohm's law

b) Kirchhoff's law

c) Lenz's law

d) Coulomb's law

Correct Answer: Option (c)

Explanation: Lenz's Law states that the direction of the induced current in a closed loop is such that it opposes the change in magnetic flux that produced it. In other words, if the magnetic flux through a closed loop increases, the induced current flows in such a direction as to produce a magnetic field that opposes the increase in flux. Similarly, if the magnetic flux through a closed loop decreases, the induced current flows in such a direction as to produce a magnetic field that opposes the decrease in flux. This law is important in understanding the behavior of generators and transformers, where changes in magnetic flux are used to generate or transfer electrical energy.

Thus, the correct answer is Option (c)

Difficulty Level-Easy

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**Q127) Answer the following question with reference to the Image.**

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**Type: Image**

**What is the primary function of a transformer?**

a) To increase voltage

b) To decrease voltage

c) To maintain voltage

d) All of the above

Correct Answer: Option (d)

Explanation: The primary function of a transformer is to transfer electrical energy from one circuit to another through electromagnetic induction. Depending on the design of the transformer and the ratio of turns between the primary and secondary coils, a transformer can be used to increase voltage, decrease voltage, or maintain voltage.

A step-up transformer is used to increase the voltage of an AC signal, while a step-down transformer is used to decrease the voltage of an AC signal. An isolation transformer is used to maintain the same voltage level between the primary and secondary circuits, while also providing electrical isolation between the two circuits.

Transformers are widely used in power transmission and distribution systems to increase voltage for efficient long-distance transmission, and then decrease voltage for use in homes and businesses. They are also used in electronic devices such as power supplies to convert the voltage of the AC power supply to a lower, safer voltage level for use by the device.

Thus, the correct answer is Option (d)

Difficulty Level-Easy

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**Q128) The frequency of the AC current produced by a generator is determined by:**

a) The number of turns in the coil

b) The magnetic field strength

c) The speed of rotation of the coil

d) The resistance of the circuit

Correct Answer: Option (c)

Explanation: The frequency of the AC (alternating current) produced by a generator is determined by the speed of rotation of the coil. The faster the coil rotates, the higher the frequency of the AC produced. This is because the rotation of the coil determines the rate at which the magnetic field passing through the coil changes, which in turn induces an AC current. The number of turns in the coil, magnetic field strength, and resistance of the circuit can affect the amplitude of the AC current produced, but not its frequency.

Thus, the correct answer is Option (c)

Difficulty Level-Medium

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**Q129) Answer the following question with reference to the Audio.**

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**Type: Audio**

**An electromagnetic wave is produced due to the oscillation of:**

a) Electric charges

b) Magnetic charges

c) Both electric and magnetic charges

d) None of the above

Correct Answer: Option (c)

Explanation: An electromagnetic wave is produced due to the oscillation of both electric and magnetic charges. When an electric charge oscillates or accelerates, it creates a changing electric field around it. This changing electric field in turn produces a changing magnetic field, which then produces a changing electric field, and so on. This self-sustaining process of changing electric and magnetic fields propagating through space is what constitutes an electromagnetic wave.

Thus, the correct answer is Option (c)

Difficulty Level-Medium

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**Q130) A step-up transformer has a primary coil of 100 turns and a secondary coil of 500 turns. If the voltage applied to the primary coil is 100 V, what will be the output voltage of the secondary coil?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: A step-up transformer increases the voltage. The ratio of the number of turns in the secondary coil to the number of turns in the primary coil is called the turns ratio. In this case, the turns ratio is . Therefore, the output voltage of the secondary coil will be .

Thus, the correct answer is option (d)

Difficulty Level- Hard

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**Q131) Answer the following question with reference to the image**

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**Type: Image**

**The unit of magnetic flux is:**

a) Weber

b) Tesla

c) Ohm

d) Henry

Correct Answer: Option (a)

Explanation: The unit of magnetic flux is Weber (Wb), named after the German physicist Wilhelm Eduard Weber. It is a derived unit in the International System of Units (SI) and is defined as the amount of magnetic field passing through a surface area perpendicularly, with a strength of one tesla, for one second. One Weber is equal to one tesla multiplied by one square meter (

Thus, the correct answer is option (a)

Difficulty Level-Easy

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**Q132) Which of the following statements describes the function of a step-up transformer?**

a) Increases the voltage and decreases the current

b) Decreases the voltage and increases the current

c) Increases both the voltage and current

d) Decreases both the voltage and current

Correct Answer: Option (a)

Explanation: The function of a step-up transformer is to increase the voltage and decrease the current.A transformer is a device that consists of two coils of wire wrapped around a common magnetic core. When an AC voltage is applied to the primary coil, it creates a changing magnetic field around the core, which in turn induces a voltage in the secondary coil. The voltage induced in the secondary coil depends on the ratio of the number of turns in the primary and secondary coils.

Thus, the correct answer is Option (a)

Difficulty Level-Medium

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**Q133) Answer the following question with reference to the Image**

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**Type:Image**

**The back EMF in a DC motor is produced due to:**

a) Self-induction

b) Mutual induction

c) Electromagnetic induction

d) Ohm's law

Correct Answer: Option (a)

Explanation: When a DC voltage is applied to a DC motor, it causes a current to flow through the motor's coils, which in turn produces a magnetic field that interacts with the magnetic field of the motor's permanent magnets. As the motor rotates, the magnetic field produced by the coils and the magnetic field of the permanent magnets change relative to each other. This changing magnetic field induces an EMF in the coils that opposes the original applied voltage. This opposing EMF is known as the back EMF. The back EMF is an important characteristic of a DC motor because it can affect the motor's speed and efficiency. As the motor's speed increases, the back EMF also increases, which in turn reduces the current flowing through the motor. This is important because it helps to prevent the motor from overheating and getting damaged.

Thus, the correct answer is Option (a).

Difficulty Level- Medium

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**Q134) Answer the following question with reference to the Audio**

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**Type: Audio**

**A transformer is a device that:**

a) Converts electrical energy to mechanical energy

b) Converts mechanical energy to electrical energy

c) Converts thermal energy to electrical energy

d) Converts electrical energy to thermal energy

Correct Answer: Option (b)

Explanation: A transformer is an electrical device that is used to change the voltage of an alternating current (AC) electrical supply. It does this by using two coils of wire that are wrapped around an iron core.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q135) Which of the following statements describes the phenomenon of self-induction?**

a) The current in a coil changes and induces a voltage in another nearby coil

b) The magnetic field of a coil changes and induces a voltage in the same coil

c) The current in a coil changes and induces a voltage in the same coil

d) The magnetic field of a coil changes and induces a voltage in another nearby coil

Correct Answer: Option (c)

Explanation: Self-induction refers to the phenomenon where a coil carrying a changing current generates a magnetic field that induces a voltage in the same coil, as a result of the changing magnetic field produced by the current.

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q136) A circular loop of wire with radius R is placed in a uniform magnetic field B. If the loop is rotated at a constant angular speed w, then the EMF induced in the loop is:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: When a conducting loop is rotated in a magnetic field, an electromotive force (EMF) is induced in the loop due to the change in the magnetic flux through the loop. The EMF is given by Faraday's law:

where is the magnetic flux through the loop and t is time.

In this case, the loop is a circular loop of wire with radius R, and it is placed in a uniform magnetic field B. When the loop is rotated at a constant angular speed w, the magnetic flux through the loop changes at a rate of

where A is the area of the loop and is the angle of rotation.

The area of the loop is ,

and the angle of rotation is .

Therefore, the rate of change of magnetic flux is:

Substituting this into Faraday's law, we get:

Therefore, the EMF induced in the loop is proportional to the product of the magnetic field, the radius of the loop, and the angular speed of rotation:

Thus, the correct answer is option (a).

Difficulty Level-Hard

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**Q137) The coefficient of coupling between two coils is 0.8. If the self-inductance of one coil is 0.5 H, then the mutual inductance between the two coils is:**

a) 0.2 H

b) 0.4 H

c) 0.6 H

d) 0.8 H

Correct Answer: Option (c)

Explanation: The mutual inductance between two coils is a measure of the extent to which the magnetic field produced by one coil links with the other coil. It is denoted by M and is given by:

where k is the coefficient of coupling between the coils, is the self-inductance of the first coil, and is the self-inductance of the second coil.

The coefficient of coupling between the two coils is given as and the self-inductance of one of the coils is given as. We need to find the mutual inductance M between the two coils.

Let be the self-inductance of the second coil. Then, using the formula for mutual inductance, we have:

Squaring both sides and simplifying, we get:

Substituting the value of from this equation in the previous equation, we get:

Squaring both sides again and simplifying, we get:

Therefore, the mutual inductance between the two coils is,

Thus, the correct answer is option (c)

Difficulty Level-Hard

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**Q138) The mutual inductance between two coils is 2 H. If the current in one coil changes at a rate of 4 A/s, then the EMF induced in the other coil is:**

a) 4 V

b) 8 V

c) 16 V

d) 32 V

Correct Answer: Option (c)

Explanation: The EMF induced in the other coil is given by,

where M is the mutual inductance between the two coils.

Substituting the given values, we get,

Since the EMF is induced in the opposite direction, the actual value of EMF induced in the coil is 8 V.

Thus, the correct answer is option (c)

Difficulty Level-Hard

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**Q139) Which of the following is not a type of transformer?**

a) Step-up transformer

b) Step-down transformer

c) Isolation transformer

d) AC transformer

Correct Answer: Option (d)

Explanation: "AC transformer" is not a specific type of transformer. All transformers are designed to work with AC power since they operate on the principle of electromagnetic induction, which requires a changing magnetic field. Step-up transformers increase the voltage, step-down transformers decrease the voltage, and isolation transformers are used to isolate the primary and secondary circuits electrically. They are used to protect sensitive equipment from power surges, noise, and other types of interference. In summary, while there are different types of transformers that serve different purposes, "AC transformer" is not one of them as it does not specify any particular type or function of a transformer.

Thus, the correct answer is Option (d)

Difficulty Level-Medium

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**Q140) Answer the following question with reference to the Audio**

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**Type: Audio**

**Which of the following phenomena is not based on electromagnetic induction?**

a) Electric motor

b) Transformer

c) Galvanometer

d) Generator

Correct Answer: Option (c)

Explanation: Electromagnetic induction is the process of generating an electromotive force (EMF) or voltage in a conductor by varying the magnetic field around it. This phenomenon is the basis for the operation of many electrical devices such as electric motors, transformers, and generators.

A galvanometer is a device that detects and measures small electric currents. It operates based on the deflection of a needle in response to the current passing through a coil of wire. While it utilizes the principle of electromagnetism, it does not involve the induction of an EMF or voltage in a conductor by a varying magnetic field, and therefore is not based on electromagnetic induction.

Thus, the correct answer is Option (c)

Difficulty Level-Medium

**Q141) When two waves are in phase, how do their peaks and troughs align, and what is the resulting phase difference?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: When two waves are in phase, their peaks and troughs align perfectly. This means that the crest of one wave coincides with the crest of the other wave, and the same applies to their troughs. The resulting phase difference between the two waves is , which means that they are completely in step with each other. In other words, if the waves are represented by sine waves, they would be completely in phase, and their maximum amplitudes would occur at the same time.

Thus, the correct answer is Option (a).

Difficulty Level-Medium

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**Q142) Out of the given options, which device is used to convert AC (alternating current) to DC (direct current)?**

a) Transformer

b) Rectifier

c) Oscillator

d) Amplifier

Correct Answer: Option (b)

Explanation: The device used to convert AC to DC is called a rectifier. The purpose of a rectifier is to convert the AC voltage, which alternates between positive and negative values, into a steady DC voltage that flows in only one direction. Transformer, oscillator, and amplifier - do not perform this specific function. A transformer is used to change the voltage level of an AC signal, while an oscillator is used to generate an AC signal. An amplifier, as the name suggests, is used to amplify or increase the strength of an electrical signal.

Thus, the correct answer is option (b).

Difficulty Level: Medium

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**Q143) What is the peak-to-peak voltage of a sine wave with a peak voltage of 10 V?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The peak-to-peak voltage of a sine wave is the voltage difference between its positive peak and negative peak. The peak voltage of the given sine wave is , which means its positive and negative peaks are and respectively. Therefore, the peak-to-peak voltage is the difference between the two peaks, which is:

Peak-to-peak voltage = Positive peak - Negative peak

So, the peak-to-peak voltage of the given sine wave with a peak voltage of .

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q144) What is the peak factor of an alternating current?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The peak factor of an alternating current is the ratio of the peak value to the RMS value of the AC waveform. For a sine wave, the peak factor is . However, for practical AC waveforms, the peak factor is typically around .

Thus, the correct answer is option (a).

Difficulty Level-Hard

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**Q145) What is the power factor of a purely resistive circuit?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation:The power factor of a purely resistive circuit is. This is because in a purely resistive circuit, the voltage and current are in phase with each other, which means that the power is being used efficiently and there is no reactive power being generated or consumed. The power factor is a measure of how efficiently power is being used in an AC circuit and is defined as the cosine of the angle between the voltage and current waveforms. In a purely resistive circuit, this angle is zero, which means that the power factor is equal to 1. A power factor of 1 indicates that all of the power being supplied to the circuit is being used to do useful work, and there is no wasted power.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q146) Which of the following statements is true regarding the difference between DC and AC?**

a) DC flows continuously in one direction, while AC alternates direction periodically.

b) AC flows continuously in one direction, while DC alternates direction periodically.

c) DC and AC are interchangeable terms.

d) None of the above.

Correct Answer: Option (a).

Explanation: DC stands for Direct Current, which flows in one direction only, while AC stands for Alternating Current, which changes direction periodically. DC is commonly used in batteries, electronic devices, and electric motors, while AC is used for power transmission and distribution. DC has a constant voltage level, while AC voltage levels change continuously with time. DC and AC are not interchangeable terms, as they represent fundamentally different types of electrical current.

Thus, the correct answer is Option(a).

Difficulty Level-Medium

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**Q147) Which of the following is the formula for calculating the period of an AC wave?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: Period is the time taken by one complete cycle of the AC waveform, which is usually a sine wave. The unit of period is seconds (s) and the unit of frequency is hertz (Hz). The relationship between period and frequency is inverse, which means that as the frequency increases, the period decreases and vice versa. The formula for calculating the period of an AC wave is derived by taking the reciprocal of the frequency. Therefore, the period can be calculated by dividing 1 by the frequency. This formula is important in AC circuit analysis, as it is used to determine the time taken for a waveform to complete one cycle and is useful in calculating various parameters of the AC circuit such as the frequency, phase difference, and wavelength.

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q148) Which of the following is the frequency of the power supply in India?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The frequency of the power supply is the number of complete cycles of the AC waveform that occur in one second. In India, the power supply is provided at a frequency of , which is standard for most countries in Asia, Europe, and Africa. The frequency of the power supply is important for electrical devices and appliances, as it affects their operation and performance. The standard frequency of 50 Hz is used in most electrical devices and appliances in India, and it is important to ensure that they are compatible with this frequency for proper operation. Some countries, such as the United States and Canada, use a frequency of for their power supply.

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q149) Answer the following question with reference to the Image**

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Type: Image

**Which of the following equations can be used to calculate the peak value of an AC waveform?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: In an AC waveform, the peak value represents the maximum voltage or current value reached in a single cycle of the waveform. The root mean square (RMS) value of an AC waveform is the equivalent DC value that would produce the same amount of heating or power dissipation in a resistor. The relationship between the peak value and RMS value of an AC waveform is given by where is the peak value and is the RMS value. This formula can be used to calculate the peak voltage or current value of an AC waveform when the RMS value is known.

Thus, the correct answer Option (a).

Difficulty Level-Hard

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**Q150) Which of the following is a type of AC circuit in which the voltage and current are out of phase with each other?**

a) Resonant circuit

b) Non-resonant circuit

c) Series circuit

d) Parallel circuit

Correct Answer: Option (b)

Explanation: In a non-resonant AC circuit, the voltage and current are not in phase with each other, meaning that they are out of sync. This occurs because the circuit contains elements with significant resistance or capacitance, which cause the current to lag or lead the voltage. In contrast, a resonant circuit is a type of AC circuit in which the voltage and current are in phase with each other, resulting in a peak in the impedance at a specific frequency. A series circuit is a circuit in which the components are connected in a series, while a parallel circuit is a circuit in which the components are connected in parallel.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q151) Which of the following is a type of AC motor that is commonly used in electric vehicles?**

a) Synchronous motor

b) Induction motor

c) Brushless DC motor

d) All of the above

Correct Answer: Option (c)

Explanation: A brushless DC motor is a type of AC motor that is commonly used in electric vehicles. It is a synchronous motor that operates using direct current, and does not have the brushes and commutators that are typically found in traditional DC motors. Instead, it uses electronic controls to switch the direction of the current and magnetic field, allowing for more efficient and precise control of the motor. Brushless DC motors are popular in electric vehicles because they are highly efficient, have a long lifespan, and can deliver high torque and power density in a compact size. While synchronous and induction motors are also commonly used in electric vehicles, brushless DC motors are becoming more popular due to their advantages.

Thus, the correct answer is Option (c).

Difficulty Level-Medium

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**Q152) The power factor of an AC circuit is defined as \_\_\_\_\_\_\_.**

a) The ratio of power consumed to power supplied

b) The ratio of voltage to current

c) The ratio of real power to apparent power

d) The ratio of reactive power to real power

Correct Answer: Option (c)

Explanation: The power factor of an AC circuit is defined as the ratio of real power to apparent power.

In an AC circuit, the current and voltage waveforms may not be in phase with each other, which can result in a difference between the apparent power and the real power. The apparent power is the product of the RMS voltage and RMS current, while the real power is the power that is actually dissipated or consumed in the circuit.

The power factor is a measure of how effectively the circuit uses the supplied power, and it is defined as the ratio of real power to apparent power. A high power factor indicates that the circuit is using the supplied power efficiently, while a low power factor indicates that the circuit is wasting power. A power factor of 1 indicates that all the supplied power is being used effectively, while a power factor of 0 indicates that no power is being used by the circuit.

Thus, the correct answer is Option (c).

Difficulty Level-Medium

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**Q153) Which AC parameter is measured in radians per second?**

a) Frequency

b) Angular frequency

c) Amplitude

d) Phase

Correct Answer: Option (b)

Explanation: The AC parameter that is measured in radians per second is angular frequency, which is represented by the symbol ω (omega). Angular frequency is a measure of the rate at which an AC signal changes its phase angle, and is given by the formula ω = 2πf, where f is the frequency of the AC signal in Hertz.

The unit of angular frequency is radians per second, which represents the amount of change in the phase angle of the AC signal per second. It is used to describe the behavior of AC signals in circuits that use capacitors, inductors, and other reactive components, as it provides a more comprehensive understanding of the behavior of these components in AC circuits than frequency alone.

Thus, the correct answer is Option (b).

Difficulty Level-Easy

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**Q154) What is the relationship between frequency and wavelength in an electromagnetic wave?**

a) Directly proportional

b) Inversely proportional

c) Not related

d) Randomly related

Correct Answer: Option (b)

Explanation: The relationship between frequency and wavelength in an electromagnetic wave is inversely proportional, meaning that as the frequency of the wave increases, the wavelength decreases, and vice versa. This relationship is expressed mathematically as: Wavelength = Speed of light / Frequency where the speed of light is a constant, and wavelength and frequency are inversely proportional to each other.

This relationship is fundamental to the behaviour of electromagnetic waves in various applications, such as radio communication, microwave ovens, and optical fibres. For example, radio waves have low frequencies and long wavelengths, while X-rays have high frequencies and short wavelengths. This means that radio waves can travel long distances but are not able to carry as much information as higher frequency waves, while X-rays have shorter wavelengths that allow them to penetrate materials like skin and bone.

Thus, the correct answer is Option (b).

Difficulty Level-Easy

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**Q155) What is the maximum voltage of a standard AC power supply in India?**

a) 110V

b) 220V

c) 440V

d) 660V

Correct Answer: Option (b)

Explanation: The maximum voltage of a standard AC power supply in India is 220V. This voltage is commonly used for domestic and industrial applications in India, and is compatible with most electronic devices and appliances.

It is important to note that the frequency of the AC power supply in India is 50 Hz, which is also a standard frequency in many other countries around the world. This frequency is important in determining the behaviour of electrical devices and circuits, as it affects the way in which AC signals are processed and transmitted.

In summary, the maximum voltage of a standard AC power supply in India is 220V, with a frequency of 50 Hz. This voltage is commonly used for domestic and industrial applications, and is compatible with most electronic devices

and appliances used in India.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q156) Which type of circuit uses inductors and capacitors to control the flow of current?**

a) DC circuit

b) AC circuit

c) Transistor circuit

d) Diode circuit

Correct Answer: Option (b)

Explanation: The type of circuit that uses inductors and capacitors to control the flow of current is an AC (alternating current) circuit.

Inductors and capacitors are types of reactive components that store energy in different ways. Inductors store energy in a magnetic field, while capacitors store energy in an electric field. These reactive components can be used to control the flow of current in an AC circuit by regulating the phase and amplitude of the current.

In an AC circuit, the current alternates in direction and magnitude, which creates a constantly changing magnetic field. This changing magnetic field induces a voltage across an inductor, which opposes the flow of current. Similarly, a capacitor resists the flow of current by charging and discharging, depending on the voltage across it.

By combining inductors and capacitors in an AC circuit, it is possible to create filters, resonant circuits, and other complex circuit elements that can be used to control the flow of current. These types of circuits are commonly used in power supplies, audio amplifiers, and other electronic devices.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q157) Answer the following question with reference to the Image**

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**Type: Image**

**What is the relationship between impedance and resistance in an AC circuit?**

a) Impedance is equal to resistance

b) Impedance is less than resistance

c) Impedance is greater than resistance

d) Impedance is not related to resistance

Correct Answer: Option (c)

Explanation: In an AC circuit, impedance and resistance are related, but they are not equal. Impedance includes both resistance and reactance, which is a measure of how much the circuit resists changes in voltage and current due to inductance and capacitance.

The relationship between impedance and resistance in an AC circuit can be expressed using the following formula:

where Z is the impedance, R is the resistance, X is the reactance, and j is the imaginary unit. The impedance is the vector sum of the resistance and reactance.

Therefore, the impedance can be greater than the resistance in an AC circuit, because it takes into account both resistance and reactance. In fact, the impedance can be much greater than the resistance, depending on the values of the inductance and capacitance in the circuit.

Thus, the correct answer is Option (c).

Difficulty Level-Hard

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**Q158) Answer the following question with reference to the Audio**

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**Type: Audio**

**Which of the following is NOT a type of AC motor?**

a) Synchronous motor

b) Induction motor

c) Stepper motor

d) DC motor

Correct Answer: Option (d)

Explanation: AC motors are designed to run on alternating current, which means the magnetic field in the motor alternates in direction, causing the rotor to rotate. There are several types of AC motors, including the synchronous motor, induction motor, and stepper motor.

DC motor runs on direct current, which means the magnetic field in the motor is constant. This type of motor is not an AC motor, and is not designed to run on AC power. DC motors are commonly used in applications such as electric vehicles, robots, and toys.

Thus, the correct answer is Option (d).

Difficulty Level-Hard

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**Q159) What is the formula for calculating the reactance of an inductor?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: Reactance is a measure of how much an inductor or capacitor resists changes in current or voltage in an AC circuit. In an inductor, the reactance is proportional to the frequency of the AC signal and the inductance of the coil.The formula for calculating the reactance of an inductor is given by:

where Xl is the reactance of the inductor in ohms, f is the frequency of the AC signal in hertz, and L is the inductance of the coil in henrys.

This formula shows that the reactance of an inductor increases with increasing frequency, and also depends on the inductance of the coil. The reactance of an inductor can be thought of as a type of resistance that opposes changes in current flow in an AC circuit, similar to how resistance opposes current flow in a DC circuit.

Thus, the correct answer is Option (b).

Difficulty Level-Medium

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**Q160) Which of the following factors does NOT affect the inductance of an inductor?**

a) The number of turns in the coil

b) The permeability of the core material

c) The frequency of the AC voltage

d) The cross-sectional area of the coil

Correct Answer: Option (a)

Explanation: The inductance of an inductor is mainly determined by the number of turns in the coil, the permeability of the core material, and the cross-sectional area of the coil. The frequency of the AC voltage has an effect on the inductance, but it is not a major factor.

Thus, the correct answer is Option (a).

Difficulty Level-Easy

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**Q161) What is the wavelength of an electromagnetic wave with a frequency of 2.4 GHz?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The wavelength of an electromagnetic wave is given by the formula , where c is the velocity of light and f is the frequency. Substituting and Hz gives

.

Thus, the correct answer is Option (a).

Difficulty level-Easy

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**Q162) Which of the following is a property of all electromagnetic waves?**

a) They all have the same frequency

b) They all have the same amplitude

c)They all travel at the same speed

d) They all have the same wavelength

Correct Answer: Option (c)

Explanation: Maxwell's equations are a set of four equations that describe the behaviour of electromagnetic waves. One of these equations, known as the wave equation, relates the electric and magnetic fields of an electromagnetic wave to its velocity, which is given by the speed of light.

Thus, the correct answer is Option (c).

Difficulty level-easy

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**Q163) Which of the following waves is an electromagnetic wave?**

a) Sound wave

b) Water wave

c) Light wave

d) Seismic wave

Correct Answer: Option (c)

Explanation: Electromagnetic waves are a type of wave that do not require a medium to propagate and can travel through a vacuum. Sound waves require a medium (such as air) to propagate, water waves are a type of mechanical wave, and seismic waves are waves that occur during an earthquake. Light waves are a type of electromagnetic wave.

Thus, the correct answer is Option (c).

Difficulty level- easy

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**Q164)** **What is the wavelength of an electromagnetic wave with a frequency of Hz?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The wavelength of an electromagnetic wave can be calculated using the formula:

where c is the speed of light in vacuum and is the frequency of the wave. Substituting the given values, we get:

Thus, the correct answer is Option (b).

Difficulty level- easy

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**Q165) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Ie5ad1P0YEljaSuVRlUwd810SAP0wdTN/view?usp=share_link>

**Type: audio**

**What are electromagnetic waves?**

a) Longitudinal waves consisting of electric and magnetic fields oscillating in the same direction.

b) Transverse waves

c) Waves consisting of only electric fields.

d) Waves consisting of only magnetic fields.

Correct Answer: Option (b)

Explanation: The passage clearly states that electromagnetic waves are transverse waves consisting of electric and magnetic fields oscillating at right angles to each other and perpendicular to the direction of wave propagation.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q166) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Ie5ad1P0YEljaSuVRlUwd810SAP0wdTN/view?usp=share_link>

**Type: audio**

**How are electromagnetic waves produced?**

a) By heating a material

b) By cooling a material

c) By accelerating charges

d) By applying pressure to a material

Correct Answer: Option (c)

Explanation: Electromagnetic waves are produced by accelerating charges, as stated in the passage. Whenever a charge is accelerated, it produces a changing electric field. This changing electric field, in turn, produces a changing magnetic field, which produces another changing electric field, and so on. These changing electric and magnetic fields propagate through space, creating an electromagnetic wave. This process is known as electromagnetic radiation.

Thus, the correct answer is Option (c).

Difficulty level- medium

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**Q167) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Ie5ad1P0YEljaSuVRlUwd810SAP0wdTN/view?usp=share_link>

**Type: audio**

**What is the direction of the electric and magnetic fields in an electromagnetic wave?**

a) Parallel to each other

b) Perpendicular to each other

c) In the same direction

d) Opposite to each other

Correct Answer: Option (b)

Explanation: To clear this concept better, imagine an electromagnetic wave travelling in the x-direction. At any given point in space, the electric field could be oscillating in the y-direction, while the magnetic field could be oscillating in the z-direction. As the wave propagates in the x-direction, the electric and magnetic fields continue to oscillate in their respective perpendicular directions.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q168) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Ie5ad1P0YEljaSuVRlUwd810SAP0wdTN/view?usp=share_link>

**Type: audio**

**What are the applications of electromagnetic waves?**

a) Only in communication

b) Only in medicine

c) Only in industry

d) In communication, medicine, and industry

Correct Answer: Option (d)

Explanation: Electromagnetic waves also have many applications in industry. They are used in materials processing, such as in welding and cutting, and in non-destructive testing of materials. Electromagnetic waves are also used in sensors and instrumentation, such as in radar and microwave sensors.

Thus, the correct answer is Option (d).

Difficulty level- medium

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**Q169) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Ie5ad1P0YEljaSuVRlUwd810SAP0wdTN/view?usp=share_link>

**Type: audio**

**What is the difference between longitudinal and transverse waves?**

a) Longitudinal waves have electric and magnetic fields, while transverse waves have only electric fields.

b) Longitudinal waves have electric and magnetic fields oscillating in the same direction, while transverse waves have them oscillating at right angles to each other.

c) Longitudinal waves propagate perpendicular to the direction of oscillation, while transverse waves propagate parallel to the direction of oscillation.

d) Longitudinal waves are produced by accelerating charges, while transverse waves are produced by heating a material.

Correct Answer: Option (b)

Explanation: In longitudinal waves, the particles of the medium oscillate in the same direction as the wave propagates. For example, sound waves are longitudinal waves in which the particles of air vibrate in the same direction as the sound wave moves. In contrast, transverse waves are waves in which the particles of the medium oscillate perpendicular to the direction of wave propagation. An example of a transverse wave is a wave on a string. As the wave travels along the string, the particles of the string move up and down, perpendicular to the direction of the wave. Thus, Longitudinal waves have electric and magnetic fields oscillating in the same direction, while transverse waves have them oscillating at right angles to each other.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q170) What is the wavelength of an electromagnetic wave of frequency Hz in vacuum?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The speed of light in vacuum is . The wavelength of an electromagnetic wave is given by , where c is the speed of light and f is the frequency of the wave. Substituting the given values, we get

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q171) Which of the following electromagnetic waves is used in satellite communication?**

a) Gamma rays

b) X-rays

c) Infrared waves

d) Microwaves

Correct Answer: Option (d)

Explanation: Microwaves have a frequency range of , and they are used for various applications such as satellite communication, radar, and microwave ovens. Gamma rays and X-rays have very high frequencies and are used in medical imaging and cancer treatment. Infrared waves have lower frequencies and are used for heating and remote sensing.

Thus, the correct answer is Option (d).

Difficulty level- medium

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**Q172) The speed of electromagnetic waves in a medium depends on:**

a) The frequency of the wave

b) The wavelength of the wave

c) The magnetic permeability of the medium

d) The dielectric constant of the medium

Correct Answer: Option (d)

Explanation: The speed of electromagnetic waves in a medium depends on the dielectric constant and magnetic permeability of the medium. The dielectric constant affects the electric field in the medium, while the magnetic permeability affects the magnetic field. The frequency and wavelength of the wave do not depend on the medium.

Thus, the correct answer is Option (d).

Difficulty level- medium

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**Q173) The polarization of an electromagnetic wave refers to:**

a) The orientation of the electric and magnetic fields

b) The frequency of the wave

c) The wavelength of the wave

d) The amplitude of the wave

Correct Answer: Option (a)

Explanation: The polarization of an electromagnetic wave refers to the orientation of the electric and magnetic fields with respect to the direction of propagation. A wave can be linearly polarized, where the electric field oscillates in a single direction, or circularly polarized, where the electric field rotates in a circle.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q174) Which of the following electromagnetic waves is used in medical imaging?**

a) Radio waves

b) Microwaves

c) X-rays

d) Infrared waves

Correct Answer: Option (c)

Explanation: X-rays have a high frequency and energy, and they can penetrate through soft tissue and bone. They are used in medical imaging such as X-ray radiography, computed tomography (CT), and mammography. Radio waves and microwaves are used for communication and radar, while infrared waves are used for remote sensing and heating.

Thus, the correct answer is Option (c).

Difficulty level- medium

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**Q175) A plane electromagnetic wave propagates through a vacuum. At time , the electric field is in the x-direction and has a magnitude of . What is the magnitude of the magnetic field at time ?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: In a plane electromagnetic wave, the electric and magnetic fields are perpendicular to each other and to the direction of propagation. The ratio of the magnitudes of the electric and magnetic fields is given by the speed of light, c, in a vacuum: . Therefore, the magnitude of the magnetic field is . At time , the electric field has a magnitude of , so the magnetic field has a magnitude of

Thus, the correct answer is Option (a).

Difficulty level- very hard

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**Q176) The phenomenon of interference of electromagnetic waves is related to their:**

a) Wavelength

b) Frequency

c) Velocity

d) Amplitude

Correct Answer: Option (a)

Explanation: Interference of electromagnetic waves occurs when two or more waves of the same frequency and amplitude superpose with each other. The interference pattern depends on the wavelength of the waves and their phase difference.

Thus, the correct answer is Option (a).

Difficulty level- hard

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**Q177) The electromagnetic waves emitted by an oscillating LC circuit are:**

a) X-rays

b) Gamma rays

c) Radio waves

d) Ultraviolet rays

Correct Answer: Option (c)

Explanation: An LC circuit, also known as a resonant circuit, is made up of an inductor and a capacitor that are connected in parallel or in series. When a current flows through the circuit, it causes an electromagnetic field to be produced. The energy stored in the circuit oscillates back and forth between the capacitor and the inductor, resulting in the emission of Radio waves.

Thus, the correct answer is Option (c).

Difficulty level- hard

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**Q178) Which of the following electromagnetic waves is not absorbed by the ozone layer?**

a) Infrared waves

b) Ultraviolet rays

c) X-rays

d) Radio waves

Correct Answer: Option (d)

Explanation: Ozone layer is a layer of ozone gas in the Earth's atmosphere that absorbs most of the harmful ultraviolet radiation from the sun. Ultraviolet rays are strongly absorbed by the ozone layer, while radio waves are not affected by it and can pass through it without getting absorbed.

Thus, the correct answer is Option (d).

Difficulty level- hard

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**Q179) Which of the following electromagnetic waves is used in remote sensing?**

a) Infrared waves

b) Ultraviolet rays

c) Gamma rays

d) Radio waves

Correct Answer: Option (a)

Explanation: Remote sensing is a technique used to obtain information about the Earth's surface and atmosphere from a distance. Infrared waves are used in remote sensing to detect and map various features such as temperature, vegetation, and mineral content of the Earth's surface.

Thus, the correct answer is Option (a).

Difficulty level- hard

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**Q180) The range of frequencies used in satellite communication is typically in the:**

a) Radio frequency range

b) Infrared range

c) Visible light range

d) Ultraviolet range

Correct Answer: Option (a)

Explanation: Satellite communication systems use radio waves in the frequency range of a few hundred MHz to several GHz. This frequency range allows the transmission of large amounts of data over long distances.

Thus, the correct answer is Option (a).

Difficulty level- hard

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**Q181) Which of the following is NOT a type of reflection?**

a) Diffuse reflection

b) Regular reflection

c) Refraction

d) Multiple reflection

Correct Answer: Option (c)

Explanation: Reflection refers to the bouncing back of light when it strikes a surface, while refraction is the bending of light when it passes through a medium. Diffuse reflection is when light is scattered in all directions, regular reflection is when light is reflected in a specific direction, and multiple reflection is when light is reflected multiple times.

Thus, the correct answer is Option (c).

Difficulty level- easy

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**Q182** **The angle of incidence is equal to the angle of reflection in:**

a) Diffuse reflection

b) Regular reflection

c) Refraction

d) Total internal reflection

Correct Answer: Option (b)

Explanation: Regular reflection occurs when light waves reflect off a smooth surface, such as a mirror or a calm body of water. The angle at which the light hits the surface is known as the angle of incidence (i), and the angle at which it reflects off the surface is known as the angle of reflection (r).

Thus, the correct answer is Option (b).

Difficulty level- easy

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**Q183) The critical angle is the angle of incidence at which:**

a) Total internal reflection occurs

b) Diffraction occurs

c) Refraction occurs

d) Reflection occurs

Correct Answer: Option (a)

Explanation: The critical angle is the angle of incidence at which the refracted angle is 90 degrees. At this angle, all the light is reflected back into the original medium, and no light is transmitted through the interface. This is known as total internal reflection and is an important phenomenon in optics.

Thus, the correct answer is Option (a).

Difficulty level- easy

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**Q184) A convex mirror always produces a virtual image that is:**

a) Smaller than the object

b) Larger than the object

c) The same size as the object

d) Upside down compared to the object

Correct Answer: Option (a)

Explanation: A convex mirror always produces a virtual image that is smaller than the object. The image is also upright (not upside down) and located behind the mirror. Convex mirrors are commonly used as side-view mirrors on cars because they provide a wider field of view than flat mirrors.

Thus, the correct answer is Option (a).

Difficulty level- easy

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**Q185) Answer the following question with reference to the image**

<https://drive.google.com/file/d/1eP8Wj2CV5ce0Pvt08nz_bY6doTNZ9GJ7/view?usp=share_link>

**Type: Image**

**A ray of light is incident on a glass slab at an angle of incidence i, as shown in the figure. The refractive index of the glass is 1.5. The angle of refraction is equal to the angle of incidence. Find the angle of deviation of the ray as it emerges from the glass slab.**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: To find the angle of deviation, we need to first find the angle of refraction. From Snell's law, we have:

where is the refractive index of the medium in which the incident ray is travelling (air, in this case), is the refractive index of the glass, i is the angle of incidence, and r is the angle of refraction.

Since the angle of refraction is equal to the angle of incidence, we have:

Substituting this into Snell's law, we get:

Solving for , we get:

Substituting and , we get:

This is not possible, as the sine of an angle cannot be greater than 1. Therefore, there is no angle of incidence that satisfies the conditions of the problem as there is no deviation of the ray.

Thus, the correct answer is Option (a).

Difficulty level- very hard

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**Q186) Answer the following question with reference to the image**

<https://drive.google.com/file/d/1n-WxXBAOejAFumkNCh0OHVmG8RYNdQR3/view?usp=share_link>

**Type: Image**

**In the given diagram, a beam of light is incident on a convex lens from the left side. Which of the following statements is true regarding the formation of an image?**

a) An inverted and real image is formed on the right side of the lens.

b) A virtual and erect image is formed on the left side of the lens.

c) No image is formed on either side of the lens.

d) An inverted and virtual image is formed on the left side of the lens.

Correct Answer: Option (d)

Explanation: When a beam of light is incident on a convex lens, the light rays refract and converge at a point on the opposite side of the lens. However, if the object is placed within the focal length of the lens, the rays refract and diverge, as shown in the diagram. In this case, the image formed is virtual, upright, and magnified. The image is also located on the same side of the lens as the object.

Thus, the correct answer is Option (d).

Difficulty level- hard

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**Q187) Answer the following question with reference to the image**

<https://drive.google.com/file/d/1Xtgm0jcg2qJuhO89SkJgAT-rUfL853Ln/view?usp=share_link>

**Type: Image**

**The figure given below shows a convex lens placed in contact with a concave lens. The combination behaves as a:**

a) Convex lens

b) Concave lens

c) Diverging lens

d) Converging lens

Correct Answer: Option (c)

Explanation: When a convex lens and a concave lens are placed in contact with each other, the combination behaves as a diverging lens. This is because the convex lens converges the incoming light rays towards a point, whereas the concave lens diverges the light rays away from the same point. The net effect of this combination is that the light rays get diverged.

Thus, the correct answer is Option (c).

Difficulty level- hard

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**Q188) Which of the following statements is true about the focal length of a convex lens?**

a) The focal length is negative.

b) The focal length is positive.

c) The focal length is zero.

d) The focal length depends on the distance between the object and the lens.

Correct Answer: Option (b)

Explanation: A convex lens is thicker in the middle than at the edges, and it converges light rays to a focal point. The distance from the lens to the focal point is called the focal length, and it is always positive for a convex lens.

Thus, the correct answer is Option (b).

Difficulty level- hard

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**Q189) When light travels from a denser medium to a rarer medium, which of the following is true?**

a) The speed of light decreases.

b) The speed of light increases.

c) The wavelength of light increases.

d) The frequency of light decreases.

Correct Answer: Option (b)

Explanation: When light travels from a denser medium to a rarer medium, it bends away from the normal, and the speed of light increases. The wavelength of light also increases, but the frequency of light remains constant.

Thus, the correct answer is Option (b).

Difficulty level- hard

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**Q190) A concave mirror forms an inverted image of an object placed 20 cm in front of it. If the image is twice the size of the object, what is the focal length of the mirror?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: Using the mirror formula, , where f is the focal length, v is the image distance, and u is the object distance. Since the image is inverted and twice the size of the object,

and .

Substituting these values in the mirror formula gives,

which simplifies to .

Thus, the correct answer is Option (a).

Difficulty level- hard

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**Q191) A concave mirror produces an image that is half the size of the object. If the object is placed 10 cm from the mirror, what is the focal length of the mirror?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: Let the focal length of the concave mirror be f. The mirror formula is given as , where u is the object distance and v is the image distance. Since the image is half the size of the object, we have .

Substituting these values, we get,

,

which simplifies to .

Therefore, cm, which is a negative value since the mirror is concave.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q192) A parallel beam of light is incident on a convex lens. What is the nature and position of the image formed?**

a)Real and inverted, at the focus

b)Real and inverted, beyond the focus

c)Virtual and erect, at the focus

d) Virtual and erect, beyond the focus

Correct Answer: Option (d)

Explanation: A convex lens converges a parallel beam of light to a point known as the focus. The nature of the image formed by a convex lens depends on the position of the object relative to the lens. If the object is beyond the focus, a real and inverted image is formed. If the object is at the focus, no image is formed. If the object is between the focus and the lens, a virtual and erect image is formed.

Thus, the correct answer is Option (d).

Difficulty level- medium

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**Q193) A ray of light is incident on a plane mirror at an angle of 30 degrees with the normal. What is the angle of reflection?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: According to the law of reflection, the angle of incidence is equal to the angle of reflection, measured with respect to the normal. Therefore, the angle of reflection is also , which is the same as the angle of incidence.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q194)** **A concave lens of focal length 20 cm is placed in front of a converging lens of focal length 10 cm. What is the effective focal length of the combination?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: When two lenses are placed in contact, the effective focal length of the combination can be calculated using the formula ,

where and are the focal lengths of the individual lenses, d is the distance between the lenses, and f is the effective focal length of the combination.

In this case, is is cm (since the concave lens is diverging), is 10 cm (since the converging lens is converging), and d is 0 (since the lenses are in contact).

Substituting these values, we get

=

, which is a negative value since the combination is diverging.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q195) Which of the following statements is true for a concave mirror?**

a) It always forms a virtual image.

b) The focal length is negative.

c) It always forms a real image.

d) It has a positive radius of curvature.

Correct Answer: Option (b)

Explanation: In a concave mirror, the reflecting surface is curved inwards. When a parallel beam of light falls on a concave mirror, the reflected rays converge at a point on the principal axis, known as the focus. The distance between the focus and the center of curvature is the focal length of the mirror. Since the center of curvature is in front of the mirror, the focal length is negative.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q196) In a glass prism, the angle of minimum deviation is found to be . The angle of the prism is:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: When a beam of light passes through a prism, it gets refracted twice: once when it enters the prism and again when it exits the prism. The amount of refraction depends on the angle of incidence and the refractive index of the prism. As the angle of incidence is changed, the angle of refraction also changes, and the beam of light undergoes deviation.

The minimum deviation occurs when the angle of deviation is smallest. This happens when the angle of incidence and the angle of emergence are equal. In this case, the angle of deviation is given by:

where i is the angle of incidence, e is the angle of emergence, and A is the angle of the prism.

In the case of minimum deviation, so we have:

Given that the angle of minimum deviation is 60°, we have:

We also know that the sum of the angles of a triangle is . In the case of a prism, the angle of the prism is the sum of the two base angles. Therefore, we have:

Simplifying this equation, we get:

Therefore, the angle of the prism is,

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q197) In Young's double-slit experiment, the distance between the slits is , and the distance between the slits and the screen is . If the distance between the central maximum and the fourth bright fringe is, then the wavelength of light used is:**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: In Young's double-slit experiment, light from a monochromatic source is split into two coherent beams by a double slit. The two beams interfere with each other to produce an interference pattern on a screen placed at a distance L from the double slit.

The spacing between the bright fringes in the interference pattern is given by:

where is the wavelength of light, L is the distance between the double slit and the screen, and D is the distance between the two slits.

The distance between the slits is given as , the distance between the slits and the screen is given as and the distance between the central maximum and the fourth bright fringe is given as We need to find the wavelength of light used.

The distance between the central maximum and the fourth bright fringe corresponds to three bright fringes, so we have:

Substituting the given values, we get:

Simplifying this equation, we get:

Therefore, the wavelength of light used is 625 nm.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q198) The focal length of a convex lens of refractive index n, when it is immersed in a liquid of refractive index is:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: When a convex lens is immersed in a liquid of refractive index , the effective refractive index of the lens changes from to . This is due to the change in the medium surrounding the lens. Therefore, the focal length of the lens in the liquid, f', can be calculated using the formula , where f is the original focal length of the lens in air.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q199)** **A concave lens always forms:**

a) Virtual, erect, and diminished image

b) Real, erect, and diminished image

c) Virtual, inverted, and magnified image

d) Real, inverted, and magnified image

Correct Answer: Option (a)

Explanation: A concave lens always forms a virtual, erect, and diminished image. This is because the diverging nature of the lens causes the light rays to spread out and appear to come from a point behind the lens. This point is the virtual image formed by the concave lens.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q200) In Young's double-slit experiment, the fringe width is given by:**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: In Young's double-slit experiment, the fringe width is given by the formula , where λ is the wavelength of light used, D is the distance between the slits and the screen, and d is the distance between the two slits. This formula tells us that the fringe width is directly proportional to the wavelength of light used and the distance between the slits and the screen, and inversely proportional to the distance between the slits.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q201) A beam of light is passed through a diffraction grating. If the distance between the two adjacent slits is reduced, what will happen to the diffraction pattern observed on the screen?**

a) The width of the central maximum will increase

b) The width of the central maximum will decrease

c) The intensity of the central maximum will decrease

d) The intensity of the central maximum will increase

Correct Answer: Option (b)

Explanation: The width of the central maximum will decrease. Diffraction gratings have a series of equally spaced slits that cause the incident light to diffract and form a diffraction pattern on a screen. The spacing between the slits determines the angle at which the diffracted light is observed. If the distance between the slits is reduced, the angle of diffraction will increase, and the width of the central maximum will decrease. This is because a smaller distance between the slits will lead to greater interference between the diffracted waves, resulting in a narrower central maximum.

Thus, the correct answer is Option (b).

Difficulty level- easy

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**Q202) Which of the following statements is true regarding a plane-polarized wave?**

a) The electric field vector oscillates in a single plane perpendicular to the direction of propagation

b) The magnetic field vector oscillates in a single plane perpendicular to the direction of propagation

c) Both the electric and magnetic field vectors oscillate in a single plane perpendicular to the direction of propagation

d) None of the above

Correct Answer: Option (a)

Explanation: The electric field vector oscillates in a single plane perpendicular to the direction of propagation. Plane-polarized light is a type of light in which the electric field vector of each individual photon oscillates in a single plane perpendicular to the direction of propagation. The magnetic field vector is also perpendicular to the direction of propagation, but it is in a plane that is perpendicular to the plane of polarization.

Thus, the correct answer is Option (a).

Difficulty level- easy

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**Q203) When a light beam is incident on a glass surface from air, which of the following phenomena occurs?**

a) Reflection and refraction both occur

b) Reflection occurs, but refraction does not

c) Refraction occurs, but reflection does not

d) Neither reflection nor refraction occurs

Correct Answer: Option (a)

Explanation: When a light beam is incident on a glass surface from air, some of the light is reflected back into the air, and some of it is refracted into the glass. The amount of light that is reflected or refracted depends on the angle of incidence, the refractive indices of the two media, and the polarization of the incident light.

Thus, the correct answer is Option (a).

Difficulty level- easy

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**Q204) The fringe width of a Young's double-slit experiment is 0.1 mm. If the distance between the slits is halved, the fringe width will be:**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: Fringe width, where is the wavelength of light, D is the distance between the slits and the screen, and d is the distance between the two slits.

If d is halved, becomes

So, new fringe width

Thus, the correct answer is Option (c).

Difficulty level- easy

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**Q205) The refractive index of a medium is 1.5. If the speed of light in vacuum is , the speed of light in the medium is:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The speed of light in a medium is given by where c is the speed of light in vacuum and n is the refractive index of the medium.

Substituting the given values, we get:

Thus, the correct answer is Option (a).

Difficulty level- easy

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**Q206) Which of the following statements is true about the interference of light waves?**

a) Constructive interference occurs when the path difference between two waves is equal to a multiple of their wavelength.

b) Destructive interference occurs when the path difference between two waves is equal to a multiple of their amplitude.

c) Interference occurs only when the light waves have the same polarization.

d) Interference occurs only when the light waves have the same frequency.

Correct Answer: Option (a)

Explanation: Constructive interference occurs when the path difference between two waves is equal to a multiple of their wavelength. In constructive interference, the crests of two waves coincide with each other, resulting in an increase in the amplitude of the resultant wave. This occurs when the path difference between the waves is equal to an integer multiple of the wavelength of the waves.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q207) What is the condition for constructive interference of two coherent sources?**

a) The path difference between the two waves should be an integral multiple of the wavelength.

b) The path difference between the two waves should be a non-integral multiple of the wavelength.

c) The path difference between the two waves should be half of the wavelength.

d) The path difference between the two waves should be double the wavelength.

Correct Answer: Option (a)

Explanation: Constructive interference occurs when the path difference between two waves is an integral multiple of the wavelength. This means that the crests and troughs of the waves will line up with each other, resulting in a maximum amplitude of the resultant wave.

Thus, the correct answer is Option (a).

Difficulty level- medium

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**Q208) Which of the following phenomena does not involve the interference of light waves?**

a) Diffraction

b) Polarization

c) Young's double-slit experiment

d) Newton's rings

Correct Answer: Option (b)

Explanation: Polarization is the process of restricting the direction of vibration of a transverse wave, such as light, by using a polarizer. It does not involve the interference of light waves. Diffraction, Young's double-slit experiment, and Newton's rings all involve the interference of light waves.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q209) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Wv09-xv6oM1E0Dmh3mLbfhdB0mNPsG7B/view?usp=share_link>

**Type: audio**

**What is wave optics?**

a) The study of the behavior of light in terms of particles.

b) The study of the behavior of light in terms of waves.

c) The study of the behavior of light in terms of both particles and waves.

d) None of the above.

Correct Answer: Option (b)

Explanation: The field of wave optics focuses on understanding the characteristics and properties of light by examining its behavior in terms of waves. It explains the properties of light such as diffraction, interference, and polarization in terms of wave phenomena.

Thus, the correct answer is Option (b).

Difficulty level- medium

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**Q210) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Wv09-xv6oM1E0Dmh3mLbfhdB0mNPsG7B/view?usp=share_link>

**Type: audio**

**What are some phenomena that demonstrate the wave nature of light?**

a) Diffraction, refraction, and scattering.

b) Interference, polarization, and scattering.

c) Diffraction, interference, and polarization.

d) Refraction, interference, and polarization.

Correct Answer: Option (c)

Explanation: When light interacts with obstacles or passes through openings, it can diffract, or bend around the edges of the obstacles or openings, creating a pattern of bright and dark regions on a screen. This phenomenon is known as diffraction and is a characteristic of wave behavior.

Thus, the correct answer is Option (c).

Difficulty level- medium

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**Q211) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Wv09-xv6oM1E0Dmh3mLbfhdB0mNPsG7B/view?usp=share_link>

**Type: audio**

**How can the behavior of light waves be described mathematically?**

a) Using Newton's laws of motion.

b) Using Einstein's theory of relativity.

c) Using Maxwell's equations.

d) Using Planck's law.

Correct Answer: Option (c)

Explanation: Maxwell's equations describe the behavior of light waves mathematically. They are a set of four partial differential equations that describe how electric and magnetic fields are generated and how they interact with each other and with charges and currents.

Thus, the correct answer is Option (c).

Difficulty level- medium

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**Q212) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Wv09-xv6oM1E0Dmh3mLbfhdB0mNPsG7B/view?usp=share_link>

**Type: audio**

**What is the speed of light in a medium dependent on?**

a) The wavelength of light.

b) The frequency of light.

c) The refractive index of the medium.

d) The density of the medium**.**

Correct Answer: Option (c)

Explanation: The speed of light in a medium is dependent on the refractive index of the medium. The refractive index is a measure of how much the speed of light is reduced in a medium compared to its speed in a vacuum.

Thus, the correct answer is Option (c).

Difficulty level- medium

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**Q213) Answer the following question with reference to the audio**

<https://drive.google.com/file/d/1Wv09-xv6oM1E0Dmh3mLbfhdB0mNPsG7B/view?usp=share_link>

**Type: audio**

**Which of the following is not a property of light explained by wave optics?**

a) Refraction

b) Polarization

c) Diffraction

d) Photoelectric effect

Correct Answer: Option (d)

Explanation: The photoelectric effect is not a property of light explained by wave optics. It is a phenomenon where electrons are emitted from a material when light of a certain frequency or higher is shone on it. It is explained using the particle nature of light.

Thus, the correct answer is Option (d).

Difficulty level- medium

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**Q214) What is the relation between the amplitude reflection coefficient (r) and the amplitude transmission coefficient (t) for an electromagnetic wave at the boundary of two dielectric media?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: The amplitude reflection coefficient (r) and the amplitude transmission coefficient (t) are related to each other for an electromagnetic wave at the boundary of two dielectric media by the principle of conservation of energy. When an electromagnetic wave passes from one medium to another, a portion of it is reflected back and the remaining portion is transmitted through the second medium.

The amplitude reflection coefficient (r) is defined as the ratio of the amplitude of the reflected wave to the amplitude of the incident wave. Similarly, the amplitude transmission coefficient (t) is defined as the ratio of the amplitude of the transmitted wave to the amplitude of the incident wave.

The relationship between the amplitude reflection coefficient (r) and the amplitude transmission coefficient (t) can be derived using the boundary conditions for the electromagnetic fields at the interface of the two dielectric media. The boundary conditions require that the tangential components of the electric and magnetic fields be continuous across the interface.

Using these boundary conditions, it can be shown that the relationship between the amplitude reflection coefficient (r) and the amplitude transmission coefficient (t) is given by:

where and are the characteristic impedances of the two media, and are the angles of incidence and refraction respectively.

Simplifying the above equations, we get:

Thus, the correct answer is Option (d).

Difficulty level- very hard

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**Q215) Which of the following statements is true about the coherence length of a laser beam?**

a) It depends on the wavelength of the laser beam.

b) It is inversely proportional to the bandwidth of the laser beam.

c) It is directly proportional to the power of the laser beam.

d) It is independent of the polarization of the laser beam.

Correct Answer: Option (b)

Explanation: Coherence length is defined as the distance over which a beam of light maintains its coherence. It depends on the bandwidth of the light source, with narrower bandwidths leading to longer coherence lengths.

Thus, the correct answer is Option (b).

Difficulty level- hard

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**Q216) A light wave is propagating through a medium with refractive index n. What happens to the phase velocity and wavelength of the wave when it enters a medium with a higher refractive index?**

a) Phase velocity increases, wavelength increases.

b) Phase velocity increases, wavelength decreases.

c) Phase velocity decreases, wavelength increases.

d) Phase velocity decreases, wavelength decreases.

Correct Answer: Option (c)

Explanation: When a light wave enters a medium with a higher refractive index, its phase velocity decreases. This is because the speed of light is slower in a medium with a higher refractive index. The wavelength of the wave increases, as the frequency remains constant.

Thus, the correct answer is Option (c).

Difficulty level- hard

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**Q217) Which of the following statements is true about a diffraction grating?**

a) It produces a single slit diffraction pattern.

b) It produces a series of bright and dark fringes.

c) It produces a circular interference pattern.

d) It produces a straight line interference pattern.

Correct Answer: Option (b)

Explanation: A diffraction grating is a device that consists of many equally spaced parallel slits or rulings. When light is passed through a diffraction grating, it produces a series of bright and dark fringes due to interference of light waves from different slits.

Thus, the correct answer is Option (b).

Difficulty level- hard

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**Q218)** **A convex lens is placed in contact with a plane mirror. A light source is placed at a distance of 2f from the lens. Where will the final image be formed?**

a) At a distance of f from the lens on the same side as the light source.

b) At a distance of 2f from the lens on the same side as the light source.

c) At a distance of 2f from the lens on the opposite side as the light source.

d) At a distance of 4f from the lens on the same side as the light source.

Correct Answer: Option (b)

Explanation: When a convex lens is placed in contact with a plane mirror, the light rays from the object are first refracted by the lens and then reflected by the mirror. The image formed by the lens is virtual and located at a distance of 2f from the lens on the same side as the light source.

Thus, the correct answer is Option (b).

Difficulty level- hard

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**Q219) A convex lens of focal length f is placed at a distance of 2f from a point source of monochromatic light. The diffraction pattern is observed on a screen placed at a distance of 3f from the lens. What is the shape of the diffraction pattern?**

a) Circular

b) Elliptical

c) Rectangular

d) None of the above

Correct Answer: Option (a)

Explanation: When a convex lens is placed at a distance of 2f from a point source of monochromatic light, a spherical wave front is produced. The lens converges this wave front to form a point image at a distance of f from the lens. This point acts as the virtual source for the diffraction pattern.

Thus, the correct answer is Option (a).

Difficulty level- hard

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**Q220) A beam of light is incident on a glass prism at an angle of incidence of . The angle of deviation is found to be . What is the refractive index of the glass prism for the given wavelength of light?**

a) 1.73

b) 1.5

c) 1.6

d) 1.8

Correct Answer: Option (a)

Explanation: The formula for the refractive index of a glass prism is,

,

where A is the angle of incidence and D is the angle of deviation.

In this case, and ,

so

Thus, the correct answer is Option (a).

Difficulty level- hard

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**Q221) Which of the following experiments led to the discovery of the wave-particle duality of electrons?**

a) Compton scattering

b) Photoelectric effect

c) Davisson-Germer experiment

d) Rutherford's gold foil experiment

Correct Answer: Option (c)

Explanation: The Davisson-Germer experiment was conducted in 1927, where a beam of electrons was fired at a nickel crystal. The electrons were scattered off the crystal and produced an interference pattern, which indicated that electrons have wave-like properties. This experiment provided evidence for the wave-particle duality of electrons.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q222) Which of the following statements is true regarding de Broglie wavelength?**

a) It is associated with matter waves

b) It is inversely proportional to momentum

c) It is directly proportional to the mass of the particle

d) It is independent of the velocity of the particle

Correct Answer: Option (a)

Explanation: The de Broglie wavelength is associated with matter waves and is given by , where λ is the de Broglie wavelength, h is the Planck's constant, and p is the momentum of the particle. The de Broglie wavelength is inversely proportional to the momentum of the particle and is independent of the mass and velocity of the particle. It is a fundamental concept in quantum mechanics and is used to describe the wave-like behavior of particles.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q223) The de Broglie wavelength associated with a moving object depends on its:**

a) Mass and velocity

b) Charge and velocity

c) Spin and velocity

d) Energy and velocity

Correct Answer: Option (a)

Explanation: According to de Broglie's hypothesis, every moving object, including a particle with mass, exhibits wave-like behavior. The de Broglie wavelength () associated with a moving object is given by , where h is Planck's constant and p is the momentum of the object. Since momentum is defined as the product of mass and velocity , the de Broglie wavelength is dependent on the mass and velocity of the moving object.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q224) The threshold frequency for the photoelectric effect depends on the:**

a) Intensity of the incident light

b) Wavelength of the incident light

c) Velocity of the incident light

d) Frequency of the incident light

Correct Answer: Option (d)

Explanation: The photoelectric effect is the emission of electrons from a metal surface when it is exposed to light of a certain frequency or higher. The threshold frequency is the minimum frequency of the incident light required to produce the photoelectric effect. According to Einstein's photoelectric equation, the kinetic energy of the emitted electrons is given by , where h is Planck's constant and ν is the frequency of the incident light. Thus, the threshold frequency is dependent only on the frequency of the incident light, and not on its intensity, wavelength, or velocity.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q225) Which of the following phenomena cannot be explained by classical physics?**

a) Photoelectric effect

b) Compton effect

c) Diffraction

d) Interference

Correct Answer: Option (a)

Explanation: The photoelectric effect is the emission of electrons from a metal surface when light falls on it. Classical physics cannot explain this phenomenon because it considers light to be a wave and cannot explain the emission of electrons. The photoelectric effect can only be explained by quantum mechanics, which considers light to be made up of particles (photons) that carry energy.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q226) Answer the following with reference to the audio**

(<https://drive.google.com/file/d/1qXZHxzns-y0IKpYws5ZO8h2Wh9FYQMeS/view>)

**Type: Audio**

**What is the dual nature of radiation and matter?**

a) They exhibit properties of only waves.

b) They exhibit properties of only particles.

c) They exhibit properties of both waves and particles.

d) They exhibit properties of neither waves nor particles.

Correct Answer: Option (c)

Explanation: The dual nature of radiation and matter is a fundamental concept in quantum mechanics, which states that both matter and radiation exhibit properties of both waves and particles. This means that they can be described in terms of both wave-like and particle-like behavior. For example, light can exhibit wave-like properties such as diffraction and interference, but it also exhibits particle-like properties such as the ability to transfer energy in discrete packets known as photons. Similarly, matter particles such as electrons can exhibit wave-like properties, such as interference and diffraction, as well as particle-like properties, such as momentum and kinetic energy.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q227) Answer the following with reference to the audio**

(<https://drive.google.com/file/d/1qXZHxzns-y0IKpYws5ZO8h2Wh9FYQMeS/view>)

**Type: Audio**

**Who first proposed the concept of the dual nature of radiation and matter?**

a) Albert Einstein

b) Louis de Broglie

c) Max Planck

d) Erwin Schrödinger

Correct Answer: Option (b)

Explanation: In 1924, Louis de Broglie introduced the idea that both matter and radiation could exhibit wave-particle duality, suggesting that particles could exhibit wave-like properties. The Davisson-Germer experiment later confirmed this hypothesis by demonstrating that electrons could behave as waves when interacting with a crystal lattice.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q228) Answer the following with reference to the audio**

(<https://drive.google.com/file/d/1qXZHxzns-y0IKpYws5ZO8h2Wh9FYQMeS/view>)

**Type: Audio**

**How was the concept of the dual nature of matter confirmed?**

a) Through the photoelectric effect

b) Through the Compton Effect

c) Through the Davisson-Germer experiment

d) Through the Stern-Gerlach experiment

Correct Answer: Option (c)

Explanation: The concept of the dual nature of matter was confirmed through the Davisson-Germer experiment. In this experiment, a beam of electrons was directed at a crystal lattice. The electrons were diffracted by the lattice, producing a diffraction pattern on a detector screen. This diffraction pattern could only be explained if the electrons were behaving like waves. The experiment provided direct evidence for the wave-particle duality of matter, confirming de Broglie's hypothesis that matter particles, like electrons, can exhibit wave-like properties.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q229) Answer the following with reference to the audio**

(<https://drive.google.com/file/d/1qXZHxzns-y0IKpYws5ZO8h2Wh9FYQMeS/view>)

**Type:Audio**

**Which experiment showed that electrons can exhibit wave-like properties?**

a) The photoelectric effect

b) The Compton effect

c) The Davisson-Germer experiment

d) The Stern-Gerlach experiment

Correct Answer: Option (c)

Explanation: The Davisson-Germer experiment showed that electrons can exhibit wave-like properties. In this experiment, a beam of electrons was directed at a crystal lattice, which diffracted the electrons, producing a diffraction pattern on a detector screen. The diffraction pattern could only be explained if the electrons were behaving like waves. The experiment provided direct evidence for the wave-particle duality of matter, confirming de Broglie's hypothesis that matter particles, like electrons, can exhibit wave-like properties.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q230) Answer the following with reference to the audio**

(<https://drive.google.com/file/d/1qXZHxzns-y0IKpYws5ZO8h2Wh9FYQMeS/view>)

**Type: Audio**

**Why did Louis de Broglie propose the concept of the dual nature of matter?**

a) To explain the photoelectric effect

b) To explain the Compton effect

c) To explain the behavior of electrons in a crystal lattice

d) To explain the behavior of protons in a magnetic field

Correct Answer: Option (c)

Explanation: Louis de Broglie proposed the concept of the dual nature of matter in order to explain the behavior of electrons in a crystal lattice. He suggested that if light could exhibit both wave-like and particle-like behavior, then perhaps matter could as well. He hypothesized that electrons, which are particles of matter, could also exhibit wave-like properties, such as interference and diffraction, when they interact with a crystal lattice. The Davisson-Germer experiment later confirmed his hypothesis, providing direct evidence for the wave-particle duality of matter.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q231) Which of the following phenomena is used to demonstrate the wave-like nature of matter?**

a) The photoelectric effect

b) The Compton effect

c) Diffraction of electrons

d) The inverse square law

Correct Answer: Option (c)

Explanation: The diffraction of electrons is a phenomenon that demonstrates the wave-like nature of matter. This was demonstrated in the Davisson-Germer experiment, where a beam of electrons was directed at a crystal lattice and diffracted, producing a diffraction pattern on a detector screen. The diffraction pattern could only be explained if the electrons were behaving like waves.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q232) Which of the following phenomena is used to demonstrate the wave-particle duality of matter?**

a) The photoelectric effect

b) The Compton effect

c) The double-slit experiment

d) The Stern-Gerlach experiment

Correct Answer: Option (c)

Explanation: The double-slit experiment is a phenomenon that demonstrates the wave-particle duality of matter. In this experiment, a beam of particles, such as electrons, is directed at a screen with two narrow slits. The particles diffract through the slits and interfere with each other, producing an interference pattern on a detector screen. This interference pattern can only be explained if the particles are behaving like waves, with each particle passing through both slits and interfering with itself. The double-slit experiment is a key example of the wave-particle duality of matter, where particles can exhibit both wave-like and particle-like properties.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q233) Which of the following scientists made significant contributions to the development of the concept of wave-particle duality?**

a) Albert Einstein

b) Louis de Broglie

c) Max Planck

d) All of the above

Correct Answer: Option (d)

Explanation: Albert Einstein proposed the idea of the photon, which is a particle of light. Louis de Broglie proposed that matter particles, such as electrons, could also exhibit wave-like properties. Max Planck's work on blackbody radiation led to the development of quantum mechanics, which describes the behavior of both particles and waves on the atomic and subatomic level.

Thus, the correct answer is option (d).

Difficulty Level- Medium

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**Q234) Which of the following is a consequence of the wave-particle duality of matter?**

a) The uncertainty principle

b) The conservation of energy

c) The conservation of momentum

d) The law of conservation of mass

Correct Answer: Option (a)

Explanation: The wave-particle duality of matter is a fundamental concept in quantum mechanics, which describes the behavior of particles and waves on the atomic and subatomic level. One consequence of this duality is the uncertainty principle, which states that it is impossible to simultaneously measure certain pairs of physical properties, such as position and momentum, with arbitrary precision. This is because the act of measuring one property will disturb the other, due to the wave-like nature of particles. The uncertainty principle is a key feature of quantum mechanics, and has profound implications for our understanding of the physical world.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q235) Which of the following experiments provided evidence that light can behave as both a wave and a particle?**

a) The photoelectric effect

b) The Compton effect

c) The double-slit experiment

d) The Stern-Gerlach experiment

Correct Answer: Option (b)

Explanation: The Compton effect is an experiment that provides evidence for the wave-particle duality of light. In this experiment, X-rays are directed at a target, which causes the X-rays to scatter. The scattered X-rays have a longer wavelength and lower energy than the original X-rays, which is known as the Compton shift. This shift can only be explained if the X-rays are behaving as particles that collide with electrons in the target, but also as waves that undergo diffraction and interference. The Compton effect was one of the key pieces of evidence that led to the development of the wave-particle duality concept in quantum mechanics.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q236) Which of the following statements accurately describes the Heisenberg uncertainty principle?**

a) It states that the position and momentum of a particle can be measured simultaneously with absolute precision.

b) It states that the energy and momentum of a particle can be measured simultaneously with absolute precision.

c) It states that the position and momentum of a particle cannot be measured simultaneously with absolute precision.

d) It states that the energy and momentum of a particle cannot be measured simultaneously with absolute precision.

Correct Answer: Option (c)

Explanation: The Heisenberg uncertainty principle, proposed by Werner Heisenberg in 1927, states that it is fundamentally impossible to measure both the position and momentum of a particle with absolute precision at the same time. This is because the act of measuring one property will inevitably disturb the other property, making it impossible to know both values simultaneously. This principle is a key aspect of quantum mechanics and is essential to understanding the wave-particle duality of matter.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q237) Which of the following statements is true regarding the behavior of particles in a double-slit experiment?**

a) Particles always pass through one of the slits and create a single point of impact on the screen.

b) Particles always pass through both slits and create two distinct points of impact on the screen.

c) Particles can pass through either one of the slits or both and create an interference pattern on the screen.

d) Particles can pass through either one of the slits or both and create a diffraction pattern on the screen.

Correct Answer: Option (c)

Explanation: In a double-slit experiment, particles such as electrons or photons are fired at a screen with two slits in it. If the particles were behaving solely as particles, they would pass through one of the slits and create a single point of impact on the screen. However, if the particles exhibit wave-like behavior, they can pass through either one of the slits or both and create an interference pattern on the screen, which is characteristic of wave behavior. This phenomenon is explained by the wave-particle duality concept, where particles can exhibit wave-like behavior and interference patterns due to their wave-like nature.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q238) Which of the following is not a characteristic of photoelectric effect?**

a) Electrons are emitted only if the frequency of the incident radiation exceeds a certain threshold value.

b) The kinetic energy of the emitted electrons is directly proportional to the frequency of the incident radiation.

c) The number of electrons emitted is directly proportional to the intensity of the incident radiation.

d) The time lag between the incidence of radiation and the emission of electrons is independent of the intensity of the incident radiation.

Correct Answer: Option (d)

Explanation: The photoelectric effect is the phenomenon in which electrons are emitted from the surface of a metal when light falls on it. The characteristics of the photoelectric effect are:The number of electrons emitted is directly proportional to the intensity of the incident radiation. This statement is not true. The number of electrons emitted depends on the intensity of the incident radiation, but it is not directly proportional to it. As the intensity of the incident radiation increases, the number of photons incident on the metal surface increases, but each photon can only eject one electron. So, eventually, the number of electrons emitted saturates, even if the intensity continues to increase.

The time lag between the incidence of radiation and the emission of electrons depends on the intensity of the incident radiation. Higher intensity radiation leads to a shorter time lag between the incidence of radiation and the emission of electrons.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q239) Which of the following is not a characteristic of a photon?**

a) It has no mass.

b) It carries energy and momentum.

c) Its energy is directly proportional to its frequency.

d) It has a well-defined position and momentum.

Correct Answer: Option (d)

Explanation: Photons are elementary particles that have wave-particle duality. As a result, they can exhibit both wave-like and particle-like properties. Photons have zero rest mass and travel at the speed of light. They also carry energy and momentum, and their energy is directly proportional to their frequency. However, photons do not have a well-defined position and momentum, according to Heisenberg's uncertainty principle. The more precisely we know a photon's position, the less precisely we can know its momentum, and vice versa.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q240) An electron is accelerated by a potential difference of and then passed through a single slit of width . If the distance between the slit and the screen is , what is the approximate width of the electron diffraction pattern on the screen?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The de Broglie wavelength of the electron is given by , where h is Planck's constant and p is the momentum of the electron. The momentum of the electron after acceleration is , where m is the mass of the electron and E is the potential difference. Substituting the values, we get . The angular width of the diffraction pattern is given by , where D is the distance between the slit and the screen. Substituting the values, we get radians. The width of the diffraction pattern on the screen is then given by .

Thus, the correct answer is option (a).

Difficulty Level- Very Hard

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**Q241) The energy of an electron in an atom is quantized, which means that:**

a) The electron can have any energy value.

b) The energy of the electron can change continuously.

c) The energy of the electron can only take certain discrete values.

d) The energy of the electron is proportional to its mass.

Correct Answer: Option (c)

Explanation: These energy levels are determined by the interaction between the electron and the positively charged nucleus of the atom. When an electron absorbs energy, it can move to a higher energy level, or orbital, further from the nucleus. When it releases energy, it moves to a lower energy level, closer to the nucleus. However, the energy of the electron cannot be any arbitrary value between these levels, it must be one of the specific values determined by the quantum nature of the electron and its interaction with the nucleus.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q242) The maximum number of electrons that can occupy the first energy level of an atom is:**

a) 2

b) 8

c) 18

d) 32

Correct Answer: Option (a)

Explanation: The maximum number of electrons that can occupy the first energy level of an atom is 2, which is determined by the number of orbitals available in the first energy level. The first energy level has only one s orbital, which can hold up to 2 electrons. This is known as the 1s subshell, and it is the closest to the nucleus. Any additional electrons would occupy higher energy levels with more orbitals and subshells available.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q243) The isotopes of an element have:**

a) Different atomic numbers and the same number of neutrons.

b) The same atomic number and the same number of neutrons.

c) Different atomic numbers and different numbers of neutrons.

d) The same atomic number and different numbers of neutrons.

Correct Answer: Option (d)

Explanation: Isotopes of an element have the same atomic number, which determines the identity of the element, but they can have different numbers of neutrons, which leads to variations in the atomic mass.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q244) Which of the following statements about the atomic number is true?**

a) It is equal to the number of electrons in the atom.

b) It is equal to the number of protons in the atom.

c) It is equal to the sum of the number of protons and neutrons in the atom.

d) It is equal to the number of neutrons in the atom.

Correct Answer: Option (b)

Explanation: The atomic number is a fundamental property of an element that determines its identity. It is the number of protons in the nucleus of an atom and is unique for each element. Since the number of protons in an atom is equal to the number of electrons surrounding the nucleus, the atomic number also represents the number of electrons in a neutral atom.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q245) What is the maximum number of electrons that can occupy the second energy level of an atom?**

a) 2

b) 8

c) 18

d) 32

Correct Answer: Option (b)

Explanation: The maximum number of electrons that can occupy a specific energy level in an atom can be calculated using the formula , where n is the principal quantum number of the energy level.

For the second energy level, which has a principal quantum number of , the maximum number of electrons that can occupy this level is:

Therefore, the maximum number of electrons that can occupy the second energy level of an atom is 8, which corresponds to the number of electrons in the second shell. This means that the second energy level can hold up to 8 electrons before it is completely filled, and any additional electrons will move to higher energy levels.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q246) Which of the following is the correct electronic configuration of a chlorine atom?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The electronic configuration of chlorine can be determined by filling electrons in the increasing order of energy levels and sub-levels, according to the Aufbau principle. The first two electrons of chlorine occupy the 1s sub-level, the next two electrons occupy the 2s sub-level, the next six electrons occupy the 2p sub-level, the next two electrons occupy the 3s sub-level, and the last five electrons occupy the 3p sub-level. Therefore, the correct electronic configuration of a chlorine atom is .

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q247) Which of the following is the correct electronic configuration of a nitrogen ion with a charge of -3?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: An ion is formed when an atom gains or losses electrons, and its electronic configuration changes accordingly. In this case, a nitrogen ion with a charge of means that it has gained three electrons. Nitrogen has an atomic number of , which means it normally has electrons in its neutral state.

The three electrons fill the 2p sub-level, and the correct electronic configuration of a nitrogen ion with a charge of is .

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q248) What is the term used to describe the attraction between a cation and an anion?**

a) Covalent bonding

b) Ionic bonding

c) Metallic bonding

d) Hydrogen bonding

Correct Answer: Option (b)

Explanation: Ionic bonding is a type of chemical bond formed between two ions with opposite charges. This type of bonding typically occurs between a metal and a non-metal, where the metal loses one or more electrons to become a positively charged ion (cation) and the non-metal gains one or more electrons to become a negatively charged ion (anion). The attraction between the oppositely charged ions results in the formation of an ionic bond. This type of bonding is characterized by the transfer of electrons from one atom to another.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q249) Which of the following statements is true about the Rutherford model of the atom?**

a) Electrons orbit around the nucleus in fixed circular paths

b) Electrons are distributed uniformly throughout the atom

c) Electrons move around the nucleus in random paths

d) Electrons move in elliptical paths around the nucleus

Correct Answer: Option (c)

Explanation: In the Rutherford model of the atom, electrons are not restricted to fixed circular paths around the nucleus. Instead, they move in random paths, somewhat like planets orbiting around the sun. Rutherford proposed that electrons orbit the nucleus in a way that is similar to how comets move through the solar system, with elliptical or irregular paths.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q250) Which of the following statements about the Pauli exclusion principle is true?**

a) It states that no two electrons in an atom can have the same four quantum numbers.

b) It states that no two electrons in an atom can have the same three quantum numbers.

c) It states that no two electrons in an atom can have the same two quantum numbers.

d) It states that no two electrons in an atom can have the same spin quantum number.

Correct Answer: Option (a).

Explanation: The Pauli exclusion principle is a fundamental principle in quantum mechanics that states that no two electrons in an atom can have the same set of four quantum numbers. This principle helps to explain the electronic structure of atoms and the arrangement of electrons in different orbitals.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q251) What is the total number of electrons that can have the quantum numbers , , , and ?**

a) 2

b) 4

c) 6

d) 8

Correct Answer: Option (a)

Explanation: The quantum numbers correspond to a specific electron in an atom.

The principal quantum number (n) indicates the energy level or shell that the electron belongs to, which is the fourth energy level in this case. The azimuthal quantum number (l) indicates the shape of the orbital, which is a p orbital with . The magnetic quantum number (m) indicates the orientation of the orbital, which is along the z-axis (). The spin quantum number (s) indicates the spin of the electron, which is.

According to the Pauli exclusion principle, each orbital can hold a maximum of two electrons, with opposite spins. Therefore, the total number of electrons that can have the quantum numbers .

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q252) What is the relationship between the wavelength of an electron and its momentum?**

a) The wavelength of an electron is proportional to its momentum.

b) The wavelength of an electron is inversely proportional to its momentum.

c) The wavelength of an electron is independent of its momentum.

d) The wavelength of an electron and its momentum are not related.

Correct Answer: Option (b)

Explanation: The wavelength of an electron is inversely proportional to its momentum, according to de Broglie's equation , where λ is the wavelength, h is Planck's constant, and p is the momentum of the electron. As the momentum of the electron increases, its wavelength decreases.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q253) What is the de Broglie wavelength of an electron with a kinetic energy of 100 eV?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The de Broglie wavelength of an electron with a kinetic energy of 100 eV can be calculated using the formula where h is the Planck constant and p is the momentum of the electron. The momentum of the electron can be calculated using the formula , where m is the mass of the electron and K is the kinetic energy. Substituting the values, we get

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q254) In a hydrogen-like atom, an electron jumps from the to energy level. What is the wavelength of the photon emitted during this transition?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The wavelength of the photon emitted during the transition of an electron from the to energy level in a hydrogen-like atom can be calculated using the formula:

Where λ is the wavelength, h is Planck's constant, c is the speed of light, and is the energy difference between the initial and final energy levels.

The energy difference between the and energy levels is:

Converting eV to Joules, we get:

Plugging in the values of h and c, we get:

Simplifying, we get:

Therefore, the wavelength of the photon emitted during the transition is .

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q255) Which of the following statements about the Bohr model of the atom is incorrect?**

a) Electrons move in circular orbits around the nucleus.

b) Electrons can only exist in certain energy levels.

c) Electrons emit or absorb energy as they move between energy levels.

d) The Bohr model accurately describes the behavior of electrons in all types of atoms.

Correct Answer: Option (d)

Explanation: The Bohr model of the atom was proposed by Niels Bohr in 1913. It suggested that electrons move in circular orbits around the nucleus and can only exist in certain energy levels. As electrons move between energy levels, they emit or absorb energy in the form of electromagnetic radiation. While the model worked well for hydrogen, it failed to explain the behavior of more complex atoms. Later, the quantum mechanical model was developed, which is more accurate and can describe the behavior of electrons in all types of atoms.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q256) Which of the following is a correct statement about the excited state of an atom?**

a) The excited state has lower energy than the ground state.

b) The excited state has higher energy than the ground state.

c) The excited state has the same energy as the ground state.

d) The excited state is always unstable.

Correct Answer: Option (b)

Explanation: When an electron in an atom gains energy, it can move from its ground state to a higher energy level or excited state. In the excited state, the electron is farther from the nucleus and has more energy. This higher energy state is not stable, and the electron will eventually return to its ground state by releasing the extra energy in the form of a photon.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q257) Which of the following is a correct statement about ionic bonds?**

a) Ionic bonds result from the sharing of electrons between atoms.

b) Ionic bonds result from the transfer of electrons from one atom to another.

c) Ionic bonds result from the attraction between two positively charged ions.

d) Ionic bonds result from the attraction between two negatively charged ions.

Correct Answer: Option (b)

Explanation: Ionic bonding is a type of chemical bonding that results from the transfer of electrons from one atom to another. One atom loses one or more electrons to become a positively charged ion (cation), while another atom gains one or more electrons to become a negatively charged ion (anion). The resulting ions are then attracted to each other due to their opposite charges, forming an ionic bond.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q258) Which of the following molecules has a linear shape?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: In , there are two double bonds between the carbon atom and each oxygen atom. The arrangement of these atoms around the central carbon atom is symmetrical, with the carbon-oxygen-oxygen bond angle being 180 degrees. Therefore, the molecule has a linear shape.

In contrast, has a trigonal pyramidal shape, has a tetrahedral shape, and has a bent or V-shape.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q259) What is the wavelength of a photon emitted when an electron in a hydrogen atom undergoes a transition from the to the energy level?**

a)

b)

c)

d)

Correct Answer: Option (d)

Explanation: The wavelength of the photon emitted can be calculated using the Rydberg formula:

where is the Rydberg constant for hydrogen Plugging in the values, we get:

When an electron in a hydrogen atom transitions from a higher energy level to a lower energy level it emits energy in the form of a photon. The wavelength of this photon can be calculated using the Rydberg formula, which relates the wavelengths of spectral lines to the energy levels of the atom.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q260) The figure below shows the energy level diagram for a helium atom.**

**(**[**https://drive.google.com/file/d/1HtV1EiKEs13a8wYG5DG4AYkLnCmv1ZIA/view**](https://drive.google.com/file/d/1HtV1EiKEs13a8wYG5DG4AYkLnCmv1ZIA/view)**)**

**Type: Image**

**Which of the following transitions will result in the emission of radiation with the longest wavelength?**

a) Transition A to B

b) Transition B to C

c) Transition C to D

d) Transition D to E

Correct Answer: Option (a)

Explanation: The energy difference between two levels is given by the formula , where h is Planck's constant and f is the frequency of radiation emitted. Since the frequency of radiation is inversely proportional to its wavelength, the transition with the longest wavelength will have the smallest energy difference. From the diagram, we can see that the energy difference between level A and B is the smallest, so the radiation emitted during this transition will have the longest wavelength.

Thus, the correct answer is option (a).

Difficulty Level- Very Hard

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**Q261) What is the mass defect?**

a) The difference between the mass of the nucleus and the sum of the masses of its constituent particles.

b) The difference between the mass of the nucleus and the mass of the neutron.

c) The difference between the mass of the proton and the mass of the electron.

d) The difference between the mass of the nucleus and the mass of the electron.

Correct Answer: Option (a)

Explanation: The mass defect is the difference between the mass of the nucleus and the sum of the masses of its constituent particles, which is caused by the conversion of some mass into energy during the formation of the nucleus.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q262) What is the nuclear force?**

a) A force that holds the electrons in the atom.

b) A force that holds the protons and neutrons in the nucleus.

c) A force that causes radioactive decay.

d) A force that causes fusion reactions.

Correct Answer: option (b)

Explanation: The nuclear force is a strong force that exists between protons and neutrons in the nucleus of an atom. It is responsible for binding the protons and neutrons together, overcoming the electrostatic repulsion between positively charged protons. The nuclear force is one of the four fundamental forces of nature, and it is the strongest force known to exist. It acts over very short distances, typically only a few femtometers, and is attractive over these distances but becomes repulsive at even shorter distances. The nuclear force is responsible for the stability of atomic nuclei, and without it, the protons would repel each other and the nucleus would fall apart.

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q263) What is the unit of activity of a radioactive substance?**

a) Joule

b) Becquerel

c) Coulomb

d) Tesla

Correct Answer: Option (b)

Explanation: The activity of a radioactive substance is a measure of the rate at which it undergoes radioactive decay. It is expressed in terms of the number of decays that occur per unit time. The SI unit of activity is the Becquerel (Bq), which is defined as one decay per second. Another commonly used unit of activity is the Curie (Ci), which is defined as the activity of one gram of radium-226 and is equal to .

Thus, the correct answer is option (b).

Difficulty Level- Easy

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**Q264) What is the principle behind carbon dating?**

a) The decay of carbon-14 to nitrogen-14.

b) The decay of uranium-238 to lead-206.

c) The decay of potassium-40 to argon-40.

d) The decay of rubidium-87 to strontium-87.

Correct Answer: Option (a)

Explanation: Carbon dating is a method used to determine the age of organic materials by measuring the amount of carbon-14 present in them. Carbon-14 is a radioactive isotope of carbon, which decays over time to nitrogen-14 with a half-life of 5730 years. By measuring the ratio of carbon-14 to carbon-12 in a sample, the age of the sample can be calculated.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q265) What is the value of Avogadro's number?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: Avogadro's number is a fundamental constant in chemistry and physics that represents the number of constituent particles (such as atoms, molecules, or ions) in one mole of a substance. It is denoted by the symbol "N" or "" and has a value of approximately particles per mole. This number is essential in many chemical and physical calculations, such as determining the number of atoms in a sample or the number of molecules in a chemical reaction.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q266) What is the difference between nuclear fission and nuclear fusion?**

a) Nuclear fission involves the combination of two small nuclei, while nuclear fusion involves the splitting of a large nucleus.

b) Nuclear fission releases energy, while nuclear fusion consumes energy.

c) Nuclear fission is the process that powers the sun, while nuclear fusion is the process that powers nuclear reactors.

d) Nuclear fission involves the splitting of a large nucleus, while nuclear fusion involves the combination of two small nuclei.

Correct Answer: Option (d)

Explanation: Nuclear fission is the process in which a heavy nucleus is split into two lighter nuclei, accompanied by the release of a large amount of energy. Nuclear fusion, on the other hand, is the process in which two light nuclei combine to form a heavier nucleus, also accompanied by the release of a large amount of energy.

Thus, the correct answer is option (d).

Difficulty Level- Medium

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**Q267) Which of the following is an example of artificial transmutation?**

a) Alpha decay

b) Beta decay

c) Gamma decay

d) Neutron bombardment

Correct Answer: Option (d)

Explanation: Artificial transmutation is the process of inducing nuclear reactions by bombarding a nucleus with a particle such as a neutron, proton, or alpha particle. Neutron bombardment is an example of artificial transmutation.

Thus, the correct answer is option (d).

Difficulty Level- Medium

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**Q268) What is the difference between mass defect and binding energy?**

a) Mass defect is the difference between the mass of an atom and the sum of the masses of its constituent particles, while binding energy is the energy required to break apart an atomic nucleus.

b) Mass defect is the energy released when an atomic nucleus is formed, while binding energy is the energy required to form an atomic nucleus.

c) Mass defect is the energy released when an atomic nucleus undergoes radioactive decay, while binding energy is the energy required to cause radioactive decay.

d) Mass defect and binding energy are the same thing.

Correct Answer: Option (a)

Explanation: Mass defect is the difference between the mass of an atom and the sum of the masses of its constituent particles (protons, neutrons, and electrons). This difference arises due to the conversion of some mass into energy during the formation of the nucleus. Binding energy, on the other hand, is the energy required to break apart an atomic nucleus into its constituent particles. It is a measure of the strength of the nuclear force that holds the nucleus together. The mass defect and the binding energy are related by Einstein's famous equation , where E is the binding energy, m is the mass defect, and c is the speed of light.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q269) Which of the following statements is true about the binding energy per nucleon in a nucleus?**

a) It decreases as the atomic number increases.

b) It is maximum for nuclei with mass number A around 56.

c) It is equal to the energy required to remove a proton from the nucleus.

d) It is directly proportional to the nuclear radius.

Correct Answer: Option (b)

Explanation: The binding energy per nucleon is the energy required to completely separate a nucleus into its individual protons and neutrons. It is a measure of the stability of a nucleus and is important in nuclear physics and chemistry. Experimental measurements show that the binding energy per nucleon is maximum for nuclei with mass number A around 56, which corresponds to the element iron. As the atomic number increases, the electrostatic repulsion between the protons becomes stronger, which decreases the binding energy per nucleon. Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q270) Which of the following particles can cause ionization indirectly?**

a) Alpha particle

b) Beta particle

c) Gamma ray

d) Neutron

Correct Answer: Option (c)

Explanation: Gamma rays are electromagnetic radiation emitted by the nucleus, often in association with alpha or beta decay. They have high energy and no charge, which allows them to penetrate matter and cause ionization indirectly by interacting with atoms or molecules along their path. This can lead to the ejection of electrons, the formation of excited states, and the creation of free radicals or ions. Alpha and beta particles, on the other hand, cause ionization directly by colliding with atoms and losing energy through Coulomb interactions. Neutrons can also cause ionization indirectly by inducing nuclear reactions or generating secondary radiation.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q271) What is the fundamental force responsible for the binding of nucleons in the nucleus?**

a) Electromagnetic force

b) Gravitational force

c) Strong nuclear force

d) Weak nuclear force

Correct Answer: Option (c)

Explanation: The strong nuclear force is the fundamental force responsible for the binding of nucleons (protons and neutrons) in the nucleus. This force is stronger than the electromagnetic force, which causes repulsion between the positively charged protons in the nucleus, and overcomes the gravitational force, which is negligible at the atomic scale.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q272) What is the principle behind carbon dating?**

a) Radioactive decay of carbon-14

b) Nuclear fusion of carbon-12

c) Nuclear fission of carbon-14

d) Alpha decay of carbon-14

Correct Answer: Option (a)

Explanation: Carbon dating is a method used to determine the age of organic materials based on the radioactive decay of carbon-14, which is a radioactive isotope of carbon. Carbon-14 is continuously produced in the Earth's atmosphere by cosmic ray bombardment and is taken up by living organisms during their lifetime. After the organism dies, the carbon-14 gradually decays back into nitrogen-14, and by measuring the remaining amount of carbon-14, the age of the material can be determined.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q273) What is the energy equivalent of 1 amu?**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: According to Einstein's famous equation the energy equivalent of a mass m is given by where c is the speed of light. 1 atomic mass unit (amu) is defined as one-twelfth of the mass of a carbon-12 atom, which is . Therefore, the energy equivalent of 1 amu is given by . However, since we often use a convenient unit called the electron volt (eV) in atomic and nuclear physics, the energy equivalent of 1 amu is approximately 931 MeV (million electronvolts), or

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q274) The figure below shows the graph of binding energy per nucleon vs. mass number for various nuclei.**

**(**[**https://drive.google.com/file/d/1YEK50Ux3m6q92gzpOTHnMPC8cUPKPyUx/view**](https://drive.google.com/file/d/1YEK50Ux3m6q92gzpOTHnMPC8cUPKPyUx/view)**)**

**Type: Image**

**Which of the following statements is true based on this graph?**

a) The most stable nucleus has a mass number around 50.

b) The most stable nucleus has a mass number around 100.

c) The most stable nucleus has a mass number around 200.

d) The most stable nucleus has a mass number around 300.

Correct Answer: Option (a)

Explanation: The binding energy per nucleon is the energy required to break apart the nucleus into its individual nucleons. A higher value of binding energy per nucleon indicates that the nucleus is more stable.

From the graph, we can see that the binding energy per nucleon is highest for nuclei with mass number around 60-70 and 130-140. Therefore, the most stable nuclei have a mass number around 70 and 140.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q275) What is the Q-value of a nuclear reaction?**

a) The energy released or absorbed in the reaction.

b) The number of particles emitted in the reaction.

c) The probability of the reaction occurring.

d) The time taken for the reaction to occur.

Correct Answer: Option (a)

Explanation: The Q-value of a nuclear reaction is the energy released or absorbed in the reaction. The Q-value is a measure of the net energy change that occurs during a nuclear reaction. It is determined by calculating the difference between the total initial mass-energy and the total final mass-energy of the particles involved in the reaction, using Einstein's famous equation . If the Q-value is positive, the reaction releases energy, while if it is negative, the reaction absorbs energy. The Q-value is an important parameter in determining the feasibility and energetics of nuclear reactions, and it is used in a variety of applications, including nuclear power generation and nuclear weapons.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q276) The binding energy per nucleon for 238U is 7.57 MeV. Calculate the binding energy of the nucleus.**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: The binding energy per nucleon is the energy required to separate a nucleus into its individual nucleons. To calculate the binding energy of the nucleus, we multiply the number of nucleons by the binding energy per nucleon.

For 238U, the number of nucleons is 238, so the binding energy is:

Therefore, the binding energy of the nucleus is approximately 1800 MeV.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q277) A radioactive sample has an initial activity of . After 5 half-lives, what will be the activity of the sample?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The activity of a radioactive sample decreases with time due to radioactive decay. The half-life is the time taken for the activity of the sample to decrease to half its initial value. After n half-lives, the activity of the sample will decrease to times its initial value.

In this case, the initial activity is 600 Bq and the sample undergoes 5 half-lives. So, the activity of the sample after 5 half-lives will be:

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q278) The activity of a radioactive substance is If the half-life of the substance is 10 days, what is the initial number of nuclei?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: The relationship between the activity (A) of a radioactive substance, the decay constant (λ), and the number of nuclei (N) is given by the equation The half-life is related to the decay constant by the equation

Using these equations, we can solve for the initial number of nuclei ():

where t is the time elapsed.

In this case, we have , and we want to find . We can first solve for the decay constant:

Then we can use the equation for :

Therefore, the initial number of nuclei is

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q279) A neutron of mass m is absorbed by a nucleus of mass M. If the final nucleus has a mass of , calculate the energy released in MeV.**

a)

b)

c)

d)

Correct Answer: Option (b)

Explanation: When a neutron is absorbed by a nucleus, the resulting nucleus may be in an excited state. This excess energy is released as gamma rays or as kinetic energy of the particles involved in the reaction.

The energy released in this reaction can be calculated using the equation:

where is the energy released, m is the mass of the neutron, M is the mass of the nucleus, and c is the speed of light.

Simplifying this equation, we get:

The mass defect in this case is . Using the mass-energy equivalence , we can convert the mass defect to energy:

Substituting the values, we get:

The negative sign indicates that energy is released in the reaction. To convert this to positive energy, we take the absolute value.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q280) The half-life of a radioactive isotope is 10 days. If the initial activity of a sample is , what will be its activity after 20 days?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The activity of a radioactive sample is given by , where is the initial activity, t is the time elapsed, and T is the half-life of the radioactive isotope.

Substituting the given values, we get

Thus, the correct answer is option (a).

Difficulty Level- Very Hard

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**Q281) Which of the following statements about intrinsic semiconductors is correct?**

a) They contain impurities that increase the number of charge carriers.

b) They are made by doping a pure semiconductor with a dopant material.

c) They have equal numbers of electrons and holes.

d) They conduct electricity better than extrinsic semiconductors.

Correct Answer: Option (c)

Explanation: Intrinsic semiconductors have equal numbers of electrons and holes, which are generated by thermal energy. This results in a balanced number of positive and negative charge carriers, and the conductivity of the material is limited.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q282) What is the effect of increasing temperature on the conductivity of a semiconductor?**

a) The conductivity increases.

b) The conductivity decreases.

c) The conductivity remains the same.

d) The conductivity first increases and then decreases.

Correct Answer: Option (a)

Explanation: When a semiconductor is heated, some of the electrons gain enough energy to break free from their covalent bonds and become free charge carriers. This increases the number of available charge carriers in the material, which results in an increase in conductivity. The increase in temperature also increases the mobility of the charge carriers, allowing them to move more easily through the material. Overall, as the temperature of a semiconductor increases, its conductivity also increases.

Thus, the correct answer is option (a).

Difficulty Level- Easy

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**Q283) Which of the following statements about diodes is correct?**

a) They allow current to flow in both directions.

b) They are made of p-type semiconductors only.

c) They are used as amplifiers.

d) They allow current to flow in one direction only.

Correct Answer: Option (d)

Explanation: Diodes are made of both p-type and n-type semiconductors, and they allow current to flow in one direction only. They are commonly used in rectifiers to convert AC to DC.

Thus, the correct answer is option (d).

Difficulty Level- Easy

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**Q284) Which of the following statements about transistors is correct?**

a) They are made of only one type of semiconductor material.

b) They are used to regulate voltage.

c) They have three terminals.

d) They allow current to flow in both directions.

Correct Answer: Option (c)

Explanation: Transistors are three-terminal semiconductor devices that are used in electronic circuits as amplifiers or switches. The three terminals of a transistor are the emitter, the base, and the collector. The emitter is the terminal that emits electrons or holes, while the collector is the terminal that collects them. The base is the control terminal that regulates the flow of current between the emitter and the collector. Transistors are made of two types of semiconductors, p-type and n-type, and they can be arranged in different configurations to achieve different functions, such as amplification, switching, and voltage regulation. Overall, the three-terminal structure of transistors allows them to perform a wide range of functions in electronic circuits.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q285) Which of the following is a common application of a p-n junction?**

a) Amplification of electrical signals.

b) Conversion of AC to DC.

c) Creation of a solar cell.

d) Storage of electrical charge.

Correct Answer: Option (c)

Explanation: A p-n junction is created when a p-type semiconductor is joined with an n-type semiconductor. This type of junction is commonly used in the creation of solar cells, which convert sunlight into electrical energy.

Thus, the correct answer is option (c).

Difficulty Level- Easy

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**Q286) What is the purpose of doping a semiconductor?**

a) To create more energy bands.

b) To make it a better insulator.

c) To increase its conductivity.

d) To decrease its conductivity.

Correct Answer: Option (c)

Explanation: Doping a semiconductor involves intentionally introducing impurities into the material to alter its electrical properties. This is done to increase its conductivity and create a either p-type or n-type semiconductors.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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**Q287) Which of the following statements is true for an intrinsic semiconductor at absolute zero temperature?**

a) The concentration of electrons is equal to the concentration of holes.

b) The concentration of electrons is higher than the concentration of holes.

c) The concentration of holes is higher than the concentration of electrons.

d) The semiconductor behaves as an insulator.

Correct Answer: Option (a)

Explanation: At absolute zero temperature, all electrons are in the valence band and there are no electrons in the conduction band. Thus, the concentration of electrons and holes is the same.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q288) Which of the following is the correct expression for the drift velocity of charge carriers in a semiconductor under an electric field?**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: This is the expression () for the drift velocity of charge carriers in a semiconductor under an electric field. Vd is the drift velocity, μ is the mobility of the charge carrier, and E is the electric field strength.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q289) Which of the following is the correct expression for the intrinsic concentration of electrons in a semiconductor at a certain temperature?**

a)

b)

c)

d)

Correct Answer: Option (c)

Explanation: is the expression for the intrinsic concentration of electrons in a semiconductor at a certain temperature. is the intrinsic carrier concentration, and are the effective density of states in the valence and conduction bands, is the bandgap energy, k is the Boltzmann constant, and T is the absolute temperature.

Thus, the correct answer is option (c).

Difficulty Level- Hard

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**Q290) The intrinsic carrier concentration ni of a semiconductor at a certain temperature T is given by , where and are the effective density of states in the conduction and valence bands, respectively, is the bandgap energy, k is the Boltzmann constant, and T is the absolute temperature. If the temperature is increased, what happens to the intrinsic carrier concentration ?**

a) It decreases

b) It increases

c) It remains the same

d) It cannot be determined

Correct Answer: Option (b)

Explanation: As the temperature increases, more electrons are thermally excited from the valence band to the conduction band, resulting in an increase in the number of intrinsic carriers and hence an increase in .

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q291) The mobility of a charge carrier in a semiconductor is given by , where is the charge of the carrier, is the relaxation time, and is the effective mass of the carrier. If the relaxation time is increased, what happens to the mobility ?**

a) It decreases

b) It increases

c) It remains the same

d) It cannot be determined

Correct Answer: Option (b)

Explanation: The mobility of a charge carrier in a semiconductor is the measure of how easily the carrier moves through the material under the influence of an electric field. It is given by the ratio of the carrier's drift velocity to the applied electric field. The mobility is affected by the relaxation time, which is the average time between two consecutive collisions of the carrier with the lattice atoms of the semiconductor.

The equation shows that the mobility is inversely proportional to the relaxation time. Therefore, if the relaxation time is increased, the mobility of the carrier will also increase. This is because the carrier spends more time between collisions, allowing it to travel further and faster under the influence of the electric field. Conversely, if the relaxation time is decreased, the carrier will collide more frequently with the lattice atoms, reducing its mobility.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q292) Which of the following is not a characteristic of p-n junction diodes?**

a) They have a low resistance when forward-biased

b) They have a high resistance when reverse-biased

c) They are used as voltage regulators

d) They have a uniform doping throughout the structure

Correct Answer: Option (d)

Explanation: p-n junction diodes are made by doping a semiconductor material with impurities to create a region of excess holes (p-type) and a region of excess electrons (n-type). When these regions are brought into contact, a depletion region is formed at the junction, which acts as a barrier to the flow of current when the diode is reverse-biased. When the diode is forward-biased, the depletion region becomes thinner and allows current to flow easily. P-n junction diodes are used as voltage regulators due to their ability to maintain a nearly constant voltage drop across the diode under varying current conditions. The uniform doping throughout the structure is not a characteristic of p-n junction diodes, as they require specific doping patterns to create the p-type and n-type regions necessary for their function.

Thus, the correct answer is option (d).

Difficulty Level- Hard

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**Q293) The reverse breakdown voltage of a diode:**

a) Increases with increasing temperature

b) Decreases with increasing temperature

c) Remains constant with increasing temperature

d) Depends on the type of semiconductor

Correct Answer: Option (b)

Explanation: The reverse breakdown voltage of a diode is the voltage at which it breaks down and allows current to flow in the reverse direction. The breakdown voltage decreases with increasing temperature due to the increase in thermal generation of free charge carriers. This can lead to an increase in the reverse leakage current and a decrease in the breakdown voltage.

Thus, the correct answer is option (b).

Difficulty Level- Hard

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**Q294) The current through a diode can be approximated by the equation:**

a)

b)

c)

d)

Correct Answer: Option (a)

Explanation: The current-voltage relationship for a diode can be approximated by the Shockley diode equation, which relates the diode current I to the voltage V across the diode. The equation is given by:

where is the reverse saturation current, q is the charge of an electron, k is Boltzmann's constant, and T is the temperature in Kelvin. This equation describes the exponential relationship between the current and voltage in a diode.

Thus, the correct answer is option (a).

Difficulty Level- Hard

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**Q295) The following diagram represents a p-n junction diode.**

(<https://drive.google.com/file/d/1lj2abB2M-ZnX8s6X8t3Xy5LCYiCWVDAo/view>)

**Type: Image**

**Which of the following statements is correct?**

a) The arrow represents the direction of current flow in the diode.

b) The n-type material is connected to the positive terminal of the battery.

c) The p-type material is connected to the negative terminal of the battery.

d) The diode is in reverse bias.

Correct Answer: Option (d)

Explanation: The direction of the arrow in the p-n junction diode diagram represents the direction of the conventional current flow when the diode is forward biassed. However, in this diagram, the arrow points away from the positive terminal of the battery, indicating that the diode is in reverse bias. In reverse bias, the width of the depletion region increases, and the diode acts as an insulator.

Thus, the correct answer is option (d).

Difficulty Level- Very Hard

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**Q296) Answer the following with reference to the audio**

**(**[**https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share\_link**](https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share_link)**)**

**Type: Audio**

**What are intrinsic semiconductors?**

a) Semiconductors that contain impurities

b) Semiconductors that are pure and have a small number of free electrons and holes

c) Semiconductors that are highly conductive

d) Semiconductors that have a high number of free electrons and holes

Correct Answer: Option (b)

Explanation: Intrinsic semiconductors are pure materials, such as silicon or germanium, that have a well-defined crystal lattice structure. Due to their structure, they have a small number of free electrons and holes, which contribute to their electrical conductivity. These free electrons and holes are created by thermal energy and are known as intrinsic carriers. Intrinsic semiconductors are also known as "undoped" or "pure" semiconductors, as they do not contain any impurities that could alter their electrical properties.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q297) Answer the following with reference to the audio**

**(**[**https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share\_link**](https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share_link)**)**

**Type: Audio**

**What is doping?**

a) The process of introducing impurities into a semiconductor

b) The process of removing impurities from a semiconductor

c) The process of heating a semiconductor to high temperatures

d) The process of cooling a semiconductor to low temperatures

Correct Answer: Option (a)

Explanation: Doping is the process of introducing impurities (dopants) into a pure semiconductor material to alter its electrical properties. This process is typically accomplished by adding small amounts of elements such as boron, phosphorus, or arsenic to the semiconductor material. The added impurities create a region of excess electrons (n-type doping) or holes (p-type doping) in the semiconductor, which can be used to create p-n junctions and other electronic devices. Doping is a crucial technique in modern electronics, as it allows for the precise control of the electrical properties of semiconductor materials, making them highly useful for a wide range of applications.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q298) Answer the following with reference to the audio**

**(**[**https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share\_link**](https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share_link)**)**

**Type: Audio**

**How does doping affect the electrical conductivity of a semiconductor?**

a) It decreases the electrical conductivity

b) It increases the electrical conductivity

c) It has no effect on the electrical conductivity

d) It makes the semiconductor insulating

Correct Answer: Option (b)

Explanation: Doping refers to the intentional introduction of impurities into a semiconductor, which can increase the number of free electrons and holes available for conduction, thereby increasing its electrical conductivity. This is because the added impurities create energy levels within the band gap of the semiconductor, which allow for easier movement of charge carriers.

Thus, the correct answer is option (b).

Difficulty Level- Medium

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**Q299) Answer the following with reference to the audio**

**(**[**https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share\_link**](https://drive.google.com/file/d/1pYIHykWiQRnS6DkYNQ2iOxlVpbalD-ry/view?usp=share_link)**)**

**Type: Audio**

**What are the two types of doped semiconductors?**

a) N-type and P-type

b) D-type and P-type

c) N-type and S-type

d) D-type and S-type

Correct Answer: Option (a)

Explanation: N-type and P-type are the two types of doped semiconductors. Doping is the process of intentionally adding impurities (dopants) to a pure semiconductor material to modify its electrical properties. When a small amount of an element with more valence electrons than the host semiconductor (such as phosphorus) is added, it creates an excess of electrons, resulting in an N-type semiconductor. Conversely, when a small amount of an element with fewer valence electrons (such as boron) is added, it creates a shortage of electrons, resulting in a P-type semiconductor. These two types of doped semiconductors are essential in the operation of many electronic devices, including transistors, diodes, and solar cells.

Thus, the correct answer is option (a).

Difficulty Level- Medium

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**Q300) Answer the following with reference to the audio**

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**Type: Audio**

**What is the process of diffusion in doped semiconductors?**

a) The intentional addition of impurities during crystal growth

b) The intentional addition of impurities after crystal growth

c) The process of allowing impurities to naturally migrate through the semiconductor crystal

d) The process of removing impurities from the semiconductor crystal

Correct Answer: Option (c)

Explanation: Diffusion is the process of allowing impurities to naturally migrate through the semiconductor crystal after they have been introduced. This process can be used to create doped regions with specific electrical properties in the semiconductor.

Thus, the correct answer is option (c).

Difficulty Level- Medium

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