ICSE SEMESTER 2 EXAMINATION

SAMPLE PAPER - 3

PHYSICS

(SCIENCE PAPER 1)

Maximum Marks: 40

Time allowed: One and a half hours

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 10 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

*Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*

SECTION A

*(Attempt **all** questions.)*
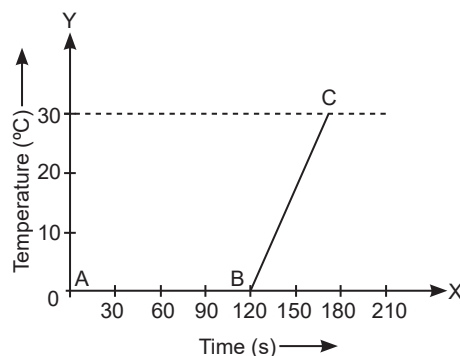
Section-A (Attempt all questions)

Question 1.

Choose the correct answers to the questions from the given options. (Do not copy the question, write the correct answer only.)

(i) The radiation with maximum ionising power is:

(a) α   (c) γ
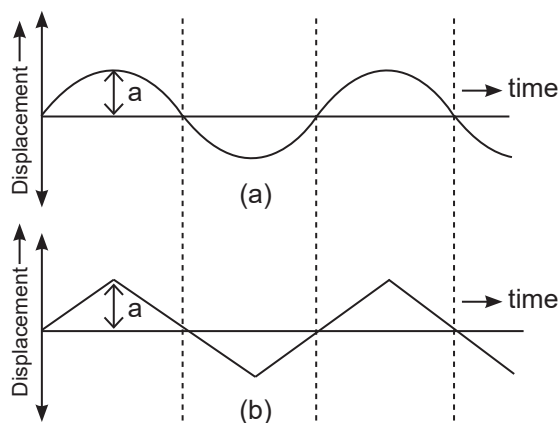
(b) β   (d) X-radiation

(ii) Consider the following heating curve of ice:

Which of the following is the portion of the latent heat of melting of ice?

(a) Part AB   (c) Part AC

(b) Part BC   (d) Only point A and C

(iii) Which of the following phenomena is know as sublimation?

    (a) The direct change of solid to vapour.

    (b) The direct change of vapour to liquid.

    (c) The direct change of liquid to solid.

    (d) The direct change of vapour to solid.

(iv) Which of the following substances contracts on melting?

    (a) Ice   (c) Wax

    (b) Lead   (d) Both (b) and (c)

(v) Which of the following is correct ascending order of speed of the given particles?

    (a) $\alpha < \beta < \gamma$ (c) $\beta < \alpha < \gamma$

    (b) $\gamma < \beta < \alpha$ (d) $\beta < \gamma < \alpha$

(vi) A radioactive nucleus emits a certain type of radiation. A particle with the same mass as before but an increased atomic number of one is emitted. Determine the particle's identity.

    (a) Alpha   (c) Gamma

    (b) Beta   (d) Delta

(vii) The temperature of a body increases by 10°C when 400 Joule of heat is applied. What is the heat capacity of the body?

    (a) $1.413 \, J \, K^{-1}$ (c) $3.413 \, J \, K^{-1}$

    (b) $2.413 \, J \, K^{-1}$ (d) $4.413 \, J \, K^{-1}$

(viii) If the supply voltage is 220 V and the total power of the appliances in the circuit is 440 W, what should the fuse's current rating be?

    (a) 1 A   (b) 2 A   (c) 4 A   (d) 6 A

(ix) Consider the following two figures of two different waves.


How figure (a) and figure (b) differs?

    (a) They differ in waveform   (c) They differ in frequency

    (b) They differ in amplitude   (d) They are identical graphs

(x) Which of the following is correct?

    (a) Radiation can cause diarrhoea, loss of hair, nausea.

    (b) Radiation can cause leukemia and cancer.

    (c) Radiation can cause Genetic disorders.

    (d) All of the above.

Section-B (Attempt any three questions from this section)

Question 2.

  (i) (a) Define e.m.f and terminal voltage?

      (b) Why is the filament of an electric bulb coiled?

 (ii) (a) What is resonance?

      (b) Explain why does a wine glass start rattling, when a note of some particular frequency is struck by a piano?

(iii) A battery with an e.m.f. of 9 V and an internal resistance of 0.6 is connected to three resistors A, B, and C in the diagram below.

9 V, 0.6 Ω

A
2Ω

B
4Ω

C
6Ω
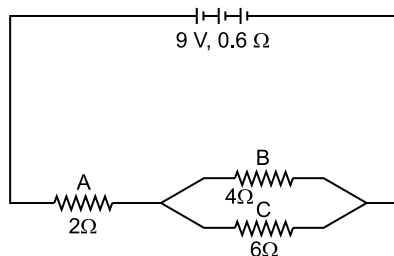
    (a) What is the combined resistance of B and C together and the total resistance of A, B and C together?

    (b) What is the total resistance of circuit?

   (c) What is the current flowing through resistor A?

Question 3.

  (i) (a) What is Lorentz force?

     (b) State faraday's laws of electromagnetic induction.

 (ii) (a) Define specific heat capacity.

     (b) Write an example of an specific heat capacity of an element.

     (c) Specific heat capacity of element is $10\,J\,kg^{-1}\,K^{-1}$. The temperature of a material raised by 20 degrees when 200 Joules of heat were given to it. What is the substance's mass?

(iii) In the centre of an evacuated spherical vessel, a radioactive sample is placed.

    (a) Name the radiations which are safe and unsafe.

    (b) Suggest two ways for more safety.

    (c) Is it true that evacuating the ship helps with safety?

    (d) On emission of which particle there will be no change in the mass number as well as in atomic number?

Question 4.

  (i) (a) To melt 1 kg of ice, how much heat energy is required? [Specific latent heat of ice = $336\,J\,g^{-1}$].

     (b) Define isotone and give an example.

 (ii) (a) Why the earth pin (shown in figure) is made so thick and long?

   (b) What is 'short circuit'?

(iii) Consider rubbing the stem of a vibrating tuning fork on a table surface, as represented in the figure below:

Tuning fork

Rubber pad
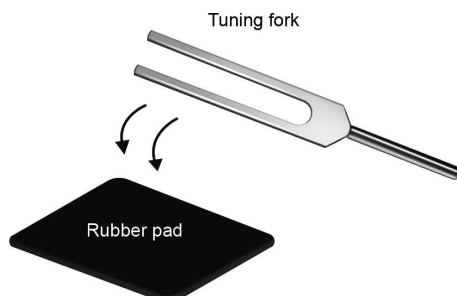
    (a) What type of vibrations will the table top produce? Is it going to make a sound?

    (b) Under what conditions does it produce resonance?

    (c) Write three key characteristics that are able to distinguish two different sounds?

Question 5.

  (i) Consider the following combination of resistors:
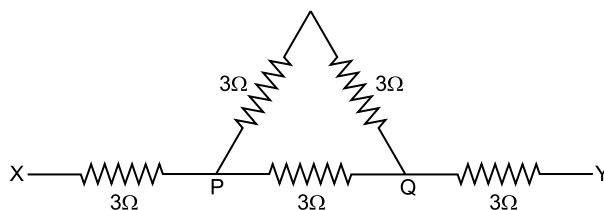
(a) What is the effective resistance across PQ?

(b) What is the equivalent resistance across XY?

(c) If a 10 V battery is connected across terminal XY, what will be the flow of current through the battery?

(ii) The diagram below shows a loop of wire carrying current I:
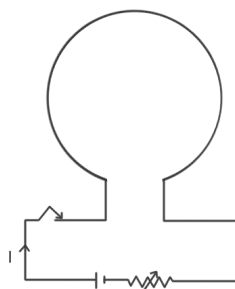
(a) What is the magnetic polarity of the loop that faces us?

(b) With respect to the diagram how can we increase the strength of the magnetic field produced by this loop?

(iii) (a) What is the purpose of using a hot water bottle for fomentation?

(b) What is sublimation? What is its opposite phenomenon called?

Answers

Section-A

Answer 1.

(i) (a) α

Explanation :

The ionising power of alpha radiation (α) is 100 times that of Beta (β) radiation and 10,000 times that of Gamma (γ) radiation. Thus, α-radiation has maximum ionising power.

(ii) (a) Part AB

Explanation :

From the graph it can be noticed that for part AB, with increase in time there is no change in temperature, thus this part is corresponds to the portion of the latent heat of melting of ice.

(iii) (a) The direct change of solid to vapour.

Explanation :

The phenomena of direct change of solid to vapour is known as sublimation and the phenomena of direct change of liquid to solid is known as solidification.

(iv) (a) Ice

Explanation :

Generally, volume of substance like lead, wax etc., increases on melting, but for ice, it is opposite. For ice, its volume decreases on melting to water.

(v) (a) α < β < γ

Explanation :

Speed of gamma particle is same as speed of light (in vacuum), speed of beta particle is around 90% of the speed of light and speed of alpha particle is around 10^7 m/s.

(vi) (b) Beta

Explanation :

When beta particle is emitted, the mass number of the daughter particle remain same but the atomic number increases by 1. Hence the given statement indicates the beta particle.

(vii) (a) 1.413 J K^{-1}

Explanation :

We know heat capacity of the body $C' = Q/\Delta t$, where Q is amount of applied heat, Δt is temperature increment.

Given, $Q = 400$ J, $\Delta t = 10$ °C $= 273 + 10 = 283$ K

Now, $C' = 400/283 = 1.413$ J K^{-1}.

(viii) (b) 2 A

Explanation :

$$\text{fuse's current rating} = \frac{\text{total power of the appliances in the circuit}}{\text{supply voltage}} = \frac{440\,\text{W}}{220\,\text{V}}$$

So, the fuse's current rating should be 2 A.

(ix) (a) They differ in waveform

Explanation :

Both the figures (a) and (b) have same amplitude 'a', also they have same frequency, but they differ in waveform.

(x) (d) All of the above.

Explanation :

All of the above are examples of radiation's harmful effects. There are three types of biological effects from nuclear radiation: (1) curable short-term effects including diarrhoea, sore throat, hair loss, nausea, and so on; (2) permanent long-term effects like leukemia and cancer; and (3) hereditary disorders.

Section-B

Answer 2.

(i) (a) The potential difference between the terminals of a cell is called its electromotive force (or e.m.f.) when no current is drawn from it.

When current is drawn from a cell, the potential difference between the cell's electrodes is known as the terminal voltage.

(b) To have a high resistance, the filament wire is long and thin. To fit in a small space it is coiled.

(ii) (a) When the frequency of an externally applied periodic force equals the natural frequency of a body, the body begins to vibrate with increased amplitude. This phenomenon is known as resonance.

(b) When the glass rattles, at that moment, its natural frequency corresponds with frequency of piano note, thus resonance takes place, which makes the glass to vibrate violently.

(iii) (a) The resistances B and C are connected in parallel. So their equivalent resistance is,

$$R_1 = (4 \times 6)/(4 + 6) = 2.4\ \Omega.$$

The resistor A is connected in series with R_1, then the equivalent resistance of A, B, and C is

$$(R_2) = 2.4 + 2 = 4.4\ \Omega.$$

(b) The total resistance of the circuit is $= R_2 + 0.6 = 4.4 + 0.6 = 5\ \Omega.$

(c) The current drawn from the battery is, $I = \text{e.m.f} / \text{total resistance} = 9/5 = 1.8$ A

Thus, Current flowing through the resistor A is 1.8 A.

Answer 3.

(i) (a) Lorentz found that a charge moving in a magnetic field, in a direction other than the direction of magnetic field, experiences a force. It is called the Lorentz force.

(b) 1. Whenever there is a change in magnetic flux linked with a coil, an e.m.f. is induced.

2. The magnitude of the induced e.m.f. is directly proportional to the rate of change of magnetic flux liked with the coil.

(ii) (a) The heat capacity per unit mass of a substance is described as its specific heat capacity.

i.e, specific heat capacity = heat capacity of the body/mass of the body.

(b) For example, specific heat capacity of water is 4180 J kg⁻¹ K⁻¹.

(c) We know that, specific heat capacity = applied heat / (mass of the body × temperature change)

Or, $10 = 200/(m \times 20)$

Or, $m = 1$ kg.

Thus, the mass of the substance is 1 kg.

(iii) (a) Because alpha radiation (α) has a lower penetration power, it is prevented by the vessel's walls. As a result, the vessel is secure from alpha radiation. The walls of the vessel cannot stop beta (β) and gamma (γ) radiations, hence the vessel is dangerous for both beta and gamma radiations.

(b) Measures for more safety: The sphere's walls must be made of lead. The radius of the sphere must be large.

(c) No. It is not recommended that the vessel be evacuated. The air within will aid in the absorption of the radiations.

(d) On emission of γ-particle there will be no change in the mass number as well as in atomic number.

Answer 4.

(i) (a) Given, $m = 1$ kg = 1000g, L = 336 Jg⁻¹.

Heat energy required = mL = 1000 g × 336 Jg⁻¹ = 336000 J = 3.36×10^5 J.

(b) Isotones are atoms with varying numbers of protons but the same number of neutrons. They also differ in the number of electrons they have. For example, $_{20}^{40}$Ar and $_{19}^{39}$K have same number of neutrons but different numbers of protons, thus they are isotones.

(ii) (a) The earth pin is made so thick because the earth pin can never be put into other pin holes of live and neutral connections. Also, because the earth pin must be connected first, it is longer than the other pins. If the holes are of equal thickness, the appliance may be destroyed if the wrong pin is accidentally placed into the wrong hole.

(b) A short circuit occurs when a live wire makes direct contact with a neutral wire. In this circumstance, resistance in the current's path drops to virtually. As a result, a large amount of current flows through the live wire.

(iii) (a) As the vibrations are due to external means, thus forced vibrations are those that occur in the table top.

Yes, it will definitely produce a sound.

(b) Resonance will occur when the natural frequency of the table top's vibrations will be equal to the frequency of the vibrating tuning fork.

(c) Loudness, pitch (shrillness), and quality (timber) are the three key characteristics that are able to distinguish two different sounds.

Answer 5.

(i) (a) Across PQ the effective resistance is = $\dfrac{(3+3) \times 3}{(3+3)+3} = \dfrac{18}{9} = 2\,\Omega$.

(b) Equivalent resistance across terminal XY is = 3 + effective resistance across PQ + 3

$$= 3 + 2 + 3 = 8\,\Omega.$$

(c) Across terminal XY 10 V is applied, *i.e.,* V = 10 V

The flow of current through the battery is = $\dfrac{\text{Voltage applied}}{\text{Equivalent resistance across terminal XY}}$

$$= 10/8$$
$$= 1.25 \text{ A.}$$

(ii) (a) South

(b) By passing a stronger current.

(iii) (a) Because water does not cool rapidly due to its high specific heat capacity, utilising a hot water bottle for fomentation gives more heat energy for fomentation over a longer length of time.

(b) Sublimation is the process in which a solid is directly transformed into vapour, without through the phase of liquid.

Deposition or de-sublimation is the opposite of sublimation, in which a material transitions from a gas to a solid state.

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