ICSE SEMESTER 2 EXAMINATION

SAMPLE PAPER - 4

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.

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*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) Safe limit of level of sound for hearing is:

(a) 20 to 100 dB
(b) 40 to 120 dB
(c) 50 to 100 dB
(d) 0 to 80 dB

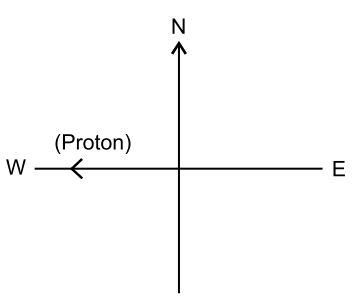
(ii) The slope of the graph showing the variation of potential difference V on X-axis and current I on Y axis gives:

(a) Resistivity (b) Inductance (c) Resistance (d) Conductance

(iii) The internal resistance of a 2.1 V cell which generates a current of 0.2 A through a resistance of 10 Ω is:

(a) 5 Ω (b) 10 Ω (c) 0.5 Ω (d) 50 Ω

(iv) A positively charged alpha particle projected towards west is deflected towards north by magnetic field. The direction of magnetic field is:



(a) towards south
(b) towards east
(c) downward
(d) upward

(v) When amplitude of sound wave decreases, its:

(a) Pitch decreases
(c) Pitch increases
(b) Loudness decreases
(d) Loudness increases

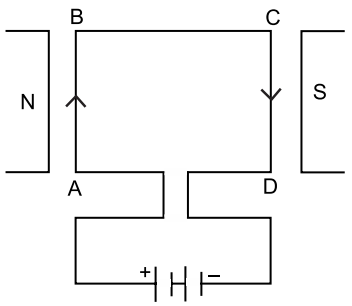
(vi) Which of the following substances has the largest specific heat ?

(a) Turpentine (b) Kerosene (c) Water (d) Glycerine

(vii) Which of the following is mass independent quantity?

(a) Specific heat capacity
(c) Weight
(b) Heat capacity
(d) Both (a) and (c)

(viii) A rectangular coil ABCD is placed between the pole pieces of a horse-shoe magnet as shown in figure:



Choose the incorrect option from the following.

(a) Current in the coil is in direction DCBA
(b) On arm BC no force acts
(c) On arm CD, force is outwards perpendicular to the plane of the coil.
(d) None of these

(ix) A beaker had 100 g of water at temperature 90°C. Another 600 g of water at temperature 20°C is poured into the beaker later on. After mixing, the temperature of the water will be.

(a) 45°C (b) 20°C (c) 30°C (d) 50°C

(x) The amount of heat energy contained in a body depends upon which of the following.

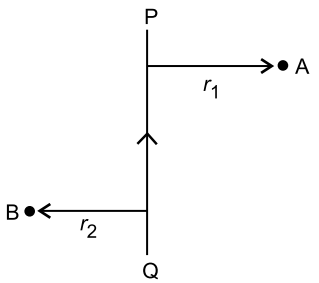
(a) Mass of the body.
(c) Material properties of the body.
(b) Temperature of the body.
(d) All of these

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

Question 2.

(i) A current carrying conductor PQ lies in the plane of the paper as shown in figure.

(a) Find the direction of the magnetic fields produced at the points A and B.

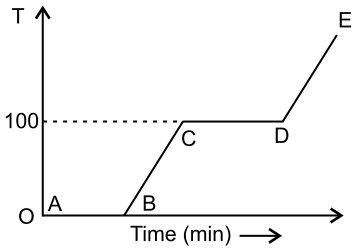


(b) If $r_1 > r_2$, then where will the strength of the magnetic field be larger?

(ii) (a) What do you understand by shriller sound ?

(b) How does loudness of sound is affected by amplitude?

(iii) The diagram given below shows a plot of temperature verus time, showing the changes in the state of ice on heating (not to scale). Answer the questions as follows.



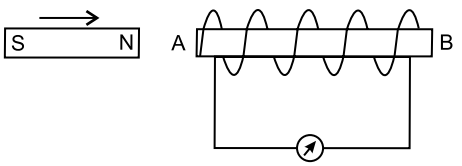
(a) What does the region AB in graph signifies?

(b) Describe the region BC in the graph?

(c) What does the region CD in the graph represent?

Question 3.

(i) The diagram shows a coil connected to a galvanometer G. The galvanometer shows a deflection to the right when north pole of a powerful magnet is moved to the right as shown.



(a) What is the direction of current in the coil when viewed from end A?

(b) What is the direction of deflection of the galvanometer when both the coil and the magnet are moved to the right at the same speed?

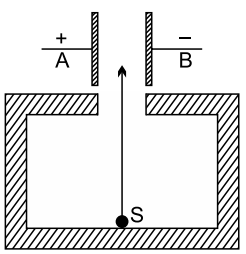
(ii) In a process 10 g of ice at –5°C is converted into the steam at 100°C.

(a) Calculate the amount of heat required to convert of ice from –5°C to 0°C, if specific heat of ice is 0.5 cal g^{-1} $°C^{-1}$

(b) Calculate the amount of heat required to convert 10 g of ice at 0°C into 10 g of water at the same temperature, if latent heat of fusion of ice is 80 cal g^{-1}.

(c) Calculate the heat required to raise the temperature of 10 g of water from 0°C to 100°C, if specific heat of water is 1 cal $g^{-1}C^{-1}$.

(iii) The diagram given below shows a radioactive source S in a thick lead walled container having a narrow opening. The radiations pass through an electric field between the plates A and B.



(a) Show the paths of α, β and γ radiation.

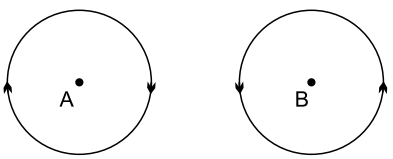
(b) Why source S is kept in a thick walled container with a narrow opening?

(c) Which radiation deflected the most?

(d) Which radiation is unaffected by the electrostatic field?

Question 4.

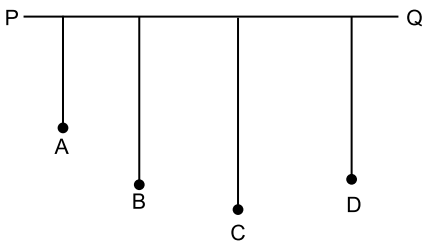
(i) The diagram shows two cases of a circular current carrying conductor.



(a) Find the direction of magnetic field at the centre of both the conductors.

(b) Find the magnetic pole towards the reader side (your side) in both the conductors A and B.

(ii) Four simple pendulums A, B, C, and D with light bobs are suspended from a horizontal rubber string as shown in figure. The system is stretched between two fixed points P and Q. The lengths of pendulums B and D are equal. The length of pendulum C is shorter whereas the length of pendulum C is longer than the pendulum B and D. On displacing the bob of pendulum D to one side and then on releasing, the system is set into oscillations.



(a) Which of the four pendulums shows free oscillations?

(b) Which of the four pendulums shows forced oscillation?

(ii) A nucleus $_{92}U^{235}$ emits an alpha particle and transforms into Thorium.

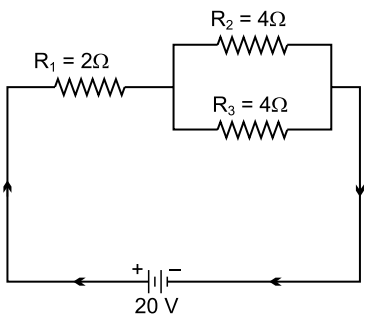
(a) What will be the mass number of Thorium?

(b) What will be the atomic number of Thorium?

(c) Write the nuclear reaction involved in the emission of this particle.

Question 5.

(i) The circuit diagram shown below is formed out of the combination of three resistors R_1, R_2 and R_3.



(a) Find total resistance of the circuit.

(b) Find total current flowing in the circuit.

(c) Find the potential difference across R_1.

(ii) A lead bullet of mass 1 kg penetrates into a solid object and melts. Initial temperature of the bullet is 27°C and its melting point is 327°C.

Given that, Latent heat of fusion of lead = 2.5×10^4 J kg^{-1}

Specific heat capacity of lead = 125 J kg^{-1} K^{-1}

(a) Calculate the heat required to raise the temperature of bullet from 27°C to 327°C.

(c) Calculate the heat required to melt the bullet.

(c) If 50% of kinetic energy of the bullet was used to heat it, then calculate the initial speed of the bullet.

(iii) An electric oven of 2KW power rating is operating in a domestic electric circuit (220V) that has a current rating of 5A.

(a) What is the power of the electric oven in watt?

(b) Calculate the current drawn by the electric oven.

Answers

Section-A

Answer 1.

(i) (d) 0 to 80 dB

Explanation :

Safe limit of level of sound for having is 0 to 80 dB. Beyond the sound level of 120 dB can cause permanent damage to ears.

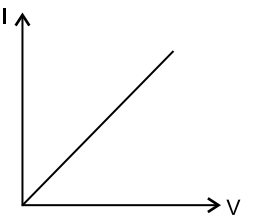
(ii) (d) Conductance

Explanation :

According to Ohm's law,

$$\frac{V}{I} = R$$

$\therefore$ Slope of given graph is $= \frac{I}{V} = \frac{1}{R}$



(iii) (c) 0.5 Ω

Explanation :

$$I = \frac{\varepsilon}{R + r}$$

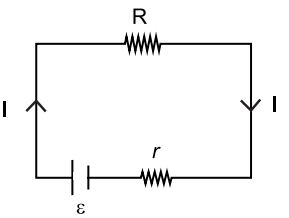
$\therefore$ $IR + Ir = \varepsilon$

or $0.2 \times 10 + 0.2 \times r = 2.1$

or $2 + 0.2r = 0.1$

or $0.2r = 0.1$

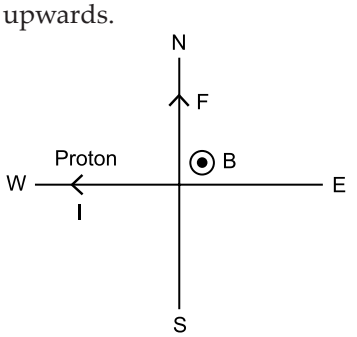
or $r = 0.5\ \Omega$



(iv) (d) upward

Explanation :

The direction of motion of proton is the direction of current I. The direction of force F on the proton is towards north (as the proton is deflected towards north). Applying Fleming's left hand rule, the direction of magnetic field (B) is upwards.



(v) (b) Loudness decreases

Explanation :

Amplitude and Loudness are directly proportional to each other, when the amplitude of sound decreases, the Loudness also decreases.

(vi) (c) Water

Explanation :

Water has the largest specific heat i.e., 1 cal g^{-1} $°C^{-1}$.

(vii) (a) Specific heat capacity

Explanation :

Weight W = *mg*, which is mass dependent. Specific heat capacity is a property of the body's material that is independent of its mass, whereas heat capacity is dependent on both the substance and the mass of the body.

(viii) (a) Current in the coil is in direction DCBA

Explanation :

From figure, the current in the coil is flowing in direction ABCD. Using Fleming's left hand rule, in the arm AB, the force is inward at right angle to the plane of the coil. On the arm BC no force acts. On the arm CD, the force is outward perpendicular to the plane of the coil. On the arm DA, no force acts.

(ix) (c) 30°C

Explanation :

Let the temperature of water after mixing is T.

$$\text{Heat lost} = \text{Heat gained}$$
$$100(90 - T) = 600\,(T - 20)$$
$$9000 - 100\,T = 600\,T - 12000$$
$$700\,T = 21000$$
$$\therefore \quad T = 30°C$$

(x) (d) All of these

Explanation :

The amount of heat energy contained in a body varies material substance to substance. Heat energy contained in a body depends upon mass, temperature, material properties of the body.

Section-B

Answer 2.

(i) (a) Magnetic field produced at A is into the plane of the paper whereas at B, it is out ot the plane of the paper.

(b) Magnetic field at any point due to a straight current carrying conductor is inversely proportional to the distance of the point from the conductor. As $r_1 > r_2$, thus magnetic field at B will be larger as compared to that at point A.

(ii) (a) Sound of higher pitch is called shriller sound. The pitch of the sound depends upon frequency of sound. The sound which have higher frequency of vibrations have higher pitch.

(b) Loudness of sound is proportional to the square of amplitude of the vibrations producing the sound. When the amplitude of vibration is large, the sound produced is loud when the amplitude is small, the sound produced is feeble.

(iii) (a) For the region AB, there is no change in temperature till the whole ice melts. In this process, the heat is being continuously supplied but the temperature of ice and water does not change. Here, the heat supplied is used in changing the state from solid (ice) to liquid (water). The process of change of state from solid to liquid is called melting.

(b) After the whole ice is converted into water in the region AB, if we continue heating, the temperature of the water begins to rise till it reaches at 100°C, where it again becomes steady. For the portion of the graph BC, the heat supplied is used to change water from liquid state to vapour or gaseous state. The change of state from liquid to vapour or gas, is called vaporisation.

(c) The region CD represents a constant temperature (100°C) with time. It means water and steam are in thermal equilibrium at boiling point.

Answer 3.

(i) (a) The current appears anti-clockwise when viewed from end A because end A will form a north pole.

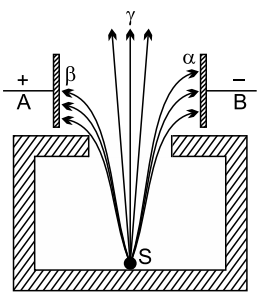
(b) No deflection is observed as there is no relative motion between the magnet and coil.

(ii) (a) $\Delta Q = Sm\Delta T = 0.5 \times 10 \times 5 = 25$ cal

(b) $\Delta Q = mL = 10 \times 80 = 800$ cal

(c) $\Delta Q = Sm\Delta T = 1 \times 10 \times 100 = 1000$ cal

(iii) (a)



(b) The radioactive substance S is kept in thick lead container with a very narrow opening to stop the radiations coming out from other directions because they may cause biological damage.

(c) β radiations deflected the most.

(d) γ radiations are unaffected by the electrostatic field and shows no deflection.

Answer 4.

(i) (a) The direction of magnetic field for A will be downwards and perpendicular to the plane of the paper.

The direction of magnetic field for B will be upwards and perpendicular to the plane of the paper.

(b) For A, it is South pole.

For B, it is North pole.

(ii) (a) The oscillations of pendulum D are free oscillations.

(b) The pendulums A and C having different lengths are made to oscillate with the frequency of D which is different from their natural frequency, hence the oscillations of A and C are forced oscillations.

(iii) (a) Mass number of Thorium = 235 – 4 = 231

(b) Atomic number of Thorium = 92 – 2 = 90

(c) ${}_{92}U^{235} — {}_{2}He^{4} + {}_{90}Th^{231}$

Answer 5.

(i) (a) For R_2 and R_3,

$$\frac{1}{R} = \frac{1}{R_2} + \frac{1}{R_3}$$

Or $$R' = \frac{R_2R_3}{R_2+R_3} = \frac{4\times4}{4+4} = 2\Omega$$

Total resistance of the circuit, $R = R_1 + R'$

$= 2 + 2 = 4\Omega$

(b) Total current flowing through the circuit, $I = \frac{V}{R}$

$\therefore$ $$I = \frac{20}{4} = 5A$$

(c) Potential difference across R_1, $V = IR_1 = 5 \times 2$

$= 10V$

(ii) (a) Given that, mass of the lead bullet, $m = 1$ kg

Heat required to raise its temperature from 27°C to 327°C

$\Delta Q_1 = Sm\Delta T$

$= 125 \times 1 \times (327 - 27)$

$= 3.75 \times 10^4$ J

(b) Heat required to melt the bullet,

$\Delta Q_2 = mL = 1 \times 2.5 \times 10^4 \text{ J} = 2.5 \times 10^4$ J

(c) Given that, 50% of kinetic energy of the bullet is used to heat it.

$\therefore$ heat developed $= \frac{1}{2} \times$ K.E

or $\Delta Q_1 + \Delta Q_2 = \frac{1}{2} \times \frac{1}{2} mv^2$

where v is the initial speed of the bullet.

$\therefore$ $(3.75 \times 10^4 + 2.5 \times 10^4) = \frac{1}{4} \times 1 \times v^2$

or $6.25 \times 10^4 = \frac{v^2}{4}$

or $v = \sqrt{4 \times 6.25 \times 10^4} = 5 \times 10^2$ m/s

$= 500$ m/s

(iii) (a) Power of the electric oven, $P = 2$ kW

$= 2 \times 1000$ W

$= 2000$ W

(b) Given, potential difference or voltage, $V = 220V$

We know that, Power $P = V \times I$

$\therefore$ $I = \frac{P}{V} = \frac{2000}{220} = 9A$

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