ICSE SEMESTER 2 EXAMINATION

SAMPLE PAPER - 2

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) In damped vibration:

(a) total energy of the oscillator decreases with time

(b) total energy of the oscillator increases with time

(c) total energy of the oscillator does not change with time

(d) total energy of the oscillator first decreases then increases with time

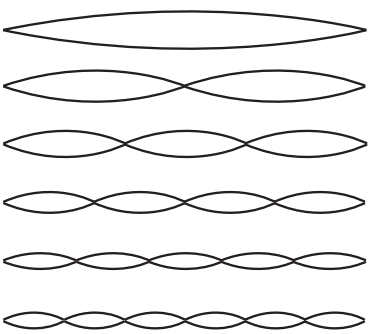
(ii) 12.5 kilocalorie is equivalent to _____.

(a) 52300 Joule (b) 5230 Joule (c) 23500 Joule (d) 32500 Joule

(iii) A conducting wire of length 2 meter and cross sectional area of 4 m^2 has resistance of 4 Ω. What is the resistivity of the wire?

(a) 4 Ω-m (b) 6 Ω-m (c) 8 Ω-m (d) 10 Ω-m

(iv) The frequency of the topmost wave is 100 Hz. What is the frequency of the bottom most wave?



(a) 100 Hz (b) 400 Hz (c) 500 Hz (d) 600 Hz

(v) What is the maximum number of electrons an atom can contain in its fourth orbit?

(a) 4 (b) 16 (c) 24 (d) 32

(vi) Lenz's law is based on conservation of _____.

(a) mass (c) angular momentum

(b) current (d) energy

(vii) How does the melting point of wax change as pressure rises?

(a) Melting point increases.

(b) Melting point decreases.

(c) Melting point remains unchanged.

(d) Cannot be said.

(viii) During which of the following processes heat energy is absorbed by the substance?

(a) Melting

(b) Freezing

(c) Boiling

(d) Both (a) and (c)

(ix) Name of the instrument presented below is _____.

(a) Fuse (c) Circuit Breaker

(b) Earthling (d) Switch

(x) Which instrument is used to measure current in an electric circuit?

(a) Ammeter (b) Potentiometer (c) Voltmeter (d) Tachometer

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

Question 2.

(i) (a) Specific heat capacity of water is more compared to ice. Correct or Wrong? Why?

(b) State the principle of Calorimetry.

(ii) (a) Write two differences between a chemical change and a nuclear change.

(b) Mention the beneficial and harmful effects of radiations.

(iii) Carbon has an isotope $^{14}_{6}C$.

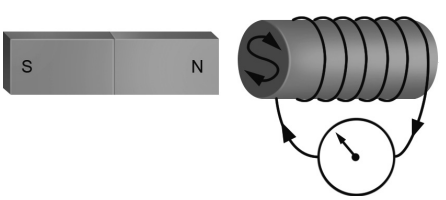
(a) How many protons and neutrons does it contain?

(b) How many neutral electrons does it contain?

(c) After decaying a particle, the daughter element becomes, say $^{14}_{7}X$. What is that decaying particle? Write down the equation of the changes.

Question 3.

(i) Consider the bar magnet and solenoid combination, where the bar magnet is placed close to the solenoid:



(a) What would be the polarity at the rightmost point of the solenoid? Will the magnet be attracted or repelled?

(b) Write one application of bar shaped electromagnet.

(ii) A current of 2 A flows through a wire of 10 m length when a potential difference of 4 voIt is applied across its ends.

(a) What is the resistance of that wire?

(b) What is the resistance per unit length of the wire?

(c) What is the resistance of 2 m length of the wire?

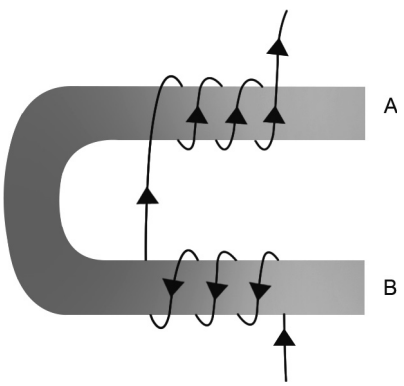
(iii) (a) What is forced vibration?

(b) Give an example of forced vibration.

(c) The amplitudes of two waves are same. Will both the wave have same picth?

Question 4.

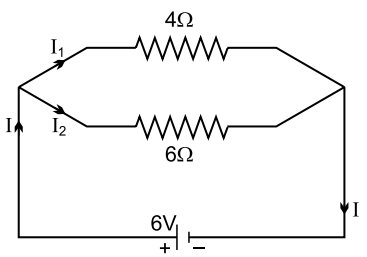
(i) The current flowing in the coil of wire coiled around the soft iron horse shoe core is depicted in the diagram above.



(a) State the polarities developed at the ends A and B.

(b) State ways to increase magnetic field strength.

(ii) Two 4 ohm and 6 ohm resistors are connected in parallel. The circuit is powered by a 6 V battery with very low resistance:



(a) What is the equivalent resistance of the circuit?

(b) What is the current flowing through the battery and 4 Ω resistor?

(iii) A metal with a mass of 400 g has a heat capacity of 200 J K^{-1}.

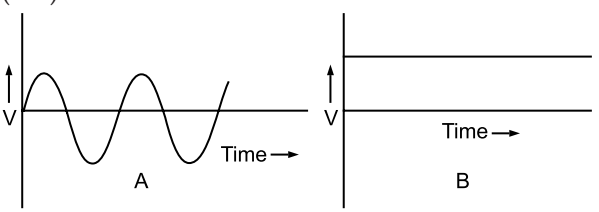
(a) How much heat energy does it take to raise the temperature by 5°C?

(b) What is the metal's specific heat capacity?

(c) Is it possible for a pure substance, the particular latent heat of fusion to be the same as the latent heat of melting?

Question 5.

(i) (a) Consider the following graphs and write which one represents alternating (AC) and which one represents direct (DC)?



(b) Write any two significant differences of AC and DC current.

(c) Which of these two (AC or DC) is the more dangerous?

(ii) (a) Define Intensity of a sound. What is its SI unit?

(b) Write any two factors on which intensity of a sound depends?

(iii) 600 calorie of heat is required to raise the temperature of 0.060 kg of a substance from 0°C to 100°C. Calculate its specific heat capacity.

(a) In calorie $kg^{-1}°C^{-1}$.

(b) In J $kg^{-1}°C^{-1}$.

Answers

Section-A

Answer 1.

(i) (a) total energy of the oscillator decreases with time

Explanation :

Vibrations are considered to be damped when the energy of a vibrating system is progressively dissipated by various resisting forces. The vibrations gradually decrease in frequency and after sometime the system returns to its equilibrium state. Thus in damped vibration, total energy of the oscillator decreases with time.

(ii) (a) 52300 Joule

Explanation :

We know, 1 cal = 4.184 Joule

Or, 1 kcal = 4184 Joule

Thus 12.5 kcal = 4184 × 12.5 = 52300 Joule.

(iii) (c) 8 Ω-m

Explanation :

we know that resistivity, $\rho = RA/l$. where R is the resistance, A is the cross sectional area of the wire and l is the length of the wire.

Given: $R = 4\ \Omega$; $A = 4\ m^2$; $l = 2$ m.

Thus, $\rho = (4 \times 4)/2 = 8\ \Omega$-m.

(iv) (d) 600 Hz

Explanation :

The topmost wave has frequency of 100 Hz, *i.e.,* fundamental frequency. Now, it can be seen that the bottom most wave is 5^{th} overtone. Thus, the frequency of the bottom most wave will be = 6 × 100 = 600 Hz.

(v) (d) 32

Explanation :

In an orbit on an atom, the maximum number of electrons can be $2n^2$, where 'n' is the orbital number. In the present case 'n' is 4. So this orbit can have a maximum of 32 electrons.

(vi) (d) energy

Explanation :

The law of energy conservation is the foundation of Lenz's law. The induced current, according to this rule, always tends to oppose the source that creates it.

(vii) (a) Melting point increases.

Explanation :

The melting point of materials that expand when melted, such as wax, lead etc., rises as pressure rises. In contrast, the melting point of substances that contract when melted, such as ice, decreases as the pressure rises.

(viii) (d) Both (a) and (c)

Explanation :

The material absorbs heat energy during the melting and boiling processes. During freezing, however, the material releases heat energy.

(ix) (c) Circuit Breaker

Explanation :

The instrument presented in the figure is called 'Circuit Breaker'.

(x) (a) Ammeter

Explanation :

Ammeter is used to measure current in a circuit.

Section-B

Answer 2.

(i) (a) The statement is Correct. Specific heat capacity of water is 4184 $J \cdot kg^{-1} \cdot K^{-1}$ and for ice it is 2108 $J \cdot kg^{-1} \cdot K^{-1}$. So, Specific heat capacity of water is more compared to ice.

Ice has a covalent chemical structure, which makes it easier to break intermolecular bonds than water. As a result, ice has a lower specific heat capacity than water.

(b) According to the principle of Calorimetry, when a hot body is kept in contact with a cold body, heat energy is transferred from the hot body to the cold body until both bodies reach the same temperature. If no heat energy is lost to the surroundings, then Heat energy lost by the hot body is equal to the Heat energy gained by the cold body.

(ii) (a) Differences:

1. A chemical change occurs when orbital electrons change, whereas a nuclear change occurs when nucleons inside the nucleus change.
2. A nuclear change requires a significantly larger amount of energy than a chemical change.

(b) Beneficial effects: Radiations emitted during the decay process are used to treat such as cancer, tumour etc.

Harmful effect: Radiations has the potential to harm and cause permanent damage to living tissues.

(iii) (a) The given isotope of carbon is ${}^{14}_{6}C$.

Number of protons = 6

Number of neutrons = mass number – atomic number = 14 – 6 = 8.

(b) Atomic number = number of protons = number of neutral electrons = 6.

(c) After decaying a particle, the daughter element became ${}^{14}_{7}X$. Means, the mass number remain the same but the atomic number is increased by 1. Thus it is a β-decay.

The equation is, ${}^{14}_{6}C \xrightarrow{-\beta} {}^{14}_{7}X$.

Answer 3.

(i) (a) According to Lenz's law, the direction of induced e.m.f is such that it opposes the cause which produces it. Thus, the polarity at the rightmost point of the solenoid would be South pole.

The magnet will be repelled. Because the nearest point of the solenoid would be North pole and North-North repelled.

(b) Bar shaped electromagnets are commonly used in relay or switching devices. Also it is used for magnetic experiments, in medical procedures, in electronic devices such as telephones, radios, televisions etc.

(ii) (a) Given, V = 4 V, I = 2 A, l = 10 m.

Thus the resistance of 10 m length of wire is, R = V/I = 4/2 = 2 ohm.

(b) The resistance per unit length of the wire is = R/l = 2/10 = 0.2 ohm m^{-1}.

(c) The resistance of 2 m length of wire is = resistance per unit length × length = 0.2 × 2 = 0.4 ohm.

(iii) (a) The vibrations of a body that occur under the influence of a periodic external force operating on it, is called forced vibrations.

(b) For instance, while a guitar is being played, the artist uses the guitar's strings to create forced vibrations.

(c) We know that loudness can be determined by amplitude, but frequency can not be measured by amplitude. Hence, pitch cannot be determined as it is independent of its amplitude.

Answer 4.

(i) (a) Using the Clock rule, looking at the face of the loop it can be said that end A will develop south pole and end B will develop north pole.

(b) The magnetic field may be increased by,

1. increasing the current strength in the coil,

2. increasing the number of turns in the coil,

(ii) (a) The resistances are connected in parallel fashion.

Thus the equivalent resistance, $1/R_{eq} = 1/4 + 1/6$,

Or, $R_{eq} = 12/5 = 2.4\ \Omega$.

(b) The current flowing through the battery is $I = V/R_{eq} = 6/2.4 = 2.5$ A.

As the resistances are connected in parallel, the voltage across each resistor will be same.

So the current through 4 Ω resistor is = 6/4 = 1.5 A.

(iii) (a) The heat energy required to raise the temperature by 5 °C (5 °C = 278 K) is,

= heat capacity x temperature change = 200 J K^{-1} × 278 K = 55600 J = 5.56 × 10^4 J.

(b) Specific heat capacity = heat capacity/mass of the metal

= 200/0.4 = 500 J kg^{-1} K^{-1}.

(c) The thermal energy necessary to melt a unit amount of ice at 0°C to water at 0°C without changing the temperature is known as the specific heat of melting of ice. The specific latent heat of fusion of ice, on the other hand, is the heat energy generated when a unit amount of water at 0°C freezes to ice at 0°C without a temperature change. Thus, for a pure substance latent heat of fusion is the same as the latent heat of melting.

Answer 5.

(i) (a) From graph B it can be said that the direction of the current is not changing, thus it is direct current. On the other hand graph A shows the periodical change in direction of the current with time, thus it is alternating current.

(b) Differences between AC and DC:

1. In direct current (DC), the electric current only flows in one direction. In alternating current (AC), on the other hand, direction changes periodically.
2. Power consumption in AC is significantly less compared to DC.

(c) Alternating current is five times as harmful as direct current. The major cause of this harmful effect on the human body is the alternating current's frequency. Even a little voltage of around 25 volts may kill a human if the frequency of alternating current is approximately 60 Hz.

(ii) (a) The amount of sound energy travelling per second, across unit area, at a point of the medium is the intensity of a sound wave at that location. Its unit is watt per metre^2 (W/m^2).

(b) The intensity of a sound wave depends upon the amplitude of vibrations, the frequency of vibrations, and the density of medium. It is proportional to the square of the amplitude of vibrations, the square of the frequency of vibrations, and the density of air.

(iii) (a) Rise in temperature ($\Delta\theta$)

$$= (100 - 0)^\circ C = 100^\circ C$$

$$Q = mc\,\Delta\theta$$

$$600 = 0.060 \times c \times 100$$

$$c = \frac{600}{0.060 \times 100} \text{ calorie kg}^{-1}{}^\circ C^{-1}$$

$$= 100 \text{ calorie kg}^{-1}{}^\circ C^{-1}$$

(b) $C = 100 \times 4.2 \text{ J kg}^{-1}{}^\circ C^{-1}$

$= 420 \text{ J kg}^{-1}{}^\circ C^{-1}$.

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