Date: 09/05/2022

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Time: 90 Min.

PHYSICS

Max. Marks: 40

ICSE Board Class X (Semester-2) Exams

Answers & Solutions (Science Paper 1)

GENERAL INSTRUCTIONS

- 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**.
- The intended marks for questions or parts of questions are given in brackets [ ].

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.) **[10×1 = 10]**

(i) Free vibrations are:

(a) the vibrations under the influence of a periodic force

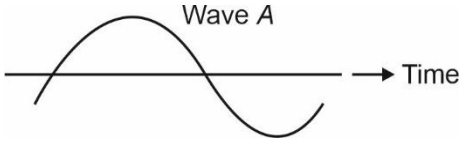
(b) the vibrations with larger amplitude

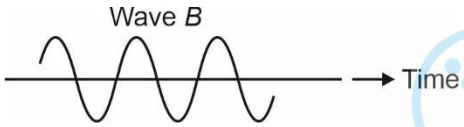
(c) the vibrations when the frequency continuously decreases

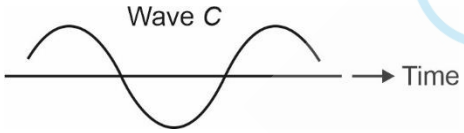
(d) the vibrations with a constant frequency and constant amplitude

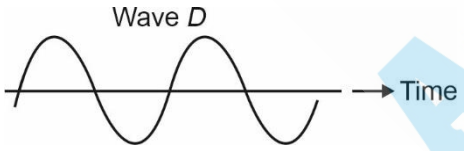
Answer (d)

(ii) The diagram below shows four sound waves. Which sound has the highest pitch?

(a) 

(b) 

(c) 

(d) 

Answer (b)

Sol. : A sound wave of the highest frequency has the highest pitch.

(iii) The graph plotted for potential difference (V) against current (I) for ohmic resistors is:

(a) A curve passing through the origin

(b) A straight line not passing through origin

(c) A straight line passing through origin

(d) A circle centred at the origin

Answer (c)

Sol. : For ohmic resistors,

$V \propto I$

(iv) A main switch in the main distribution board is present in:

(a) A live wire

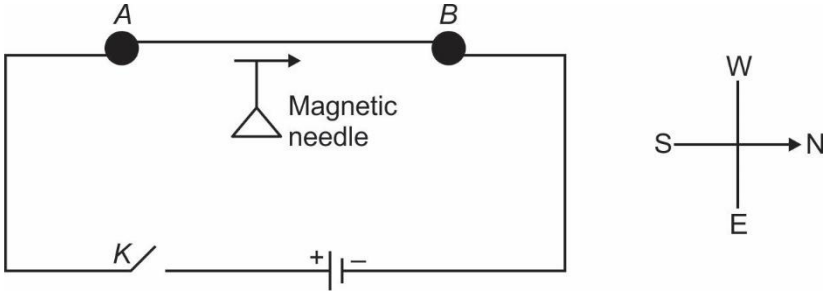
(b) A neutral wire

(c) A live as well as neutral wire

(d) An earth wire

Answer (a)

(v) A conductor *AB* is kept along north south direction of the earth above a magnetic needle as shown below. When the key *K* is closed then:



(a) the needle will not show any deflection

(b) the needle will deflect towards east

(c) the needle will turn in the opposite direction i.e. towards south

(d) the needle will deflect towards west

Answer (d)

(vi) A coil wound around a piece of soft iron can become an electromagnet only when:

(a) the circuit is open

(b) a magnetic compass is present in the vicinity

(c) a galvanometer is connected to the circuit

(d) a current flows in the circuit

Answer (d)

(vii) If water absorbs 4000 joule heat to increase the temperature of 1 kg water through 1°C then the specific heat capacity of water is :

(a) $4\ Jkg^{-1}\ °C^{-1}$ (b) $400\ Jg^{-1}\ °C^{-1}$

(c) $4\ Jg^{-1}\ °C^{-1}$ (d) $4.2\ Jg^{-1}\ °C^{-1}$

Answer (c)

Sol. : Specific heat capacity (c) of water $= \frac{4000\ J}{kg\ °C}$

$$= \frac{4000\ J}{1000\ g\ °C}$$

$$= 4\ Jg^{-1}\ °C^{-1}$$

(viii) Water is used in car radiators because :

(a) it is a good conductor of heat.

(b) it conducts heat faster as compared to the other substances and cools the engine quickly.

(c) its specific heat capacity is very low.

(d) its specific heat capacity is very high so it can cool the engine without a greater increase in its own temperature.

Answer (d)

(ix) The heaviest nuclear radiation is :

(a) *x*-radiation (b) α-radiation

(c) γ-radiation (d) β-radiation

Answer (b)

(x) To study the age of excavated material of archaeological significance we study the rate of decay of an isotope of :

(a) Uranium (b) Cobalt

(c) Carbon (d) Chlorine

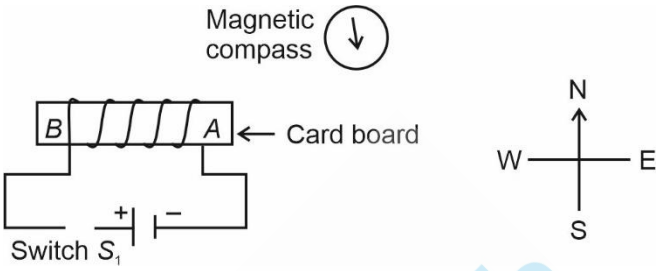
Answer (c)

SECTION-B

(*Attempt **any three** questions from this Section*)

Question 2

(i) The diagram below shows a magnetic compass kept closer to a coil *AB* wound around a hollow cylindrical cardboard: **[3]**



(a) After studying the circuit and the magnetic compass carefully, state whether the switch S_1 is open or closed.

(b) How did you arrive at the conclusion in (a)?

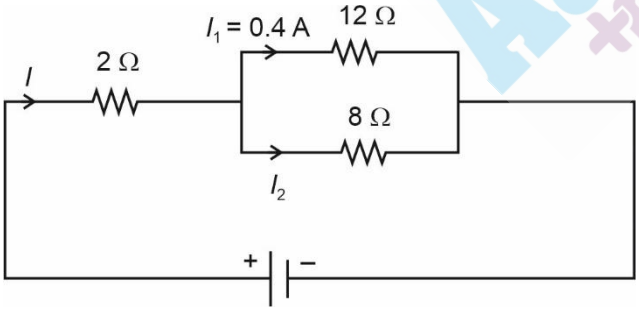
(c) What is the purpose of placing the magnetic compass in the above setup?

(ii) (a) Give an important reason for copper to be used as a material for a calorimeter. **[3]**

(b) Calculate the thermal capacity of 40 g of water.

[Specific heat capacity of water = 4200 $Jkg^{-1}\ °C^{-1}$]

(iii) **[4]**



In the above circuit diagram, calculate:

(a) the external resistance of the circuit

(b) the current I_2

(c) the current *I*.

Solutions :

(i) (a) Switch S_1 is closed. **[1]**

(b) If the switch is open, then there will be no external magnetic field around the coil and in the absence of any external magnetic field, the compass needle should point in geographical *N* –*S* direction. **[1]**

(c) Magnetic compass is placed to detect the presence of magnetic field around the coil *AB*. **[1]**

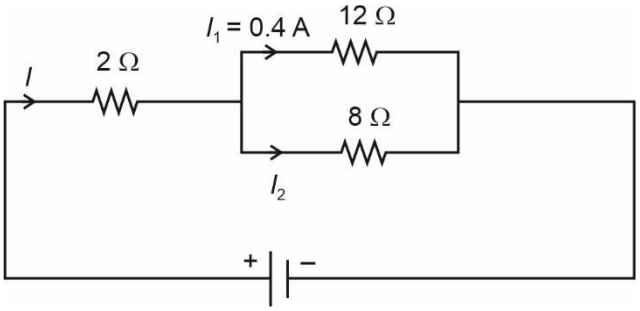
(ii) (a) Copper has low specific heat capacity, so the heat capacity of calorimeter is low and the amount of heat energy taken by the calorimeter from its contents to acquire the temperature of the contents is negligible. **[1½]**

(b) Thermal capacity = $m \times s$

$$= \frac{40}{1000} \times 4200$$

$$= 168 \text{ J } °C^{-1}$$ **[1½]**

(iii)



(a) For parallel combination,

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{8} + \frac{1}{12}$$

$$\Rightarrow \quad \frac{1}{R_P} = \frac{5}{24}$$

$$\Rightarrow \quad R_P = \frac{24}{5} = 4.8\ \Omega$$

$$R_{eq} = 2 + 4.8 = 6.8\ \Omega$$ **[1½]**

(b) $I_1R_1 = I_2R_2$

$0.4(12) = I_2(8)$

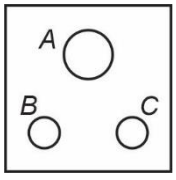
$$\Rightarrow \quad I_2 = \frac{4.8}{8} = 0.6 \text{ A}$$ **[1½]**

(c) $I = I_1 + I_2$

$= 0.4 + 0.6 = 1$ A **[1]**

Question 3

(i) Three wires with proper colour coding are connected to the three terminals of a three-pin socket. Match the colour of the wire with the proper terminals *A*, *B* and *C* of the socket. **[3]**



(a) Brown

(b) Green

(c) Light blue

(ii) (a) Why does it become colder after a hailstorm than during or before the hailstorm? **[3]**

(b) 'If two bodies have the same specific heat capacities, then they will always absorb the same amount of heat if their temperature increases by the same amount.' State whether the given statement is true or false.

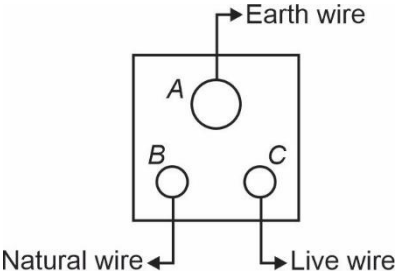
(iii) A metal piece of mass 420 g present at 80°C is dropped in 80 g of water present at 20°C in a calorimeter of mass 84 g. If the final temperature of the mixture is 30°C then calculate the specific heat capacity of the metal piece. **[4]**

[Specific heat capacity of water = 4.2 $Jg^{-1}\,°C^{-1}$,

Specific heat capacity of the calorimeter = 200 $Jkg^{-1}\,°C^{-1}$]

Solutions :

(i)



(a) Brown → *C* **[1]**

(b) Green → *A* **[1]**

(c) Light blue → *B* **[1]**

(ii) (a) It becomes colder after a hailstorm than during or before the hailstorm, because after the hailstorm, the ice absorbs the heat energy required for melting from the surroundings, so the temperature of the surroundings falls and we feel more cold. **[1½]**

(b) False, bodies with same specific heat capacity and different masses require different amount of heat energy to raise their temperature by the same amount. **[1½]**

(iii) Heat lost by metal piece = Heat gained by water and calorimeter **[1]**

$m_m \,.\, c_m\,[80 - 30] = [m_w \,.\, c_w + m_{cal} \,.\, c_{cal}][30 - 20]$

$420 \,.\, c_m \times 50 = [(80 \times 4.2) + (84 \times 0.21)] \times 10$ **[1]**

$420\, c_m \times 5 = 336 + 16.8$

$\therefore \quad c_m = \dfrac{352.8}{420 \times 5}$ **[1]**

$= 0.168\ Jg^{-1}\,°C^{-1}$

$= 168\ Jkg^{-1}\,°C^{-1}$ **[1]**

Question 4

(i) Rohit playing a flute and Anita playing a piano emit sounds of same pitch and loudness. **[3]**

(a) Name one characteristic that is different for waves from the two different instruments.

(b) If now the loudness of the sound from flute becomes four times that of the sound from piano, then write the value of the ratio $A_F : A_P$. (A_F – amplitude of sound wave from flute, A_P – amplitude of sound wave from piano)

(c) Define 'Pitch" of a sound.

(ii) (a) Name two factors on which the force experienced by a conductor carrying current, placed in a magnetic field, depends. Also state how these factors affect the force.

(b) With the help of which **rule** you can determine the direction of force acting on a current carrying conductor placed in a magnetic field? **[3]**

(iii) (a) What is nuclear energy?

(b) After emission of a nuclear radiation, the atomic number of the daughter nucleus increases by 1. Identify the nuclear radiation.

(c) Write a nuclear reaction indicating the nuclear change mentioned in (b).

(d) What is the special name given to the parent and daughter nucleus when this radiation is emitted? **[4]**

Solutions :

(i) (a) Quality **[1]**

(b) $\frac{L_F}{L_P} = \frac{A_F^2}{A_P^2} = \frac{4}{1}$ [$L_F \rightarrow$ Loudness of sound wave from flute, $L_P \rightarrow$ Loudness of sound wave from piano]

$\frac{A_F}{A_P} = \frac{2}{1}$

$A_F : A_P = 2 : 1$ **[1]**

(c) Pitch is that characteristic of sound by which an acute (or shrill) note can be distinguished from a grave or flat note. **[1]**

(ii) (a) Length of conductor (L). **[1]**

$F \propto L$

Amount of current flowing through conductor (I). **[1]**

$F \propto I$

(b) By Fleming's left hand rule we can determine the direction of fore acting on a current carrying conductor placed in a magnetic field. **[1]**

(iii) (a) When the nucleus of an atom undergoes a change to form new atoms, it releases a tremendous amount of energy, this energy is termed as nuclear energy. **[1]**

(b) ${}^{y}_{x}A \longrightarrow {}^{y}_{x+1}B + {}^{0}_{-1}e$ (β - emission) **[1]**

(c) ${}^{14}_{6}C \longrightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ **[1]**

(d) Special name for parent and daughter nucleus is 'Isobar'. **[1]**

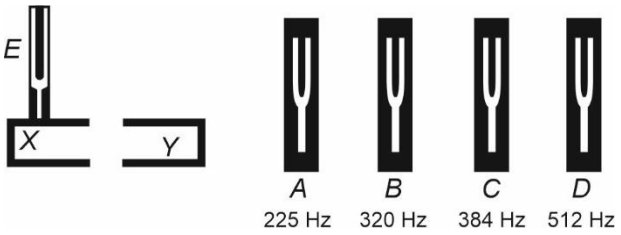
Question 5

(i) An appliance rated 440 W, 220 V is connected across 220 V supply. **[3]**

(a) Calculate the maximum current that the appliance can draw.

(b) Calculate the resistance of the appliance.

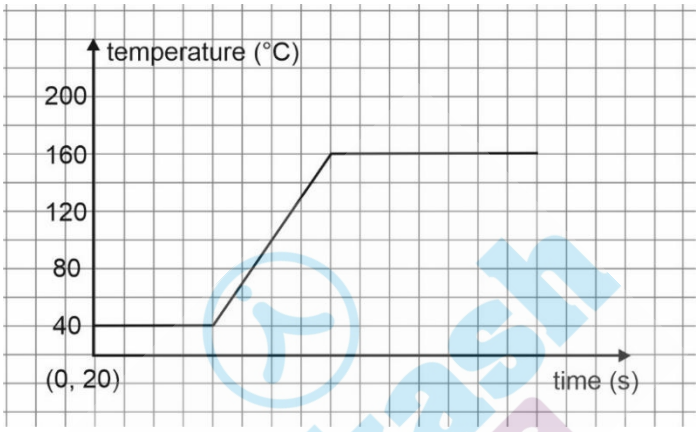
(ii) The diagram below shows a vibrating tuning fork *E* mounted on a sound box *X*. When the vibrating tuning forks *A*, *B*, *C* and *D* are placed on the sound box *Y* one by one, it is observed that a louder sound is produced when the tuning fork *B* is placed on *Y*. **[3]**



(a) What is the frequency of tuning fork *E*?

(b) Why does *B* produce a louder sound?

(iii) (a) From the graph of heating curve given below state the melting point and boiling point of the substance. **[4]**



(b) Complete and rewrite the following nuclear reaction by filling the blanks.

$$^{235}_{.....}U \rightarrow {}^{.....}_{90}Th + {}^{4}_{2}He$$

Solutions :

(i) (a) P = 440 W, V = 220 V

As, $P = VI$

$$\Rightarrow \quad I = \frac{P}{V} = \frac{440}{220} = 2\,\text{A}$$ **[1½]**

(b) As, $P = \frac{V^2}{R}$

$$\Rightarrow \quad R = \frac{V^2}{P} = \frac{220 \times 220}{440} = 110\ \Omega$$ **[1½]**

(ii) (a) Frequency of tuning fork *E* = Frequency of tuning fork *B*

$\Rightarrow$ f_E = 320 Hz **[1½]**

(b) When $f_E = f_B$, resonance occurs due to which a louder sound is produced. **[1½]**

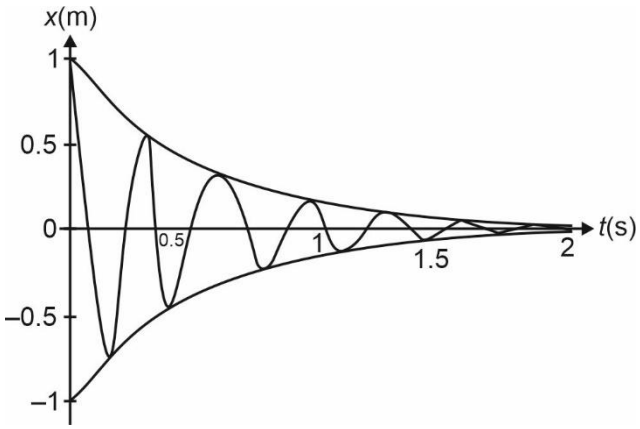
(iii) (a) Melting point of the substance = 40°C **[1]**

Boiling point of the substance = 160°C **[1]**

(b) $^{235}_{92}\text{U} \xrightarrow{\alpha\text{–decay}} {}^{231}_{90}\text{Th} + {}^{4}_{2}\text{He}$ **[2]**

Uranium (parent) — Thorium (daughter) — α-particle

Question 6



(i) Study the above figure and answer the following: **[3]**

(a) What type of vibration does the above figure represent?

(b) State one reason for which the amplitude of the vibration decreases with time.

(c) Write an example of natural vibrations.

(ii) A certain beam of α particles, β particles and γ radiations travel through a region of electric field produced between two oppositely charged parallel plates A(+) and B(–). **[3]**

(a) Which of the above three has the maximum speed?

(b) Which one deviates the most from its original path?

(c) Which one does not deviate at all when passing through a region of electric or magnetic field?

(iii) If a wire of resistance 2 Ω gets stretched to thrice its original length: **[4]**

(a) Calculate the new resistance of the wire.

(b) What happens to the specific resistance of the wire?

Solutions :

(i) (a) Damped oscillations. **[1]**

(b) The amplitude of vibrations decreases due to presence of resistive forces. Due to these resistive forces body loses its energy continuously. **[1]**

(c) When a tuning fork is struck against a hard rubber pad, it vibrates with natural frequency. **[1]**

(ii) (a) γ-radiations has the maximum speed. **[1]**

(b) β-particles deviate the most from its original path in the given electric field. **[1]**

(c) γ-radiations does not deviate when pass through a region of electric or magnetic field. **[1]**

(iii) (a) $R_1 = 2\ \Omega$, $R_2 = ?$

$l_1 = l$, $l_2 = 3l$

During stretching of wire, volume will remain constant. **[1]**

$A_1 l_1 = A_2 l_2$

$A_1 l = A_2 (3l)$

$\therefore \quad A_2 = \frac{A_1}{3}$

and $R_2 = \frac{\rho \times 3l}{A_2} = \frac{\rho \times 3l}{\frac{A_1}{3}}$ **[1]**

$R_2 = 9R_1$

$= 9 \times 2$

$R_2 = 18\ \Omega$ **[1]**

(b) Specific resistance of the wire will remain the same, as it is independent of the length and area of cross-section of the wire. **[1]**

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