

# ICSE Solved Paper 2022 Semester-2

## PHYSICS

### Class-X

(Maximum Marks : 40)

(Time allowed : One and a half hours)

Candidates are allowed additional 15 minutes for only reading the paper. They must NOT start writing during this time.

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 marks intended for questions are given in brackets [ ].

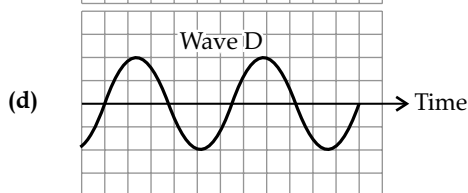
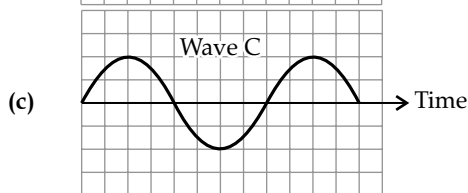
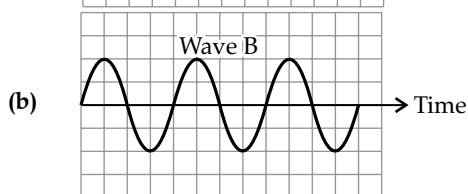
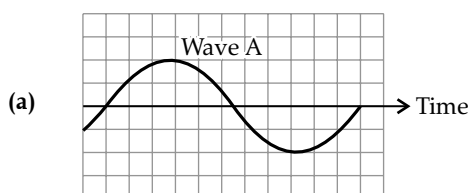
#### SECTION-A

Q. 1. Choose the correct answers to the question from the given options. (Do not copy the question. Write the correct answer only.) [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.

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



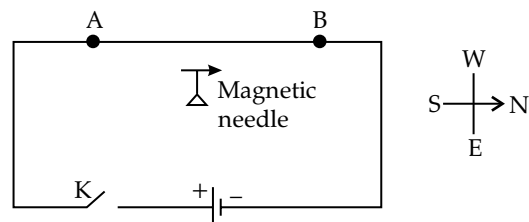
(iii) **The graph plotted for potential difference (V) against current (I) for ohmic resistors is**

- (a) A curve passing through the origin.
- (b) A straight line not passing through origin.
- (c) A straight line passing through the origin.
- (d) A circle centred at the origin.

(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

(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.
- (vi) **A coil wound around a piece of soft iron can become an electromagnetic 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.
- (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)  $4 \text{ Jkg}^{-1} \text{ }^\circ\text{C}^{-1}$   
 (b)  $400 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$   
 (c)  $4 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$   
 (d)  $4.2 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$
- (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.
- (ix) The heaviest nuclear radiation is
- (a) x-radiation  
 (b)  $\alpha$ -radiation  
 (c)  $\gamma$ -radiation  
 (d)  $\beta$ -radiation
- (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

Ans. (i) Option (d) is correct.

*Explanation* : Free vibrations are the vibrations with constant frequency and constant amplitude in the absence of any external force like air resistance.

(ii) Option (b) is correct.

*Explanation* : Pitch depends on frequency. Wave B has the highest frequency. So, it has the highest pitch.

(iii) Option (c) is correct.

*Explanation* : The relation between potential difference (V) and current (I) is  $I \propto V$ . So, it is an equation of a straight line passing through the origin.

(iv) Option (c) is correct.

*Explanation* : If you have a look at the inner portion of the main switch you will find that there are two fuses – one for live and other for neutral. So, it is

present in both live and neutral.



(v) Option (b) is correct.

*Explanation* : As the key is closed, a current will flow through the wire and a magnetic field will be produced. In interaction with the earth's magnetic field the resultant magnetic field will deflect the needle towards east.

(vi) Option (d) is correct.

*Explanation* : Retentivity of soft iron is low. So, as long as the current is flowing through the coil the soft iron behaves as an electromagnet. As soon as the current stops flowing it loses magnetism.

(vii) Option (c) is correct.

*Explanation* : Specific heat capacity is the amount of heat energy required to raise the temperature of a substance per unit of mass. 4000 J heat is required to raise the temperature of 1 kg of water through 1°C i.e. 4000 J heat is required to raise the temperature of 1000g of water through 1°C i.e. 4 J heat is required to raise the temperature of 1g of water through 1°C. So, specific heat capacity of water  $4 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$ .

(viii) Option (d) is correct.

*Explanation* : Water is used as a coolant in car radiators because of its high specific heat capacity. So, it can absorb a large amount of heat for a degree rise in temperature.

(ix) Option (b) is correct.

*Explanation* :  $\alpha$  and  $\gamma$  radiations are electromagnetic radiation.  $\beta$  radiations are stream of electrons.  $\alpha$  radiations are basically helium nucleus. Hence,  $\alpha$  radiation is the heaviest.

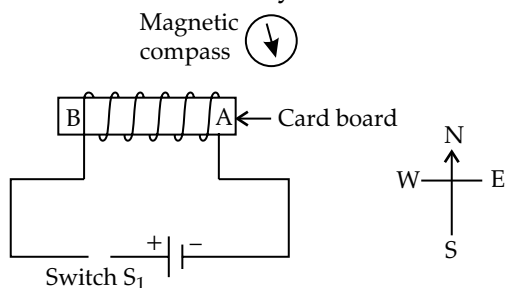
(x) Option (c) is correct.

*Explanation* : Radiocarbon dating (also referred to as carbon dating or carbon-14 dating) is a method for determining the age of archeological substances by using the properties of radiocarbon, a radioactive isotope of carbon.

**SECTION-B**

(Attempt any three questions from this Section)

- Q. 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?

- Ans. (a)** The switch  $S_1$  is closed.  
 (b) There is a deflection in the magnetic compass. So, it is concluded that the switch  $S_1$  is closed and current is flowing through the coil.  
 (c) The purpose of placing the magnetic compass is to determine the polarity developed at the A end of the solenoid.

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

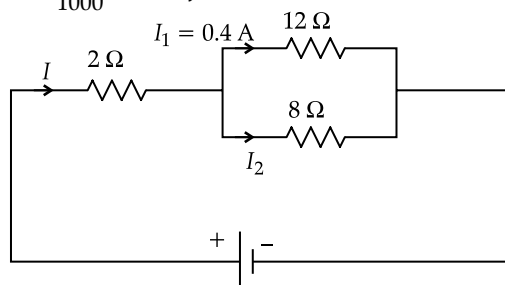
- (b) Calculate the thermal capacity of 40 g of water.  
 [Specific heat capacity of water =  $4200 \text{ J Kg}^{-1} \text{ }^\circ\text{C}^{-1}$ ]

- Ans. (a)** Reason for using copper as material for calorimeter: Copper is a good conductor of heat. Calorimetry is the process of measuring the amount of heat released or absorbed during a process. Copper has low specific heat capacity and so it reaches the equilibrium temperature quickly by absorbing a small amount of heat.

- (b) Thermal capacity = specific heat capacity  $\times$  amount of substance

$$\therefore \text{Thermal capacity of 40g water} = 4200 \times \frac{40}{1000} = 168 \text{ J } ^\circ\text{C}^{-1}$$

- (iii)



In the above circuit diagram, calculate:

- (a) the external resistance of the circuit  
 (b) the current  $I_2$   
 (c) the current  $I$ .

- Ans. (a)** External resistance of the circuit:

$12\Omega$  and  $8\Omega$  are in parallel. So the equivalent

$$\text{resistance} = \frac{12 \times 8}{12 + 8} = 4.8\Omega$$

$2\Omega$  is in series with this combination.

Hence the total resistance =  $2 + 4.8 = 6.8\Omega$

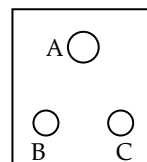
- (b) Potential difference across the  $12\Omega$  resistor = potential difference across  $8\Omega$  resistor

$$\text{Or, } 12 \times 0.4 = 8 \times I_2$$

$$\therefore I_2 = \frac{12 \times 0.4}{8} = 0.6\text{A}$$

- (c) Current  $I = I_1 + I_2 = 0.4 + 0.6 = 1\text{A}$

- Q. 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

- Ans.** C is line. Brown coloured wire is to be connected here.

B is neutral. Light blue coloured wire is to be connected here.

C is earth. Green coloured wire is to be connected here.

- (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.

- Ans. (a)** After a hailstorm, ice absorbs the heat energy (latent heat) needed for melting from the environment and thus lowering the surrounding temperature.

- (b) No. The statement is not true. Amount of heat absorbed depends on the mass of the

body also. So, if the masses of the two bodies are different then they will absorb different amounts of heat.

- (iii) A metal piece of mass 420 g present at 80°C is dropped in 80g of water present at 20°C in a calorimeter of mass 84g. 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 Jkg<sup>-1</sup> °C<sup>-1</sup>, Specific heat capacity of the calorimeter = 200 Jkg<sup>-1</sup> °C<sup>-1</sup>]

**Ans.** Mass of metal = 420g  
 Sp. Heat of metal = S  
 Temperatur = 80°C  
 Mass of water = 80g  
 Sp. Heat of water = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>  
 Temperatur = 20°C  
 Mass of calorimeter = 84g  
 Sp. heat of calorimeter material = 200 J kg<sup>-1</sup> °C<sup>-1</sup> = 0.2 J g<sup>-1</sup> °C<sup>-1</sup>  
 Temperature = 20°C  
 Final temperature of mixture = 30°C  
 Heat loss by metal = 420 × S × 50 = 21000 S J  
 Heat gain by water = 80 × 4.2 × 10 = 3360 J  
 Heat gain by calorimeter = 84 × 0.2 × 10 = 168 J  
 Since, heat lost = heat gained  
 ∴ 21000S = 3360 + 168  
 ∴ S = 0.168 J g<sup>-1</sup> °C<sup>-1</sup>

- Q. 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<sub>F</sub> : A<sub>P</sub> (A<sub>F</sub> – amplitude of sound wave from flute, A<sub>P</sub> – amplitude of sound wave from piano)  
 (c) Define 'Pitch' of a sound.

**Ans.** (a) The characteristics is quality.  
 (b) Loudness (L) is proportional to the square of amplitude (A)

$$\text{So, } L_F/L_P = A_F^2/A_P^2$$

$$\text{Or, } 4/1 = A_F^2/A_P^2$$

$$\therefore A_F/A_P = 2:1$$

- (c) **Pitch:** Sensation of sound is referred to as pitch. High pitch (shrill) sound corresponds to high frequency sound. Low pitch (flat) sound corresponds to low frequency 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. [3]  
 (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?

**Ans. (a)** Factors acting in a current carrying conductor depend on strength of magnetic field and strength of current flowing. Force is directly proportional to the strength of the magnetic field. Force is directly proportional to the strength of the current flowing.  
 (b) With the help of Fleming's left-hand rule, the direction of force experienced by current carrying conductor placed in a magnetic field can be determined.

**Fleming's left hand rule:**

If the thumb, first finger and second finger of left hand are held mutually perpendicular to each other then thumb represents the direction force on the conductor. The first finger represents the direction of the magnetic field. The second finger represents the direction of the current.

- (iii) (a) What is nuclear energy? [4]  
 (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?

**Ans. (a) Nuclear energy:** Nuclear energy is a form of energy released from the nucleus, the core of atoms, made up of protons and neutrons. This source of energy can be produced in two ways: fission – when nuclei of atoms split into several parts or fusion – when nuclei fuse together.  
 (b) The nuclear radiation is β-radiation.  
 (c)  ${}^A_Z X \rightarrow {}^{A-1}_{Z-1} Y + {}^0_{-1} \beta$   
 (d) Isobars.

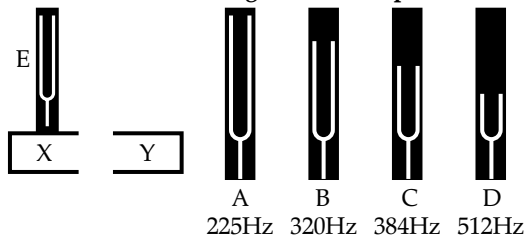
Two atoms of different elements having same mass numbers but different atomic nos. are called isobars. Referring to nuclear reaction of (c), mass numbers of X (parent) and Y (daughter) remain same, but the atomic numbers differ. So, they are isobars.

- Q. 5. (i)** An appliance rated 440 W, 220V is connected across 220V supply. [3]

- (a) Calculate the maximum current that the appliance can draw.  
 (b) Calculate the resistance of the appliance.

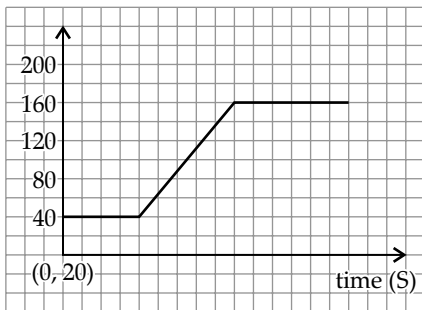
**Ans. (a)** Maximum current drawn =  $I = W/V = 440/220 = 2A$

- (b) Resistance of the appliance =  $R = W/I^2 = 440/2^2 = 110\Omega$
- (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 k. B is place on Y. [3]

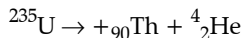


- (a) What is the frequency of tuning fork E?  
 (b) Why does B produce a louder sound?

- Ans. (a) Frequency of E is 320 Hz.  
 (b) B produces large sound since the frequency of B matches with the frequency of E and resonance occurs.
- (iii) (a) From the graph of heating curve given below state the melting point and boiling point of the substance. [4]

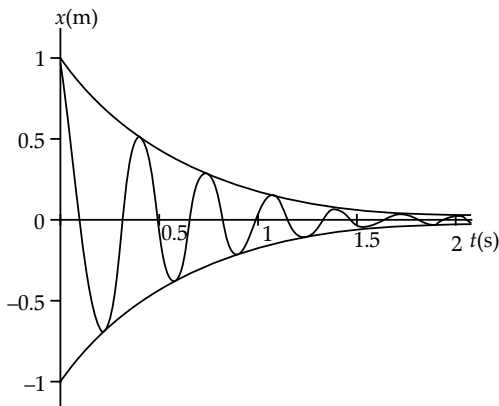


- (b) Complete the rewrite of the following nuclear reaction by filling in the blanks.



- Ans. (a) Melting point is  $40^\circ\text{C}$  and boiling point is  $160^\circ\text{C}$ .  
 (b)  ${}^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + 4\text{He}$

Q. 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.

- Ans. (a) It is damped vibration.  
 (b) Reason of decrement of amplitude of vibration is loss of energy due to friction.  
 (c) Example of natural vibration is an oscillating pendulum.
- (ii) A certain beam of  $\alpha$  particles,  $\beta$  particles and  $\gamma$  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?

- Ans. (a)  $\gamma$  radiation has the maximum speed which is equal to the speeds of light in vacuum.  
 (b)  $\beta$  particles deviate from their original path.  
 (c)  $\gamma$  radiation does not deviate at all when passing through a region of electric or magnetic field since it is made of uncharged particles photons.
- (iii) If a wire of resistance  $2\Omega$  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?

- Ans. (a)  $R = \rho \frac{l}{A}$   
 When new length becomes  $3l$ , then new area becomes  $A/3$ .  
 So,  $R' = 9\rho = \frac{1}{A} 9R = 9 \times 2 = 18\Omega$
- (b) Specific resistance remains same since, it does not depend on the dimension of the wire. It depends on the material.