FIITJEE

ICSE PART TEST – II

PHYSICS

Time: 1:30 Hours **Max Marks: 40**

Instructions:

1. **Section – A** (20 Marks): Attempt all questions from this section.

   Q1. 5 sub-parts (Short Answer Type) - 2 Marks Each

   Q2. 5 sub-parts (Short Answer Type) - 2 Marks Each

2. **Section – B** (20 Marks): Attempt any 2 questions from this section
   (There are 4 questions in this section, each question contains 3 sub-parts out of which 2 questions are of 3 marks and 1 question of 4 marks).

3. Wherever necessary, neat and properly labled diagram should be drawn.

Name of the Candidate : .....

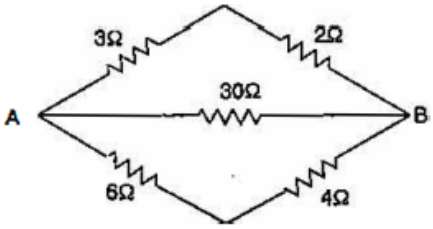
Enroll Number : .....

Date of Examination : .....

SECTION-A

1. (a) (i) Sketch a graph to show the change in potential difference across the ends of an ohmic resistor and the current flowing in it. Label the axes of your graph.
(ii) What does the slope of the graph represent ? [2]
(b) (i) Define heat capacity of a given body. What is its SI unit ?
(ii) What is the relation between heat capacity and specific heat capacity of a substance? [2]
(c) The electrical gadgets used in a house such as bulbs, fans, heater, etc., are always connected in parallel, not in series. Give two reason for connecting them in parallel. [2]
(d) An electrical heater is rated 4 h W, 220 V. Find the cost of using this heater for 12 hours if one kWh of electrical energy costs Rs. 3.25. [2]
(e) A mixture of radioactive substances gives off three types of radiations. [2]
(i) Name the radiation which travels with the speed of light.
(ii) Name the radiation which has the highest ionizing power.

2. (a) Two bulbs are marked 100 W, 220 V and 60 W, 110 V. Calculate the ratio of their resistances. [2]
(b) (i) What is the colour code for the insulation on the earth wire?
(ii) Write an expression for calcula1ing electrical power in terms of current and resistance. [2]
(c) Calculate the equivalent resistance between A and B from the following diagram: [2]

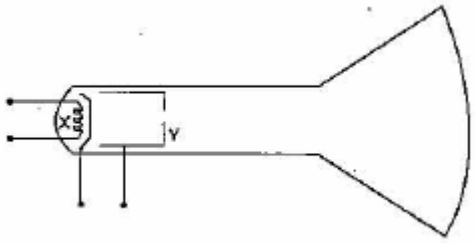


(d) Differentiate between heat and temperature. [2]

(e) (i) Define Calorimetry. [2]
(ii) What is meant by Energy degradation?

SECTION-B

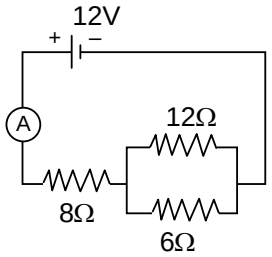
3. (a) (i) When does the nucleus of an atom become radioactive ?
(ii) How is the radioactivity of an element affected when it undergoes a chemical change to form a chemical compound ?
(iii) Name the product of nuclear fission which is utilized to bring about further fission of $^{235}_{92}U$. [3]
(b) (i) Mention one use and one harmful effect of radioactivity.
(ii) Give one source of background radiation. [3]
(c) (i)



The above diagram shows an electron gun of a hot cathode ray tube,
1. Name the parts X and Y.
2. A 6V d.c. source and a 1000V d.c. source are available. Show how these sources should be connected to the terminals of X and Y so as to obtain a focused' beam of fast moving electrons.

(ii) Give one use of a cathode ray tube. [4]

4. (a) (i) Draw a graph of Potential difference (V) versus Current (I) for an ohmic resistor.
(ii) How can you find the resistance of the resistor from this graph ?
(iii) What is a non-ohmic resistor ? [3]
(b) (i) An electric bulb is marked 100 W. 250 V. What information does this convey?
(ii) How much current will the bulb draw if connected to a 250 V supply ? [3]
(c} Three resistors are connected to a 12 V battery as shown in the figure given below:



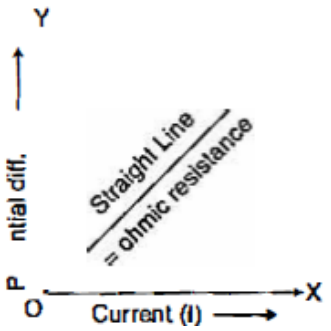
(i) What is the current through the 8 ohm resistor?
(ii) What is the potential difference across the parallel combination of 6 ohm and 12 ohm resistor?
(iii) What is the current through the 6 ohm resistor? [4]

5. (a) (i) Explain why the weather becomes very cold after a hail storm.
(ii) What happens to the heat supplied to a substance when the heat supplied causes no change in the temperature of the substance ? [3]
(b) (i) When 1g of ice at 0°C melts to form 1g of water at 0°C then, is the latent heat absorbed by the ice or given out by it ?
(ii) Give one example where high specific heat capacity of water is used as a heat reservoir.
(iii) Give one example where high specific heat capacity of water is used for cooling purposes. [3]
(c) 250g of water at 30°C is present in a copper vessel of mass 50g. Calculate the mass of ice required to bring down the temperature of the vessel and its contents to 5°C.
Specific latent heat of fusion of ice = 336×10^3 J kg^{-1}
Specific heat capacity of copper vessel = 400 J kg^{-1} $°C^{-1}$
. Specific heat capacity of water = 4200 J kg^{-1} $°C^{-1}$ [4]

6. (a) (i) State two properties which a substance should possess when used as a thermionic emitter.
(ii) When an alpha particle gains two electrons it becomes neutral and becomes an atom of an element which is a rare gas. What is the name of this rare gas? [3]
(b) (i) Define radioactivity.
(ii) What happens inside the nucleus that causes the emission of beta particle ?
(iii) Express the above change in the form of an equation. [3]
(c) (i) Name a device which is commonly used to convert an electrical signal into a visual signal.
(ii) The nucleus $^{202}_{84}X$ emits an alpha particle and forms the nucleus Y. Represent this change in the form of an equation.
(iii) What changes will take place in the mass number and atomic number of the nucleus Y if it emits gamma radiations ? [4]

HINTS & SOLUTIONS

1. (a) (i)



(ii) Slope = $\frac{\Delta V}{\Delta I} = R$

(b) (i) Heat capacity: Heat capacity is the amount of heat required to raise the temperature of a body by 1 °C. Its SI unit is J/° C.

(ii) Heat capacity = mass $\times$ specific heat capacity

(c) (i) In parallel the voltage across or potential across is same.

(ii) If one of the appliances is off or not working at least others will work.

(d) Given: P = 4 Kw, V = 220 V, t = 12 hrs

E = P $\times$ t =·4 $\times$ 12 = 48kWh

Cost = 48 $\times$ 3·25 = Rs.156.

(e) (i) γ (Gamma)

(ii) α (Alpha)

2. (a) $R = \frac{V^2}{P}$

$R_1 = \frac{(220)^2}{100}$

$R_2 = \frac{(110)^2}{60}$

$\frac{R_1}{R_2} = \frac{220 \times 220 \times 60}{100 \times 110 \times 110} = \frac{12}{5}$

(b) (i) Green or yellow

(ii) P = VI

= (IR) I ∵ By Ohm's Law, V = IR

$P = I^2R$

(c) Let R be the equivalent resistance between A and B,

$\frac{1}{R} = \frac{1}{3+2} + \frac{1}{30} + \frac{1}{6+4}$

$= \frac{1}{5} + \frac{1}{30} + \frac{1}{10}$

$= \frac{6+1+3}{30}$

$= \frac{10}{30}$

R = 3 Ω

(d) Difference between heat and temperature

Heat	**Temperature**
(i) It is a form of energy	(i) It the degree of hotness or codness of a body.
(ii) Unit is Joule/Calorie.	(ii) Unit is ac, °For Kelvin.

(e) (i) Heat is a form of energy which flows from the body at a higher temperature to a body at a lower temperature. The measurement of the quantity of heat is called calorimetry.

(ii) The dissipation of energy in the form of non useful energy (usually due to friction) is called Energy degradation.

3. (a) (i) When the atomic number of an element is more than 82, it became radioactive.
∴ elements having atomic number ·between 82 to 92 are very good radioactive elements.

(ii) No change, because in chemical change only electron changes while radioactivity is nuclear phenomenon.

(iii) Similar product as $^{235}_{92}U$.

(b) (i) **Use of radioactivity:** Carbon dating.
Harmfull effect: The radiation kills living cells and tissues.

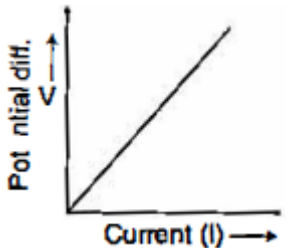
(ii) Background radiations are produced by substances like K-40, C-14 and radium contained jn our body.

(c) (i) (1) X $\rightarrow$ filament.
Y $\rightarrow$ anode.

(2) X (filament) is given low d.c. source (6V) and Y (anode) is given high voltage (1000V d.c.).

(ii) Use : In picture tube of T.V.

4. (a) (i)



(ii) Resistance = Slope of the graph

(iii) A non-ohmic resistor does not follow Ohm's Law.

(b) (i) It means that if a bulb is given a 250 V supply, it will consume 100 J of energy in each second.

(ii) Let· P = VI

$I = \frac{100}{250}$ ·

I = 0.4A

(c) Since 12Ω and 6Ω resistors are in parallel.

Their effective resistance = $\frac{12 \times 6}{12 + 6} = \frac{72}{18}$ = 4Ω

Total resistance of the ckt = 8 + 4 = 12Ω

Current drawn $\frac{12}{12}$ = 1A

(i) Current through the 8 ohm resistor= 1A.

(ii) P.D. across an resistor = 1 × 8 = 8V

P.D. across the parallel combination of resistors = 12 – 8 = 4V

∴The 12Ω and 6Ω resistances are in parallel, hence they have the same P.D. each i.e., 4V.

(iii) Current through the 6Ω resistor = $\frac{4}{6} = \frac{2}{3}$ A = 0·67 A

5. (a) (i) After the hail storm, ice absorbs heat energy required for melting from the surroundings, so the temperature of the surroundings fall further down and we feel cold .

(ii) Heat is stored as latent heat which is used in the change of state of the substance.

(b) (i) Latent heat of fusion is released by ice.

(ii) Hot water bottles used for fomentation.

(iii) Drinks get cooled more quickly by ·adding pieces of ice at 0°C than the ice cold water at 0°C.

(c) Heat lost by ice = Heat gained by water + Heat gained by copper

Let the mass of ice needed be M kg.

$M \times L_f = m_1 C_w \Delta t + m_2 C_c \Delta t$

$M \times 336 \times 10^3 = \frac{250}{1000} \times 4200 \times (30-5) + \frac{50}{1000} \times 400 \times (30-5)$

$M \times 336 \times 10^3 = 26250 + 500$

$M = \frac{26750}{336 \times 10^3} = 0.07961$ kg

= 79.61 gm

6. (a) (i) 1. Low Work Function

2. High Melting Point.

(ii) Helium gas.

(b) (i) Radioactivity is a random nuclear phenomenon in which spontaneous emission of α, β or γ radiations from the nuclei of atoms during their decay takes place.

(ii) In an unstable nucleus. number of neutrons are more than number of protons. In such a case, a neutron may change to a proton to achieve stability.by emitting an electron called beta particle.

(iii) ${}^{A}_{Z}P \longrightarrow {}^{A}_{Z+1}Q + \underset{(\beta \text{ particle})}{{}^{0}_{-1}e}$

(c) (i) Cathode Ray Tube.

(ii) ${}^{202}_{84}X \longrightarrow {}^{198}_{82}Y + {}^{4}_{2}He(\alpha \text{ particle})$

(iii) No change.