ICSE CLASS 10 EXAMINATION

PRACTICE QUESTION PAPER

PHYSICS

Chapter 11 : CALORIMETRY

(Specific Heat Capacity · Heat Capacity · Method of Mixtures · Change of State · Specific Latent Heat of Fusion and Vaporisation)

Maximum Marks: 40 **Time allowed: One hour**

1. Answers to this Paper must be written on the paper provided separately.

2. You will not be allowed to write during the first 5 minutes. This time is to be spent in reading the question paper.

3. The time given at the head of this Paper is the time allowed for writing the answers.

*4. **Section A** is compulsory. Attempt **all** questions from Section A and **any two** questions from Section B.*

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

6. Take specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$, specific latent heat of fusion of ice = 336 J g^{-1} and of vaporisation of water = 2260 J g^{-1}. Assume no loss of heat unless stated.

SECTION A (20 Marks)

(Attempt all questions from this Section.)

Question 1

Choose the correct answers to the questions from the given options. *(Do not copy the question, write the correct answers only.)* **[8]**

(i) The S.I. unit of specific heat capacity is:

(a) J kg^{-1} K^{-1} (b) J K^{-1}

(c) J kg^{-1} (d) kg J^{-1} K^{-1}

(ii) The heat energy required to raise the temperature of 2 kg of water by 5 K is (specific heat capacity of water = 4200 J kg^{-1} K^{-1}):

(a) 8400 J (b) 21000 J

(c) 42000 J (d) 84000 J

(iii) While ice at 0 °C is melting, the temperature of the ice–water mixture:

(a) rises steadily (b) falls steadily

(c) remains constant (d) first rises and then falls

(iv) Among the following, the substance having the highest specific heat capacity is:

(a) lead (b) copper

(c) iron (d) water

(v) Assertion (A): Burns caused by steam at 100 °C are more severe than those caused by boiling water at 100 °C.

Reason (R): Steam gives out a large amount of latent heat on condensing to water at 100 °C.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true, and (R) is the correct explanation for (A).

(d) Both (A) and (R) are true, but (R) is not the correct explanation for (A).

(vi) The heat required to melt 50 g of ice at 0 °C to water at 0 °C is (specific latent heat of fusion of ice = 336 J g^{-1}):

(a) 6720 J (b) 16800 J

(c) 33600 J (d) 3360 J

(vii) A body of mass 2 kg has specific heat capacity 500 J kg^{-1} K^{-1}. Its heat capacity is:

(a) 250 J K^{-1} (b) 500 J K^{-1}

(c) 1000 J K^{-1} (d) 2000 J K^{-1}

(viii) The principle of the method of mixtures is based on the law of conservation of:

(a) energy (b) mass

(c) momentum (d) charge

Question 2

(a) Define specific heat capacity of a substance. State its S.I. unit. **[2]**

(b) Fig. 1 shows a section of a calorimeter used in the laboratory. The parts are labelled P, Q, R and S. **[3]**

(i) Name the parts P and Q and state the purpose of P. **[1]**

(ii) Name the parts R and S and state why they are used. **[1]**

(iii) State one reason why the vessel Q is made of copper. **[1]**

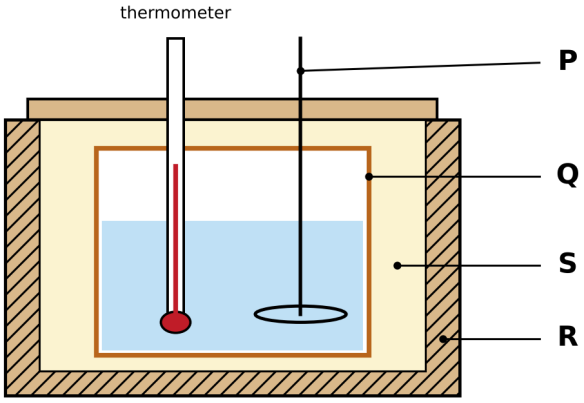


Fig. 1

(c) State the S.I. unit of heat capacity. **[1]**

Question 3

(a) A 700 W heater is used to heat 500 g of water from 20 °C to 70 °C. Calculate (i) the heat energy absorbed by the water, (ii) the time taken by the heater (assume no loss of heat), and (iii) the heat capacity of the water. **[3]**

(b) Two liquids A and B, each of mass 400 g, are heated separately by identical 50 W heaters. Fig. 2 shows how their temperatures vary with time. **[3]**

(i) Which liquid has the greater specific heat capacity? Give a reason. **[1]**

(ii) Find the ratio of the specific heat capacities of A and B. **[1]**

(iii) Calculate the specific heat capacity of liquid A in J kg^{-1} K^{-1}. **[1]**

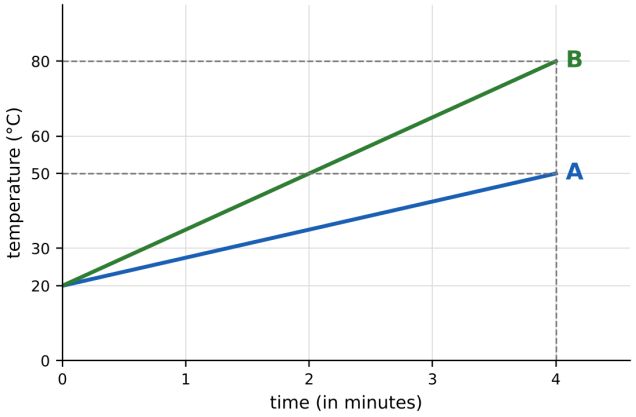


Fig. 2

SECTION B (20 Marks)

(Attempt any two questions from this Section.)

Question 4

(a) Define specific latent heat of fusion. State its value for ice in J g^{-1}. Calculate the heat required to convert 25 g of ice at 0 °C into water at 0 °C. **[3]**

(b) Give a reason for each of the following: (i) Water is used as a coolant in car radiators. (ii) The temperature of an ice–water mixture stays at 0 °C while the ice is melting, even though heat is supplied. (iii) A sea breeze blows from the sea to the land during the day. **[3]**

(c) A solid of mass 100 g is heated by a heater and its temperature is plotted against the heat supplied, as shown in Fig. 3. The solid is initially at 20 °C. **[4]**

(i) State the melting point of the solid and what the part BC of the graph represents. **[1]**

(ii) Calculate the specific heat capacity of the solid (in J g^{-1} $°C^{-1}$). **[1]**

(iii) Calculate the specific latent heat of fusion of the solid. **[1]**

(iv) Calculate the specific heat capacity of the liquid. **[1]**

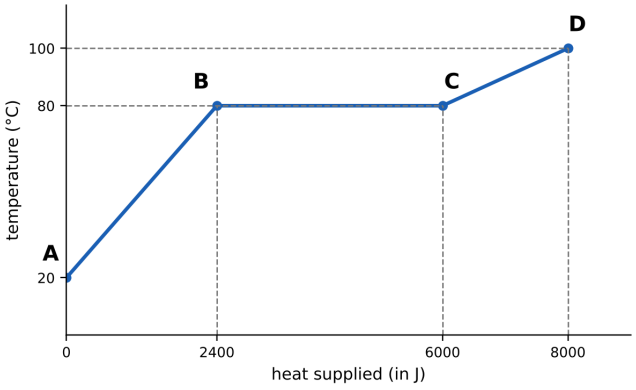


Fig. 3

Question 5

(a) State three precautions to be observed while performing a calorimetry experiment by the method of mixtures. **[3]**

(b) In Fig. 4, 60 g of hot water at 80 °C is poured into a copper calorimeter containing 40 g of water. Both the calorimeter and the water in it are initially at 20 °C, and the mixture attains a steady temperature of 50 °C. **[3]**

(i) Calculate the heat lost by the hot water. **[1]**

(ii) Calculate the heat gained by the cold water in the calorimeter. **[1]**

(iii) Hence find the heat gained by the calorimeter and its heat capacity. **[1]**

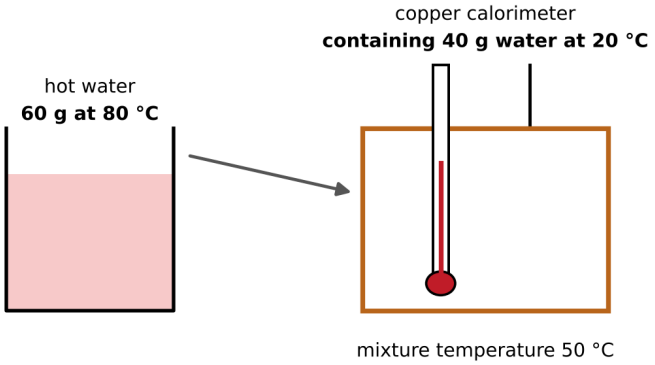


Fig. 4

(c) A block of ice below 0 °C is heated by a 500 W heater which supplies heat at a steady rate. Fig. 5 shows how the temperature varies with time (heat losses are negligible). **[4]**

(i) How long does the ice take to melt completely once it has reached 0 °C? **[1]**

(ii) Calculate the heat supplied during this time. **[1]**

(iii) Hence calculate the mass of the ice. **[1]**

(iv) Using the part AB of the graph, calculate the specific heat capacity of ice in J g^{-1} $°C^{-1}$. **[1]**

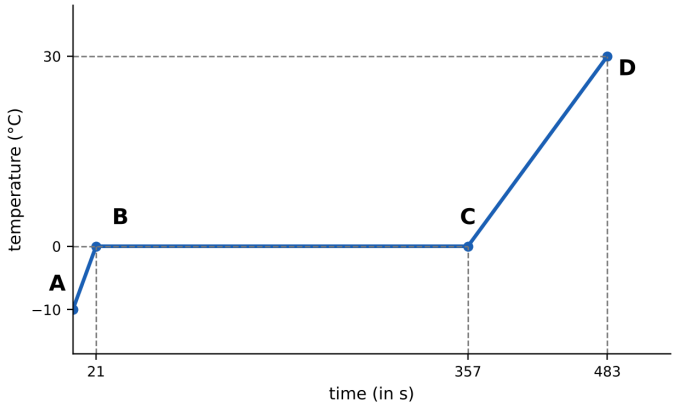


Fig. 5

Question 6

(a) A metal block of mass 150 g is heated to 100 °C and dropped into 100 g of water at 20 °C. The final steady temperature is 30 °C. Ignoring the heat taken by the container, calculate (i) the heat gained by the water, (ii) the fall in temperature of the block, and (iii) the specific heat capacity of the metal. **[3]**

(b) (i) Define specific latent heat of vaporisation. (ii) Calculate the heat released when 10 g of steam at 100 °C condenses to water at 100 °C. (iii) Find the total heat released if this water then cools further to 40 °C. **[3]**

(c) Fig. 6 shows two ice cubes of total mass 40 g at 0 °C placed in a drink of mass 200 g at 40 °C. Assume the drink has the same specific heat capacity as water and no heat is lost to the surroundings. **[4]**

(i) Calculate the heat needed to melt the ice completely. **[1]**

(ii) If the final temperature is t °C, write the heat balance equation. **[1]**

(iii) Find the final temperature of the drink. **[1]**

(iv) Why is ice at 0 °C more effective in cooling the drink than the same mass of water at 0 °C? **[1]**

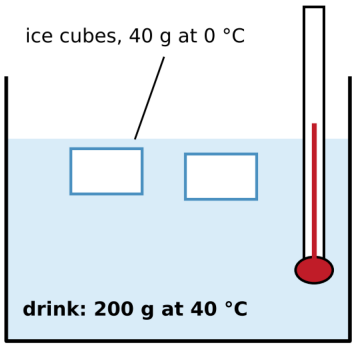


Fig. 6

— End of Question Paper —