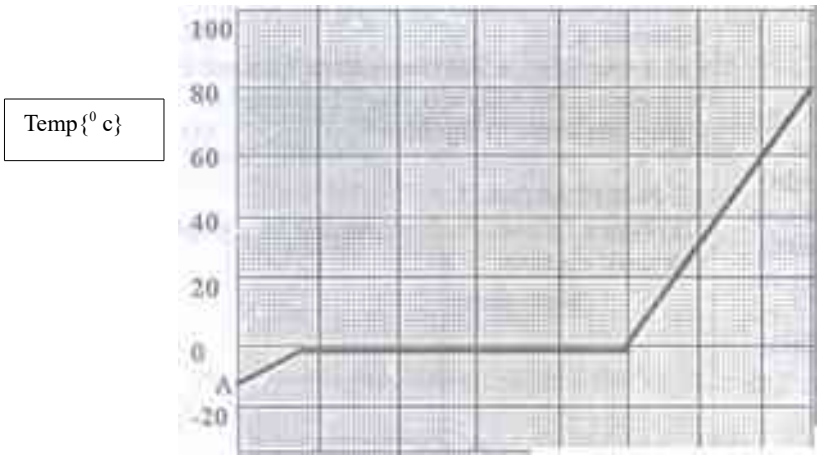
NAME	INDEX NUMBER
SCHOOL	DATE

QUANTITY OF HEAT

1. 1994 Q3c P2

A 200 gm mass of ice at 10°C was slowly heated by an immersion heater rated 200 w. The graph below shows how the temperature varies with time.



(i) Use the values below to calculate the time corresponding to the points labeled B and C

Specific heat capacity of water - 4200 J kg^{-1} k^{-1}
Specific heat capacity of ice - 2300 J kg^{-1} k^{-1}
Specific latent heat of fusion of ice - 330 k J k g^{-1} $x10^3$ (6 marks)

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(ii)Show by extrapolating the graph how the temperature varies with time up to the time the water has boiled for some time. (1 mark)

(iii) From the graph determine the time taken for the water to boil. (2 marks)

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2. 1995 Q22 P1

Distinguish between heat capacity and specific heat capacity of a body (1 mark)

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3. 1996 Q20 P1

A girl heats 5 kg of water to temperature of 80^0C. When she adds m kg of water at 15^0 C the mixture attains temperature of 40^0C. Determine the value of m. (ignore heat changes due to the container) (3 marks)

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4. 1996 Q21 P1

Equal masses of water and paraffin with specific heat capacities C_W and C_P respectively are heated using identical sources of heat, for the same length of time. The final temperature θ_P of paraffin was found to be greater than final temperature of water, Show that C_W is greater than C_P.

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5. 1996 Q4 P2

(a) (i) Describe the experiment to determine the specific heat capacity C, of a block of aluminium with two holes drilled in it, to accommodate a thermometer and an electric immersion heater (2 marks)

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(ii) State the measurements required in the experiment and show how they would be used to obtain C (5 marks)

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(iii) State two precautions that should be taken in this experiment (2 marks)

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(b) A copper calorimeter of mass 60g is filed with 100g of water at 25^0C. Steam at a normal temperature and pressure (N.T.P) is passed thought the water until a temperature 45^0C is attained. The final mass of calorimeter and the contents was found to be 163.5g. Calculate the specific latent heat of vaporization 'l' of water

(6 marks)

Specific heat capacity for water is $4200JKg^{-1}$ and for copper is $378Kg^{-1}K^1$

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6. 1998 Q3 P1

A heating coil rated 1000 W takes 15 minutes to heat 20kg of a liquid from 26°C of 42°C. Determine the specific heat capacity of the liquid.

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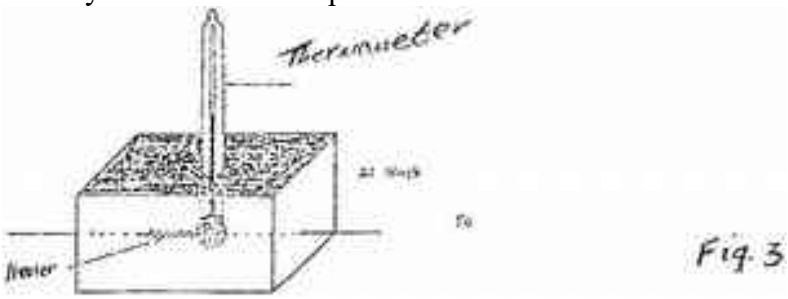
7. 1998 Q4 P2

a) In an experiment to determine the rate at which solar energy is absorbed by a surface, an aluminium block, coated black and fitted with a heater **(Fig. 3)** is exposed to the sun, for a period of time. The temperature rise in noted. After the temperature of the block is allowed to fall to the initial temperature, the block is electrically heated to the temperature.



(i) Draw and labelled a circuit diagram that would be used to determine the electrical energy.

(ii) State the measurements that would be taken in (a)(i) to determine the rate of heating of the block.

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(iii) Explain how the measurements stated in (a) (ii) would be used to determine the rate of heating of the block by the sun.

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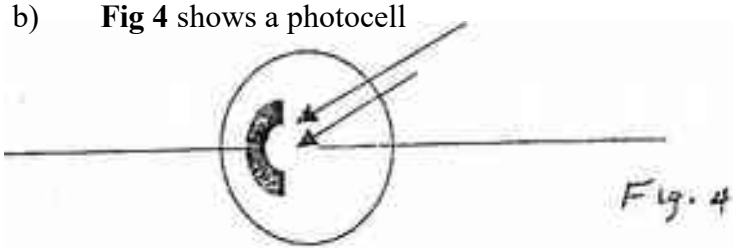
b) **Fig 4** shows a photocell



(i) Label the cathode and anode.

(ii) How are electrons produced in the cell

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(iii) Draw a simple circuit including the photocell to show the direction of flow of current

(iv) Calculate the photon energy in ultraviolet radiation whose frequency is 8.60×10^{14} HZ. (Plank's constant $h=6.63 \times 10^{-34}$ Js)

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8. 1999 Q20 P1

A substance of mass 2kg and specific heat capacity 400 Jkg K initially at 81^0C is immersed in water at 20^0C. If the final temperature is 21^0C. Determine the mass of water.

(The specific heat capacity of water is 4200j/kgK). Give your answer to 1 decimal place.

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9. 2001 Q1 P2

A block of ice of mass 40g at 0oC is placed in a calorimeter containing 400g of water at 20oC .Ignoring the heat absorbed by the calorimeter, determine the final temperature of the mixture after all the ices has melted.

(Specific latent heat capacity of fusion of ice= 340,00J/kg, specific heat capacity of water = 4,200j/kg).

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10. 2002 Q19 P1

An immersion heater rated 90W is placed is a liquid of mass 2kg. When the heater is switched on for 15 minutes the temperature of the liquid rises from 20°C to 30°C Determine the specific heat capacity of the liquid. (Assume no heat losses)

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11. 2002 Q4 P2

a) **Fig 5.** Shows the variation of temperature, T(^{0}C), with time, t (seconds). When frozen water is heated for some time.

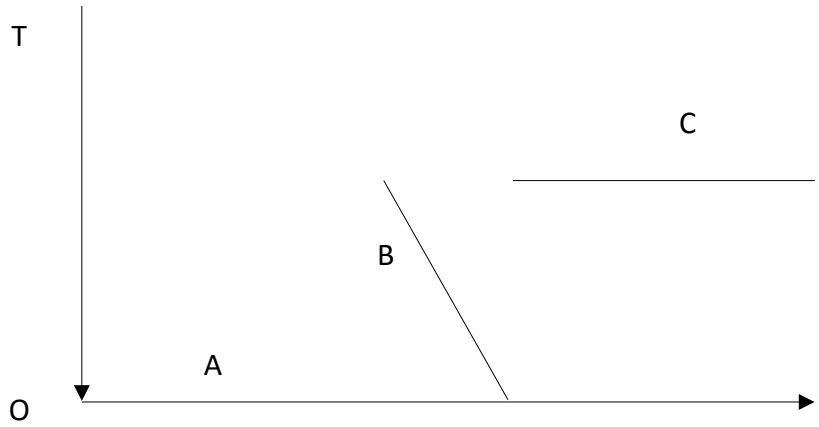

Fig. 5

(i) Explain the shape of the curve at the parts labelled AB and C.

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(ii) It is observed that when the temperature starts to rise, the volume initially decreases and then increases. State the reason for this observation.

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(iii) In the **fig. 5** sketch and explain the curve that would be obtained if frozen water was used. (Hint: specific heat capacity for seawater is lower what of fresh water.

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(b) Determine the quantity of heat energy required to change 3.0 kg of ice at 0^0 C to water at 5 ^{0}C. Specific latent heat of fusion of ice is 3.36 x 10^5 J/kg. Specific heat capacity of water is 4200J/kgK)

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12. 2003 Q28 P1

A heating element rated 2.5 kW is used to raise the temperature of 3.0kg of water through 500^{o}C. Calculate the time required to effect this. (Specific heat capacity of water is 4200 J/kgK)

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13. 2003 Q3 P2

(a) State what is meant by the term 'specific latent heat of vaporization'

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b) In an experiment to determine the specific latent heat of vaporization of water, steam at 100^0C was passed into water contained in a well-lagged copper calorimeter.

The following measurements were made;

Masss of calorimeter 50g
Initial mass of water 70g
Final mass of calorimeter + water + condensed steam = 23g
Final temperature of mixture = 30g

(Specific heat capacity of water = 4,200 Jkg^{-1} K^{-1} specific heat capacity for copper = 390 Jkg^{-1} K^{-1})

(i) Determine the:

I Mass of condensed steam

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II Heat gained by the calorimeter and water

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(ii) Given that L is the specific latent heat of vaporization of steam,

I write an expression for the heat given out steam.

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II Determine the value of L.

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14. 2004 Q21 P1

Determine the quantity of heat by the heater from the time the power starts to melt to the time it has all melted.

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15. 2004 Q22 P1

Determine the specific latent heat of fusion of powder assuming the container absorbs negligible amount of heat.

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16. 2004 Q2a P2

a) In an experiment to determine the power of an electric heater, melting ice was placed in a container with an outlet and the heater placed in the ice as shown in **Fig. 2**. The melted ice was collected.

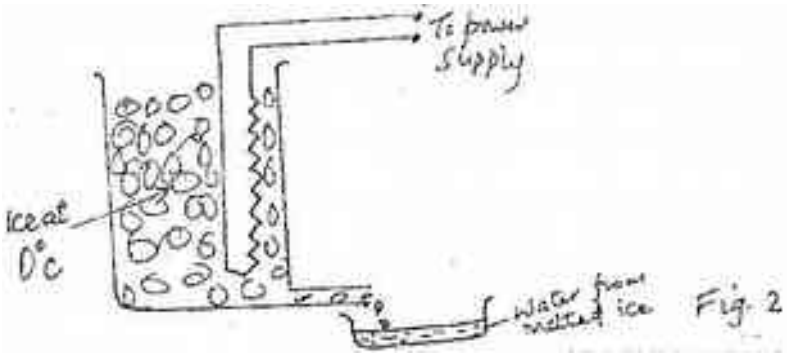

Fig. 2

i) Other than the current and voltage, state the measurement that would be taken to determine the quantity of heat absorbed by the melted ice in unit time.

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(ii) If the latent heat of fusion of ice is L, show how measurement in (i) above would be used in determining the power P. of the heater.

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(iii) It is found that the power determined in this experiment is lower than the manufacturer's value indicated on the heater.

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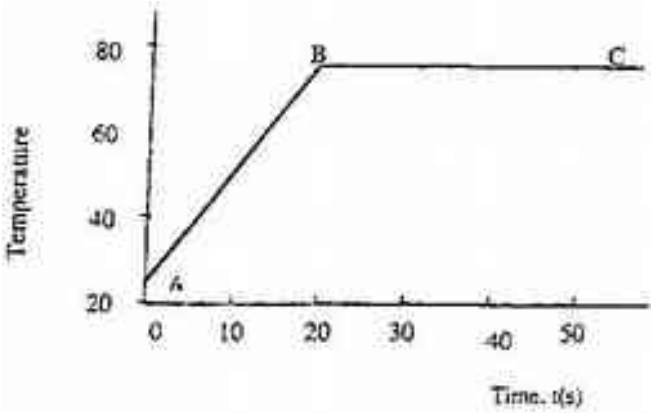
17. 2005 Q20 P1

Fig 11 shows the variation of temperature,θ, with time t, when an immersion heater is used to heat a certain liquid. Study the figure and answer questions 20 and 21.



State the reason for the shape of graph in the section labelled BC (1 mark)

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18. 2005 Q34 P1

Explain why a drop of methylated spirit on the back of the hand feels colder than a drop of water at the same temperature.

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19. 2006 Q8 P1

Beaker A contains 200g of water at 0^0 C while beaker B contains 200g of a mixture of ice and water at 0^0C. Two identical metal blocks are removed from a hot furnace. One block is dropped into beaker A while the other is dropped into beaker B at the same time.

Explain why more water evaporates from beaker A than from beaker B (2 marks)

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20. 2006 Q18 P1

(a) Define specific latent heat of fusion of a substance (1 mark)

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(b) Water of mass 200 g at a temperature of 60^0C is put well lagged copper calorimeter of mass 80g. A piece of ice at 0^0 C and mass 20 g is placed in the calorimeter and the mixture stirred gently until all the ice melts. The final temperature, T of the mixture is then measured.
Determine

(i) The heat absorbed by the melting ice at 0^0 C. (2 marks)

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(ii) The heat absorbed by the melted ice (water) to rise to temperature T (answer may be given in terms of T) (2 marks)

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(iii) The heat lost by the warm water and the calorimeter (2 marks)
(answer may be given in terms of T)

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(iv) The final temperature T of the mixture
(specific latent heat of fusion of ice = 334 000 J kg^{-1}
(specific heat capacity of water = 4 200 Jkg^{-1} k^{-1}
Specific heat capacity of copper = 900 J kg^{-1}) (4 marks)

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21. 2007 Q11 P1

State two factors that affect the melting point of ice (2 marks)

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22. 2007 Q17 P1

(a) Define the term specific latent heat of vaporization of a substance

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(b) Figure 11 shows the features of a domestic refrigerator. A volatile liquid circulates through the capillary tubes under the action of the compression pump.

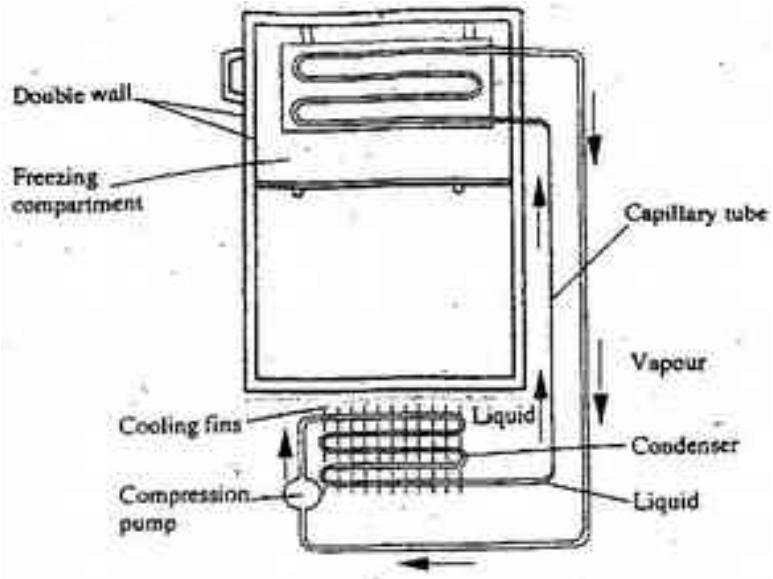

Figure 11

(i) State the reason for using a volatile liquid (1 mark)

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(ii) Explain how the volatile liquid is made to vaporize in the cooling compartment and to condense in the cooling fins (2 marks)

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(iii) Explain how cooling takes place in the refrigerator (3 marks)

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(iv) What is the purpose of the double wall? (1 mark)

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(c) Steam of mass 3.0 g at 100^0 C is passed into water of mass 400g at 10^0C. The final temperature of the mixture is T. the container absorbs negligible heat.
(Specific latent heat of vaporization of steam = 2260 kJ/ kg, specific heat capacity of water = $4200 Jkg^{-1}K^{-1}$)

(i) Derive an expression for the heat lost by the steam as it condenses to water at temperature T. (3 marks)

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(ii) Derive an expression for the heat gained by water (2 marks)

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(iii) Determine the value of T (2 marks)

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23. 2008 Q16 P1

a) Define the term heat capacity. (1 mark)

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b) You are provided with the apparatus shown in **Fig. 9** and a stop watch.

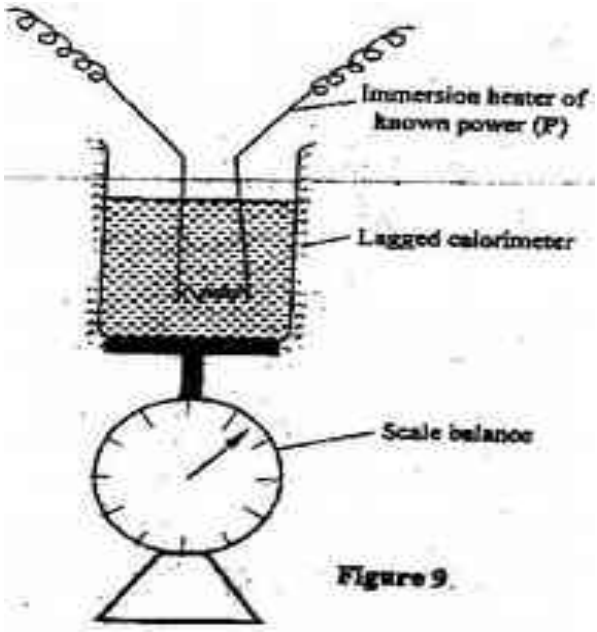

Figure 9

Describe an experiment to determine the specific latent heat of steam, l, using the set up. In your answer clearly explain the measurements to be made and how these measurements could be used to determine l. (6 marks)

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c) A block of metal of mass 150g at 100^0C is dropped into a lagged calorimeter of heat capacity $40JK^{-1}$ containing 100g of water at 25^0C. The temperature of the resulting mixture is 34^0C.

(Specific heat capacity of water = $4200JK^{-1)}$.

Determine:

(i) Heat gained by calorimeter; (2 marks)

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(ii) Heat gained by water; (1 mark)

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(iii) Heat lost by the metal block; (1 mark)

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(iv) Specific heat capacity of the metal block (3marks)

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24. 2009 Q15 P1

(a) State two factors that affect the boiling point of a liquid. (2 marks)

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(b) 100g of a liquid at a temperature of 10°C is poured into a well lagged calorimeter. An electric heater rated 50W is used to heat the liquid. The graph in **figure 8** shows the variation of the temperature of the liquid

with time.

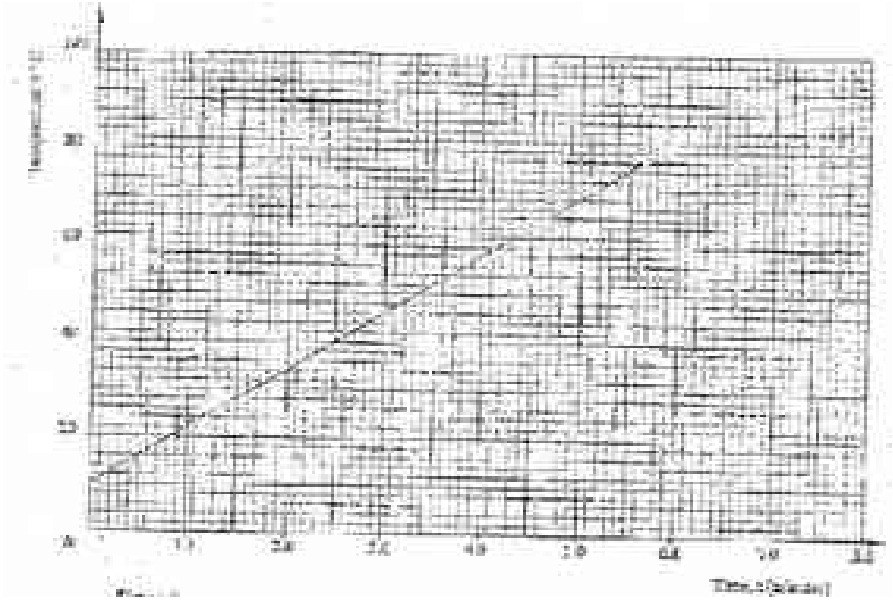

Figure 8

(i) From the graph, determine the boiling point of the liquid (1 mark)

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(ii)(I) Determine the heat given out by the heater between the times t= 0.5 minutes and t =5.0 minutes (2 marks)

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(II) From the graph determine the temperature change between the times t= 0.5 minutes and t = 5.0 minutes (1 mark)

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(III) Hence determine the specific heat capacity of the liquid. (2 marks)

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(iii) 1.8g of vapour was collected from above the liquid between the times t=6.8 minutes and t = 7.3 minutes. Determine the specific heat of vaporization of the liquid. (4 marks)

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25. 2010 Q17 P1

a) Explain why it is advisable to use the pressure cooker for cooking at high attitudes (2 marks)

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b) Water of mass 3.0kg initially at 20^0C is heated in an electric kettle rated 3.0KW. The water is heated until it boils at 100^0C. (Take specific heat capacity of water 4200jkg^{1}K^{-1}. Heat capacity of the kettle = 450JK-1, Specific latent heat of vaporization of water = 2.3mjkg-1)

Determine

i) The heat absorbed by the water. (1 mark)

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ii) Heat absorbed by the electric kettle (2 marks)

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iii) The time taken for the water to boil (2 marks)

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iv) How much longer it will take to oil away all the water. (2 marks)

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26. 2011 Q17c-d P1

In an experiment to determine the specific heat capacity of a metal, a 100g of the metal was transferred from boiling water to a lagged copper calorimeter containing cold water. The water was stirred and a final steady temperature was realized. The following data was recorded.

Initial temperature of cold water and calorimeter =20c
Temperature of boiling water=99c
Final temperature of water, calorimeter=27.7C
Mass of cold water and calorimeter=130g
Mass of calorimeter=50g

(take specific heat capacity of water as 4200jkg-1k-1)
(take specific heat capacity of copper as 400jkg-1k-1.)
Use the data to determine:

(i) The heat gained by the water and the calorimeter; (3 marks)

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(ii) The specific heat capacity of the meat. (3 marks)

Heat lost by metal=heat gained by water + calorimeter

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(d) State one possible source of error in the value of the specific heat capacity obtained in the experiment. (1 mark)

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27. 2012 Q13 P1

Figure 4 shows a graph of temperature against time when pure melting ice at 0^0C is heated uniformly.

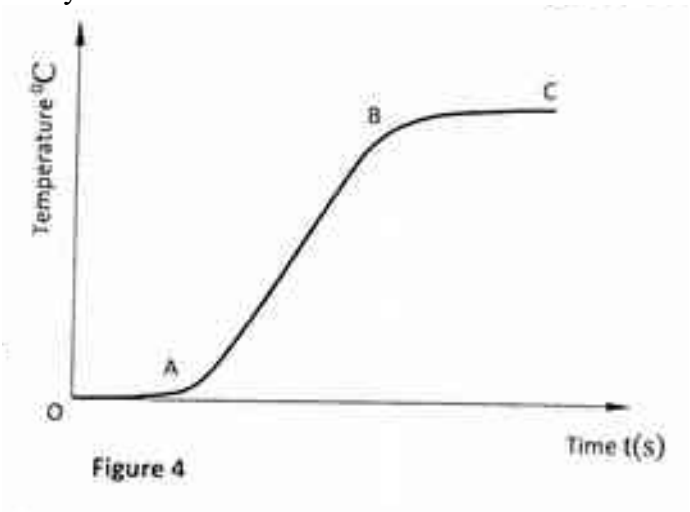

Figure 4

Explain what happens between parts:

(i) OA (1 mark)

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(ii) AB (1 mark)

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28. 2012 Q17d P1

An immersion heater rated 2.5 Kw is immersed into a plastic jug containing 2kg of water and switched on for 4minutes.Dermine;

(i) The quantity of heat gained by the water; (2 marks)

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(ii) The temperature change for the water; (3 marks)
take specific heat capacity of water as 4.2 x 103Jkg^{-1}K^{-1}).

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