S.6 PHYSICS REVISION QUESTIONS (On Calorimetry)

Where necessary,
Assume;
Acceleration due to gravity g = 9.81ms^{-1}
S.h.c of water = 4200Jkg^{-1}K^{-1}

1. (a) State Newton's law of cooling.

   (b) Describe an experiment to verify Newton;s law of cooling.

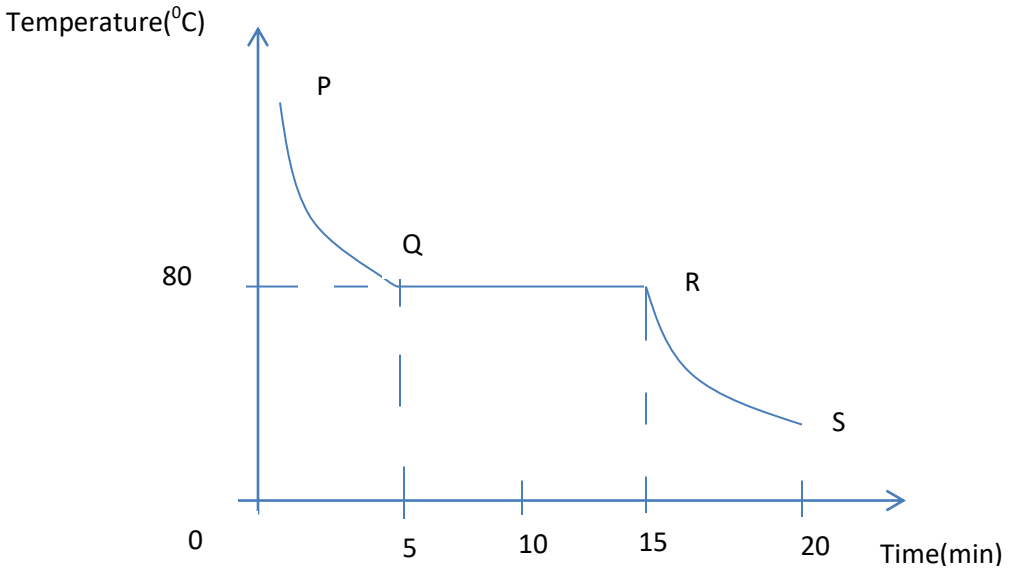
   (c) A metal cylinder of mass 0.5kg is heated electrically by a 12W heater in a room at 15^{o}C. The cylinder temperature rises uniformly to 25^{o}C in 5min and later becomes constant at 45^{o}C.

   (i) What is the rate of heat loss of the cylinder to the surroundings at 45^{o}C? Explain your answer.
   (ii) Assuming Newton's law of cooling, calculate the rate of loss of heat of the cylinder at 20^{o}C.
   (iii) Calculate the specific heat capacity of the metal , taking into account the loss of heat to the surroundings.

2. (a) What is meant by a cooling correction?

   (b) Describe an experiment to determine a cooling correction when determining the specific heat capacity of a poor heat conducting solid.

   (c) The figure below shows a cooling curve for a substance which, starting as a liquid, eventually solidifies.



(a) Explain the shape of the curve.

(b) Assuming Newton's law of cooling and taking; the room temperature as 20^oC, slope of the tangent to the curve when temperature is 70^oc as $10Kmin^{-1}$, specific heat capacity of the liquid as $2 \times 10^3 kg^{-1}K^{-1}$, mass of liquid as $1.5 \times 10^{-2}kg$, calculate the specific latent heat of fusion of the substance.

3. (a) (i) Describe the continuous flow method for determining the specific heat capacity of a liquid.

(ii) Outline any three advantages of using the continuous flow method over the method of mixtures in determining the specific capacity of a liquid.

(i) Outline any advantage of the method of mixtures over the continuous flow method in determining the specific heat capacity of a liquid.

(c) In an experiment to determine the specific heat capacity of water, a stream of water flows at a steady rate of $5.0gs^{-1}$ over an electrical heater dissipating 135W and a temperature rise of 5.0K is observed. On increasing the rate of flow to $10.0gs^{-1}$, the same temperature rise is produced with a dissipation of 240W. Calculate the specific heat capacity of water.

(d) Ice at 0^oC is added to 200g of water initially at 70^oCin vacuum flask. When 50g of ice has been added and has all melted the temperature of the flask and contents is 40^oC. When a further 80g of ice has been added and has all melted the temperature of the whole becomes 10^oC. Calculate the specific latent heat of fusion of ice, neglecting any heat lost to the surroundings.

(e) In the absence of bearing frictiona winding engine would raise a cage weighing 1000kg at 10ms-1, but this is reduced by friction to 9ms-1, How much oil, initially at 20^oC , is required per second to keep the temperature of the bearing s down to 70^oC? [specific heat capacity of oil = $2100Jkg^{-1}K^{-1}$,