TUTORIAL QUESTIONS 1

Wherever necessary use:

The triple point of water is 273.16K

The specific heat capacity of water is C_w = 4200Jkg^{-1}K^{-1}

The specific latent heat of fusion of ice is L_1 = 334,000Jkg^{-1}

The linear expansivity, α for copper is 1.7 x 10-5K^{-1}

The Boltzmann constant, k = 1.38 x 10^{-23} JK^{-1}

The specific latent heat of vaporization = 2 x 10^{6}Jkg^{-1}

Stefan's constant, σ = 5.6703 x 10^{-8}Wm^{-2}K^{-5}

Qn. 1. (a) (i) What is the cause of hotness of a body? (ii) State the zeroth law of thermodynamics

(b) The resistance of a platinum resistance thermometer is 2.20Ω when measuring the Kelvin temperature T of oil and 2.00 Ω at the triple point of water. Find the temperature T.

(c) Find the final temperature of the mixture of 20.0g of ice at 0°C and 60.0g of water at 100°C.

(d) The temperature of a 2m long copper rod rises from 10°C to 20°C. Calculate the new length of copper.

Q2. (a) Define a Celsius temperature scale in terms of a thermometric property Y.

(b) What are the four advantages of the thermoelectric thermometer?

(c) The resistance R_Θ of a platinum varies with the temperature Θ°C as measured by constant-volume gas thermometer according to the equation $R_\Theta = R_0 (1 + 4000a\theta - a\theta^2)$. Where a is a constant. Calculate the temperature of the platinum scale corresponding to 300°C on this gas scale.

Q3. (a) What is meant by the specific latent heat of vaporization of a liquid?

(b) A metal of mass 0.2kg at 100°C is dropped into 0.08kg of water at 15°C contained in a calorimeter of mass 0.12kg and specific heat capacity 400Jkg^{-1}K^{-1}. The final temperature reached is 35°C. Find the specific heat capacity of metal. Then, assuming negligible heat loss.

(c) An electrical kettle with a 2 kW heating element has a heat capacity of 400JK^{-1} is used to heat 0.5kg of water. If the initial temperature is 30°C and neglecting the heat loss. Find

i. How long will it take to heat the water to its boiling point 100°C?

ii. Total heat supplied by the electrical heater in 6 minutes.

Q 4 (i) Define temperature in degree Celsius in terms of a temperature measuring property x.

ii) State the Zeroth law of thermodynamics

5 The temperature of a 6m long copper rod rises from 10°C to 20°C. Calculate the new length of copper.

6 Explain the following observations:

(a) Heat is supplied to the boiling kettle and yet no rise in temperature is observed.

(b) The mass of water in boiling kettle decreases steadily with time.

(c) The hand feels cold if it is wetted with alcohol

(d) Why a scald from steam is more dangerous than a scald from the same mass of boiling water?

7 (a) Outline the steps in establishing a temperature scale.

(b) A liquid – in glass thermometer uses liquid of which the volume varies with temperature according to the relationship $V_T = V_0 (aT + bT^2)$ where V_T and V_0 are the volume at T°C and 0°C on the gas scale respectively, and a and b are constants. If $a = b \times 10^3$, what temperature will be indicated on the liquid in glass scale when that on the gas thermometer is 60°C?

8 a) What is difference between temperature and heat?

b) State Zeroth law of thermodynamics

9 Write down the steps followed in establishing temperature scale.

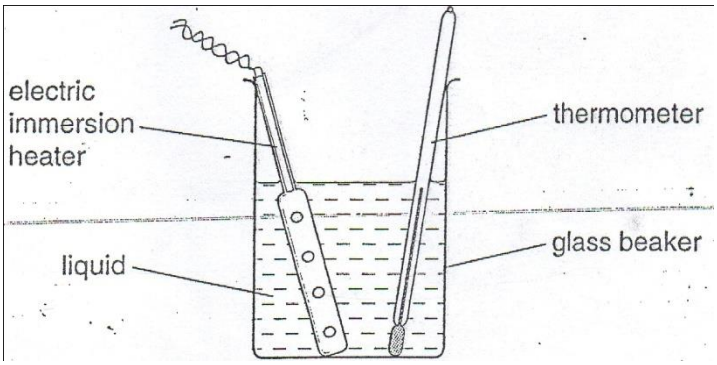
10 Define: -

i. Lower fixed point

ii. Upper fixed point.

11 a) Define specific heat capacity.

b) The diagram shows apparatus which may be used to find specific heat capacity of a liquid.



The readings taken are: power of heater is 50W, time which heater is switched on is 600 s, initial temperature of the liquid is 20°C, final temperature of the liquid is 65°C and mass of the liquid heated is 200g.

i) Use the data to calculate the specific heat capacity of the liquid

ii) Explain why the value obtained from third data will be higher than the actual value.

iii) Describe one addition to the apparatus which would make the calculated experimental value nearer to the actual value.

12. a) Define specific latent heat of fusion

b) Calculate the thermal energy that is necessary to convert 5.00kg of ice at -20.0°C to water at 20°C.

Qn. 13. a) State (i) the zeroth law of thermodynamics and (ii) heat.

b) The resistance of a platinum resistance thermometer is 3.30Ω when measuring the Kelvin temperature T of oil and 3.00Ω at the triple point of water. Find the temperature T.

c) What are the four advantages of the thermoelectric thermometer?

d) Differentiate between heat capacity and specific heat capacity.

e) The temperature of a 5.0m long copper rod rises from 10°C to 30°C. Calculate the new length of copper.

(f) Find the final temperature of the mixture of 20.0g of ice at 0°C and 40.0g of water at 100°C.

13. (c) A liquid-in-glass thermometer uses liquid of which the volume varies with temperature according to the relation $V_\Theta = V_0 (1 + a\theta + b\theta^2)$ where V_Θ and V_0 are the volumes at θ°C and 0°C on the gas scale respectively, and a and b are constants. If $a = b \times 10^2$, what temperature will be indicated on the liquid-in-glass scale when that on the gas thermometer is 90°C?
14. (a) What is meant by the specific latent heat of fusion of a solid?

(b) A electrical kettle with a 1.5 kW heating element has a heat capacity of 400 JK^{-1}. It is used to heat 0.5kg of water. If the initial temperature is 20°C and neglecting the heat loss? Find

i. How long will it take to heat the water to its boiling point 100°C

ii. Total heat supplied by the electrical heater in 10 minutes

iii. Starting at 20°C what mass of water is boiled away in 10 minutes.

15. A puddle of water lies on a concreate pavement. Discuss the factors which will influence the rate of evaporation of water in the puddle.
16. Calculate the temperature which has the same value on Celsius and Fahrenheit scales.
17. Why is it incorrect to say matter contains heat?
18. Why is it important to protect water pipes so they don't freeze?
19. If water had lower s.h.c would lakes be more likely or less likely to freeze in the winter?
20. Define the word calorie.
21. A liquid freezes at 40 °C and boils at 290 °C. Find the boiling point of a liquid in this scale if it boils at 62°C in normal scale. (Answer: 195 °C)