MENGO SENIOR SCHOOL

BEGINNING OF TERM 2 EXAMS 2003

S.6 PHYSICS P510/1

TIME: 2 HOURS

INSTRUCTIONS:
Attempt all questions.
Assume where necessary
-Acceleration due to gravity, g= 9.81ms^{-2}
-Specific Heat capacity of water = 4200Jkg^{-1}k^{-1}
-Mass of the Earth = 5.97 x 10^{24}kg
-Radius of the Earth, Re = 6.4 x 10^{6}m
-Avogadros number, NA = 6.02 x 10^{23} mol^{-1}

QUESTIONS:

1(a)(i) What assumptions are made in the derivation of the kinetic theory expression for the pressure of an ideal gas? (2)

(ii) State any two ways in which real gases differ from ideal gases. (2)

(b) Distinguish between saturated and unsaturated vapors. (3)

(c) Draw sketch graphs to show, for a saturated vapour, the variation of:
(i) Pressure with temperature, volume remaining constant. (1)
(ii) Pressure with volume, temperature remaining constant. (1)

(d) Explain the form of the curves in (c)(i) and (ii) above, using the kinetic Theory of matter. (2)
(e) State the relation between pressure and volume for:
(i) Reversible isothermal process. (1)
(ii) Reversible adiabatic process. (1)

(f)(i) A diatomic gas initially at a pressure of 1.0 x 10^5 Pa expands reversibly to five times its original volume of 2.0 x 10^{-3} m^3 at constant temperature of 273k. Calculate the work done by the gas during the expansion (= 1.40) (4)

(ii) State the conditions necessary to realise in practice:
- Areversible isothermal expansion. (2)
- A reversible adiabatic expansion,. (1)

2(a)(i) Define the coefficient of thermal conductivity of a material. (1)

(ii) Describe searle's method of determining the thermal conductivity of a good conductor of heat. (7)

(b) The two ends of a metal bar of length 1.0m are perfectly lagged up to 20cm from either end. The ends of the bar are maintained at 100^0C and 0^0C respectively.

(i) Sketch a temperature versus distance graph, along the bar. (2)

(ii) Expalin the features of the graph in b(i). (3)

(c) The external walls of a house consist of 2 layers of brick separated by air cavity. The outer face of the wall is at a temperature of 45^0C, while the inside of the house is at 20^0C. If the thickness of each brick layer is 15cm and that of the air cavity is 5cm, calculate the temperatures of the walls in contact with the air in the cavity. The thermal conductivities of brick and air are 1.0 and 0.026 $Wm^{-1}k^{-1}$ (7)

3(a)(i) What is meant by a thermometric property? (1)

(ii) What qualities make a particular property suitable for use in a practical thermometer? (3)

(b) The value of the thermometric property X of a certain substance is given by:
$X_t = X_0 - 0.50t + (2.0 \times 10^{-4})\, t^2$

Where t is the temperature in degrees Celsius measured on a gas thermometer scale. What would be the Celcius temperature defined by the property X which corresponds to a temperature of 50^0C on this gas thermometer scale? (4)

(c)(i) Describe an electrical method for determining the latent Heat of vapourisation of a liquid. (4)

(ii) An electrical heater rated 500W is immersed in a liquid of mass 2.0kg contained in a large thermos flask of heat capacity $840Jk^{-1}$ at 28^0C. Electrical power is supplied to the heater for 10 minutes. If the specific Heat Capacity of the liquid is 2.5×10^3 $Jk^{-1}k^{-1}$, its specific latent heat of vapourisation is $8.54 \times 10^3 Jkg^{-1}$ and its boiling point is 78^0C, estimate the amount of liquid which boils off. (8)

State any assumptions made in your calcuilation.

4(a)(i) Define the term Specific Heat Capacity.

(ii) What is meant by a cooling correction in calorimetry

(b) A metal containing of heat capacity $20Jk^{-1}$ holds 0.15kg of liquid. An immersion heater is placed in the liquid and a current of 3.0A with a p.d of 12V flows for 4.0 minutes. The temperature and time values are tabulated below:

Temp.0^0C	15.0	20.0	24.7	29.3	33.9	32.8	31.7	30.6
Time t(s)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0

(i) Plot a graph of temperature against time and use it to estimate the cooling correction.

(ii) Calculate the Heat Capacity of the liquid.

END