TIGANIA SOUTH 2015

PHYSICS PAPER 3

MARKING SCHEME

1. b) I = 0.12 ± 0.01A ✓1
   V = 2.6 ± 0.1V ✓1
   c) E = 3.3 ±0.2V ✓1 maximum range, E = 3.5V
   d)

Length L (cm)	100	70	60	50	40	20
I (A)	0.12	0.19	0.2	0.24	0.28	0.42
P.d (V)	2.6	2.5	2.4	2.35	2.3	2.0
E – V (v)	0.9	1.0	1.1	1.15	1.2	1.5

Use the E of the student in the row containing the values of E – V(f)

2

Angle i	10	20	30	40	50	60
Distance a (cm)	4.5	4.2	3.9	3.6	3.3	3.0

$\pm$ 0.2 cm

All correct values max 5mks

Each correct value 1mk

(h) Slope $S = \frac{\Delta y}{\Delta x}$

$= \frac{(4.5 - 3.75)\text{ cm}}{(10 - 35)}$ √ M1 correct substitution

$= \frac{-0.75}{25} = -0.03\text{cm}$ √ A 1

(i) From the graph a_{max} is when i = o i.e 4.8cm

(j) a = mi + k

m is the slope = - 0.03cm √ A 1

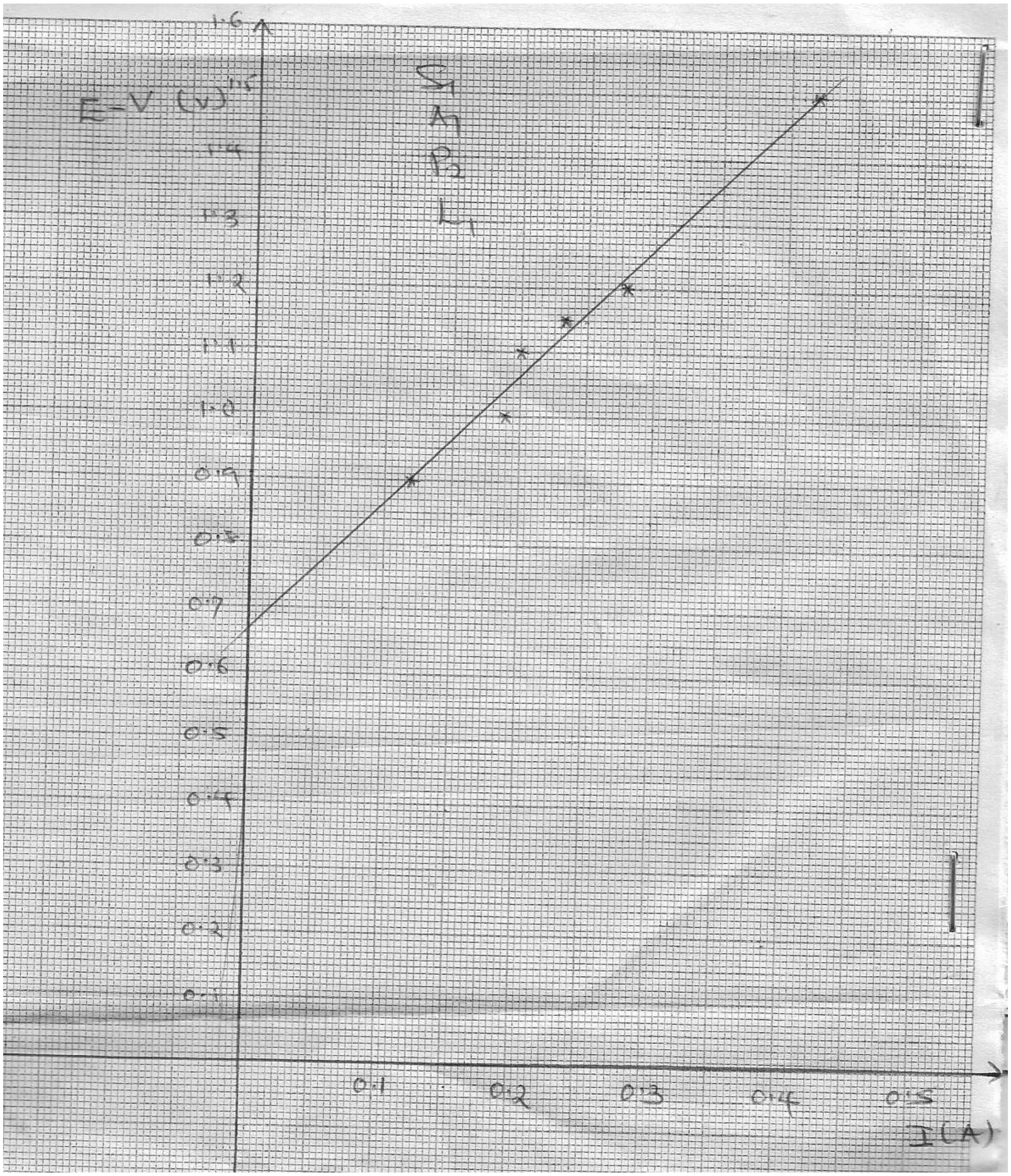
k is the y intercept = 4.8cm √ A 1

(k) Width of refracting glass block

W = 6.0cm $\pm$ 0.2cm √ A 1

(i) For i = 30^0, $x = \frac{w}{a} = \frac{6.0\text{cm}}{3.9\text{cm}} = 1.538$ √ A 1

(m) X represents refractive index of the glass block √ A 1



f) Slope = $\frac{\Delta(E-V)}{\Delta I}$ ✓1 = $\frac{1.5-0.9}{0.42-0.12}$ ✓1

= $\frac{0.6}{0.3} = 2\Omega$ ✓1

g) E = V + Ir

E – V = rI + C ✓1

r = internal resistance = slope = 2Ω ✓1

NAME……………………………………………………………ADM NO……...CLASS..…

232/1 **Candidate's Signature….…….**
Physics
Paper 1 **Date……………………………**
MAY 2015
2 hours

TIGANIA SOUTH PRE-MOCKS 2015

Kenya Certificate of Secondary Education
PHYSICS
Paper 1
2 hours

MARKING SCHEME

INSTRUCTIONS TO CANDIDATES

*Write your **name, admission number** and **class** in the spaces provided above.*

***Sign and write the date** of examination in the spaces provided above.*

*This paper consists of **TWO** sections: **A** and **B**.*

*Answer **ALL** the questions in sections **A** and **B** in the spaces provided.*

***ALL** working **MUST** be clearly shown.*

Non-programmable silent electronic calculators and KNEC mathematical tables may be used.

***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing**.*

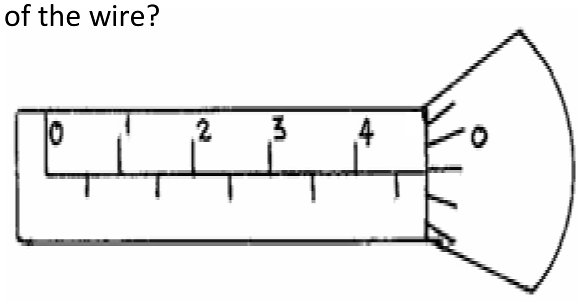
For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1 – 8	25	
B	9	09	
	10	12	
	11	10	
	12	10	
	13	07	
	14	07	
	Total Score	80	

SECTION A (25 MARKS)

Answer all questions in this section in the spaces provided:

1. The diagram **below** shows a micrometer screw gauge used by a student to measure the thickness of a wire. If it has a zero error of 0.06mm, what is the actual thickness of the wire? (2mks)



=4.99-0.06

=4.93mm

2. (a). State two differences between heat transfer by convection and radiation ***(2mks)***

- ***Convection requires a medium ,radiation does not***
- ***Convection is by actual movement of particles while radiation is by electromagnetic waves***

(b). Give a reason why a thick glass bottle cracks when boiling hot water is suddenly poured inside it (1mk)

Uneven expansion

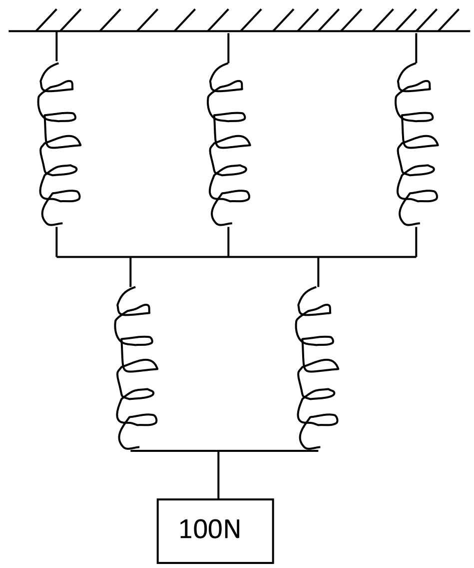
3. An aircraft 300m from the ground, travelling horizontally at 400 m/s releases a parcel. Calculate the horizontal distance covered by the parcel from the point of release. (Ignore air resistance) (2mks)

300= 0.5gt²

t= 7.746sec

R=ut = 400×7.746= 3098.4m

4. A single spring stretches by 2.0 cm when supporting a load of 50N. If in the system below the springs are identical and have negligible weight;



Find:

a) The total extension of the system. (2mks)

=2+1.33=3.333cm

b)The total spring constant. (2mks)

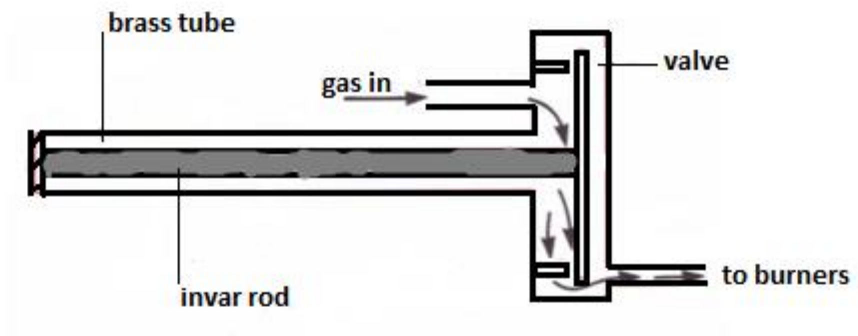
$= \frac{\textbf{\textit{total load}}}{\textbf{\textit{total extension}}} = \frac{\mathbf{100}}{\mathbf{3.3333}}$ ***= 30.0003N/cm***

5. (a) The distance between the ice point and steam point on a liquid in glass thermometer is 30cm. what temperature is recorded when the mercury thread is 12cm above the ice point? (2mks)

$\frac{\mathbf{30}}{\mathbf{100}} = \frac{\mathbf{12}}{\boldsymbol{x}}$

X = 40^0

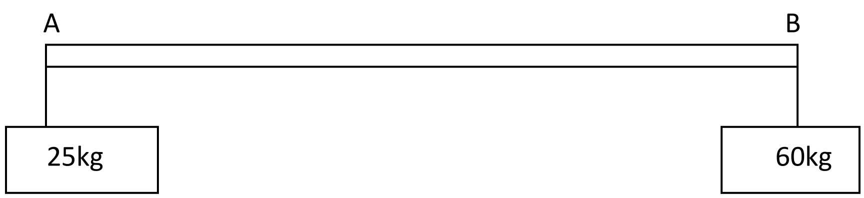
b) The diagram below shows a gas cooker thermostat



Briefly explain how the thermostat works (3mks)

A temperature increase causes the brass tube to expand and move to the left. The invar rod also moves with it and causes the valve to partially close. This reduces the gas inflow. A decrease in temperature causes the brass tube to contract and move the valve forward. The movement opens the entrance and increases the flow of gas to the burners

6. The figure below shows a uniform plank AB of length 10m weighing 500N. Two masses measuring 25kg and 60kg are loaded on its ends.



Determine the distance from point A where a support should be placed for the plank to balance horizontally. (3mks)

$250y+100(y-5)= 600(10-y)$

$250y+ 100y- 500= 6000-600y$

$600y+350y = 6000+500$

$Y= 6.842m$

7. In an experiment to determine the thickness of an oil molecule, an oil drop of volume 3.60×10^{-6} m^3 was observed to form a circular patch of diameter 0.016m on the surface of water covered with lycopodium powder

i). Explain why the oil drop forms a circular patch. (1mks)

Oil lowers the surface tension of water, in attempt of water molecules trying to make their surface as small as possible

Or

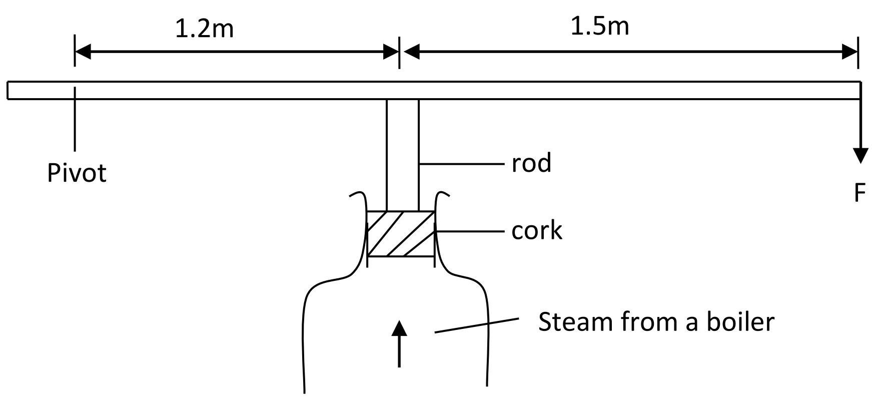
Oil spread uniformly because it breaks the surface tension of water whose particles pull away from the oil

ii) Determine the thickness of the oil molecule (2mks)

$$3.60 \times 10^{-6} = \pi \times \frac{0.016^2}{4} t$$

$$t = 5.625 \times 10^{-2} m$$

8. A cork enclosing steam in a boiler is held down by the system shown.



If the area of the cork is 15 cm^2 and a force (F) of 500N is needed to keep the cork in place, determine the pressure of the steam in the boiler. (3mks)

1.2F=2.7×500

$$F = \frac{2.7 \times 500}{1.2} = 1125$$

$$P = \frac{F}{A} = \frac{1125}{15 \times 10^{-4}} = \frac{1125 \times 10^4}{15} = 750{,}000 N/M^2$$

SECTION B

Answer all questions in this section in the spaces provided:

9. (a) An electric crane lifts a load of 2000kg through a vertical distance of 3.0m in 6s.

Determine:

i) Work done (1mk)

W=mgh=2000×10×3=60,000 J

ii) Power developed by the crane (2mks)

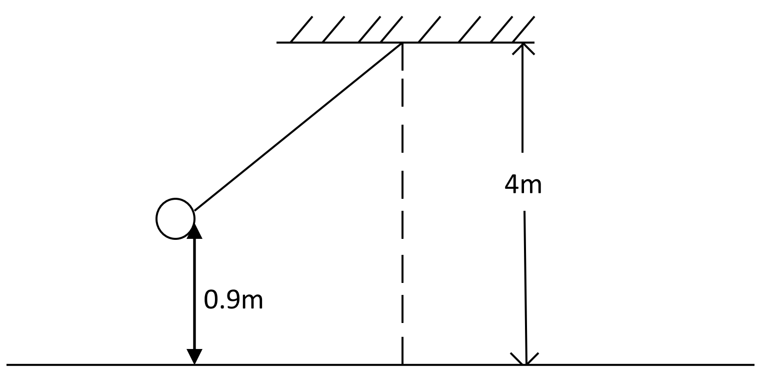
$P = {}^{W}/_{t} = \frac{60,000}{6} = 10,000W$

iii) Efficiency of the crane if it is operated by an electric motor rated 12.5 Kw (2mks)

$= \frac{Power\ output}{power\ input} \times 100$

$= \frac{10}{12.5} \times 100 = 80\%$

b) A bob of mass 20kg is suspended using a string of 4m from a support and swings through a vertical height of 0.9m as shown below:



Determine:

i) The potential energy of the body at its position. (2mks)

p.e=mgh

=20×10×0.9=180J

ii) Speed of the body when passing through the lowest point. (2mks)

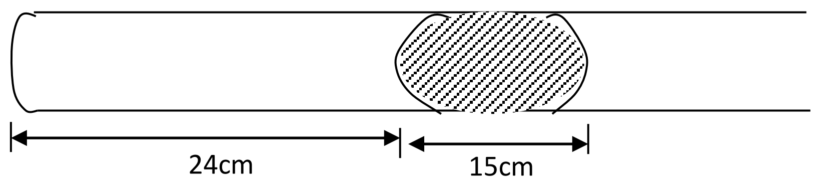
k.e gained= p.e lost

$\frac{1}{2}mv^2=mgh$

$v^2=\sqrt{2gh} = \sqrt{2 \times 10 \times 0.9}$

=4.24m/s

10. (a) A glass capillary contains enclosed air by a thread of mercury 15cm long when the tube is horizontal, the length of the enclosed air column 24cm as shown.



i) What is the length of the enclosed air column when the tube is vertical with the open end uppermost if the atmosphere pressure is 750mmHg? (2mks)

$P_1V_1=P_2V_2$

$24 \times 750= (750+15)V_2$

$V_2=\frac{24\times 75o}{765}$ ***=23.53cm***

ii) Explain why the mercury does not run out when the tube is vertical with the closed end uppermost. (1mk)

The mercury does not run out because the upwards atmospheric pressure in the mercury column is greater than the downward pressure due to the enclosed air and its own mass.

b) Explain why an air bubble increase in volume as it rises from the bottom of a lake to the surface. (1mk)

At the bottom of the lake, the bubble is under the pressure of water column + the atmospheric pressure on the surface of water. As the bottle rises the depth of the water column decreases as so does the pressure decreases in pressure results in increase in where since PV=a constant (Boyle's law)

c) When an inflated balloon is placed in a refrigerator it is noted that its volume reduces, use the kinetic theory of gases to explain this observation. (2mks)

Low temperature reduces the kinetic energy of molecules which lead to lower rate of collision which results to reduction of pressure.

d) A certain mass of hydrogen gas occupies a volume of $1.6m^3$ at a pressure of 1.5×10^5 Pa and a temperature of 22^0c. Determine the volume when the temperature is 0^0c at a pressure of 0.8×10^5 Pa. (3mks)

$$\frac{P1V1}{T1}=\frac{P2V2}{T2}$$

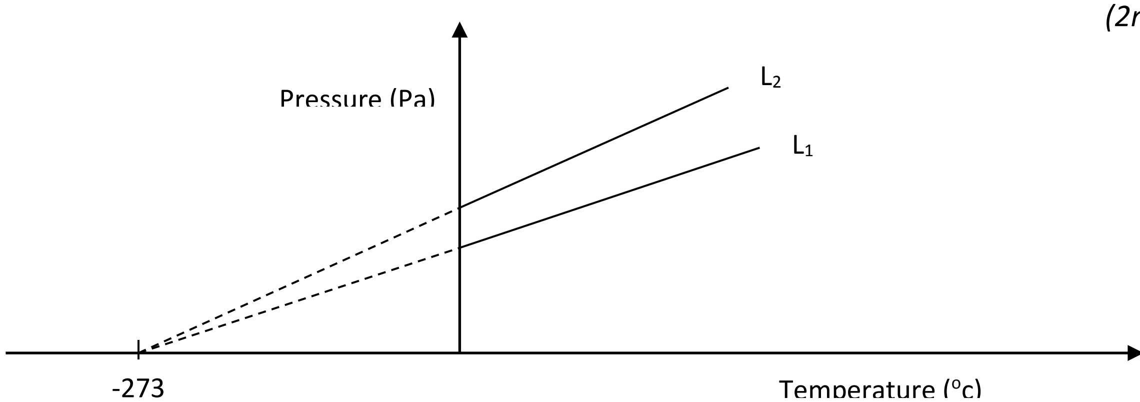
$$\frac{1.5\times10^5\times1.6}{295}=\frac{0.8\times10^5\times V2}{273}$$

V_2= 2.776cm^3

e) i)State the pressure law (1mk)

Pressure of a fixed mass of a gas is directly proportional to its absolute temperature provided volume is kept constant

ii)On the axis provided, sketch a graph of pressure against temperature on the celcius scale. On the same axis sketch another graph for a gas of a larger volume. *(2mks)*



11 (a) in a hydraulic press, a force of 200N is applied to a master piston of area 25cm^2. If the press is designed to produce a force of 5000N, determine the area of the slave piston. (2mks)

$\frac{F1}{A2}$ = $\frac{F2}{A2}$ = $\frac{200}{25}$ = $\frac{5000}{x}$ = **625cm^2**

(b) The barometric height in a town is 70cmHg. Given that the standard atmospheric pressure is 76cmHg and the density of mercury is 13600kg/m^3, determine the altitude of the town. (density of air is 1.25kg/m^3) (3mks)

h_a= $\frac{0.06\times13600\times10}{1.25\times10}$ ***= 652.8m***

(c) In an experiment to determine atmospheric pressure, a plastic bottle is partially filled with hot water and the bottle is then tightly corked. After some time the bottle starts to get deformed.

(i) State the purpose of the hot water. (1mk)

Expel air

(ii) State the reason why the bottle gets deformed. (2mks)

Pressure imbalance on the inside and outside causes the higher atmospheric pressure on the outside to act on the bottle

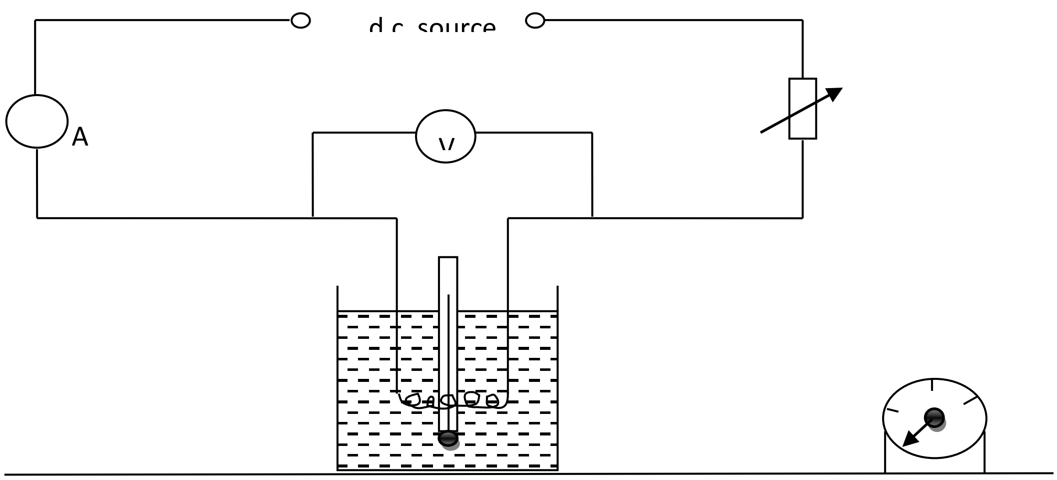
(d) A hole of area $2.0cm^2$ at the bottom of a tank 5m deep is closed with a cork. Determine the force on the cork when the tank is filled with sea water of density $1.2g/cm^3$. (2mks)

P = hdg	***F= PA***
= 5×1200×10	***= 6000×2.0×10^{-4}***
=60000Pa	***= 12.0N***

12. (a) Define specific latent heat of vaporization (1mk)

Amount of heat energy required to change a unit mass of a liquid to vapour at constant temperature.

b) The illustration below is used to produce a measured rise in temperature of a liquid using electrical energy.



Explain why;

(i) The liquid will tend to be warmer at the top of the container than at the bottom. (1mk)

Hot water is less dense and thus rises to the top due to convectional current.

(ii) The temperature will eventually stop rising even though the current is still passing through the heating coil. (1mk)

The liquid has reached its boiling point

iii) if the apparatus is used to determine the specific heat capacity of the liquid, the accuracy of the experiment will be increased if the liquid is first cooled to about 5^oc below room temperature and the current passed until the temperature is about 5^oc above room temperature. (2mk)

Heat losses are minimized as follows:
When 5^oc below room temperature heat is gained; when 5oc above room temperature, the same amount of heat previously gained is now lost. Thus the net heat exchange is zero

(c). A 50W heating coil is totally immersed in100g of water contained in an insulated flask of negligible heat capacity. The initial temperature of water in the flask is 20^oc.
(i) Determine how long it takes for the water to boil at 100^oC when the heater is switched on (2mks)

$$Pt = mc\theta$$
$$50t = 100 \times 4.2\ (100-20)$$
$$50t = 100\times 4.2\times 80$$
$$t = \frac{100\times 4.2\times 80}{50}$$
$$t = 672 \text{ sec}$$

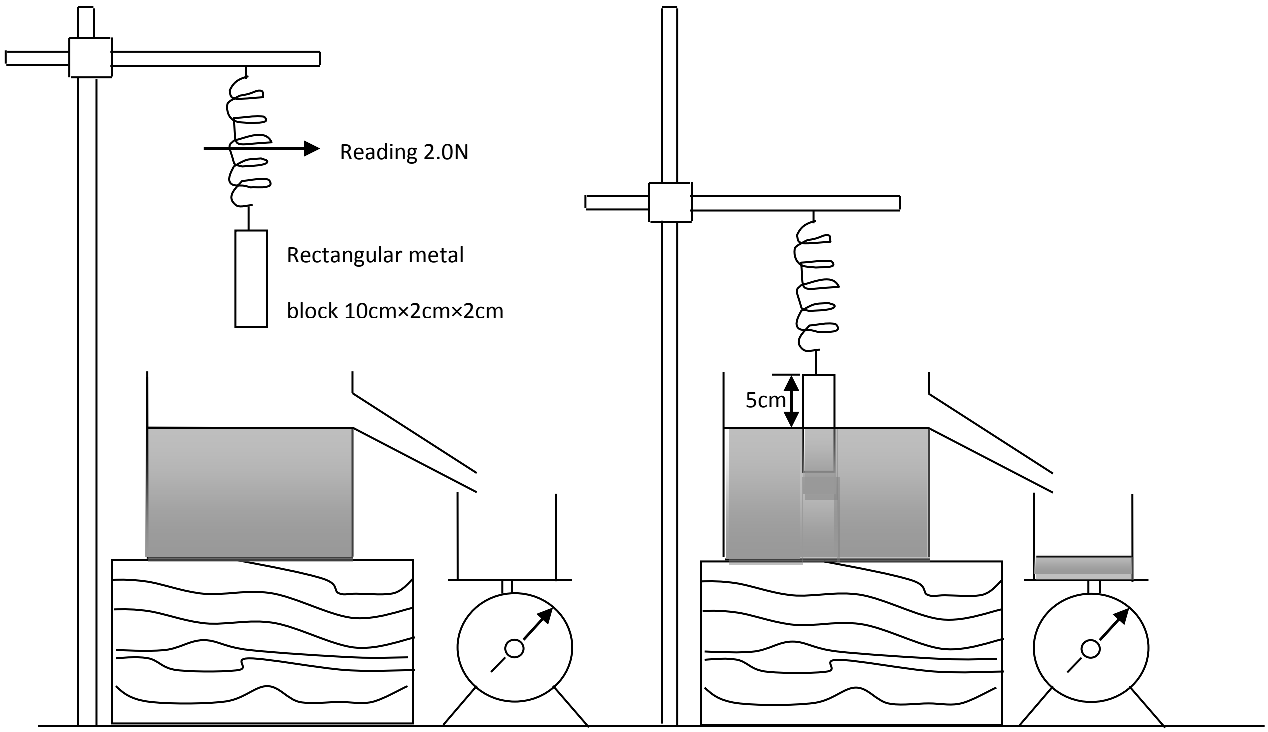
(ii)After the water has been boiling for 15 minutes, it is found that the mass of water in the flask has decreased to 80g. Assuming no external heat losses, calculate a value for the specific latent heat of vaporization of water (3mks)

$$Pt = ml_v$$

$$= 50\times 15\times 60 = 20\times 10^{-3} l_v\ ;$$

$$l_v = 2.25\times 10^6 Jkg^{-1}$$

13. (a) The figure below shows details of an experiment performed by a student and the results taken. (take the density of water as $1.0g/cm^3$)



Compression balance reading 4N

i) Calculate the volume of the metal block below the water (1mk)

$V= 5\times2\times2=20cm^3$

ii) Calculate the new reading on the compression balance after the block is halfway immersed (2mks)

= 4.0+ 0.2= 4.2N

iii) Calculate the reading you would expect to obtain on the spring balance (2mks)

= 2.0- 0.2= 1.8N

iv) Give a statement of the principle you have used in part (iii) above (1mk)

When a body is wholly or partially immersed in a fluid, it experiences an upthrust equal to the weight of the fluid displaced

b). Explain why the narrow stem of a hydrometer provides greater sensitivity than a wide one (1mk)

To displace the required amount of liquid a narrow stem sinks deeper giving a larger reading than a wide stem which sinks less deep.

14 (a) (i) A car goes round a flat circular bend whose radius is 100m at a constant speed of 30m/s. Calculate its acceleration (2mks)

$a = \frac{v2}{r} = \frac{30^2}{100} = 9rad/s^2$

(ii) if the mass of the car is 1500kg, calculate the frictional force required to provide this acceleration. (2mks)

$Fr = Fc = \frac{mv^2}{r} = \frac{1500\times30^2}{100} = 13500N$

(b) (i) Calculate the maximum speed at which the car can go round the bend without skidding if the coefficient of friction between the tyres and the ground is 0.5. (2mks)

$Fc = Fr = \mu N = 0.5 \times 15000$

$= 7500N = \frac{mv^2}{r} = \frac{1500\times v^2}{100}$

$v^2 = \frac{7500}{15} = 500$

$V = \sqrt{500} = 22.36m/s$

(ii) Give a reason why the driver of the car has to move through the same bend at a lower speed during a rainy day. (1mk)

Friction is reduced thus centripetal force is less to avoid skidding hence reduced speed.