232/1 - **PHYSICS** -Paper 1

(THEORY)

2022 – 2 hours

Name:......MARKING SCHEME.......**Index Number:**..............

School: .... **Date**......................

MUMIAS WEST SUB-COUNTY JOINT EVALUATION

TERM 1 JUNE 2022

Instructions to candidates

(a) Write your name, index number in the spaces provided above.

(b) Sign and write the date of the examination in the spaces provided

(c) This paper consists of **TWO** Sections: **A** and **B**.

(d) Answer **ALL** the questions in section **A** and **B** in the spaces provided.

(e) All working **MUST** be clearly shown.

(f) KNEC mathematical tables and silent non programmable electronic calculators may be used.

(g) This paper consists of 12 printed pages

(h) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

(i) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Section	Question	Maximum Score	Candidate's Score
A	1 – 11	25	
B	12	13	
	13	10	
	14	12	
	15	12	
	16	09	
	Total Score	80	

SECTION A (25 MARKS)

1. Determine the reading of the vernier callipers shown in the **figure 1.**

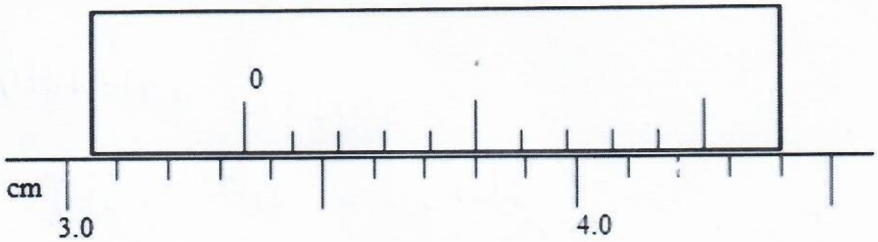


Fig. 1

........3·35 cm ✓ 1.................... (1mk) ①

2. **Figure 2** shows the apparatus a student uses to investigate the extension of a spring.

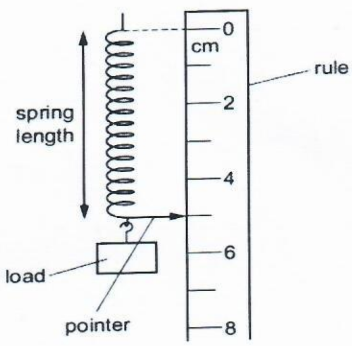


Fig. 2

The initial pointer position was at the 2cm mark, when a load of 4N is applied the pointer position is as shown. Find the spring constant of the material of the spring (2mks)

e = 5·0 − 2·0 = 3·0 cm ✓ | K = F/e | 133333 N/m ✓

F = Ke | = 4/0.03 | 2

3. Give a reason why water wets glass. (1mk)

Water has stronger adhesion than cohesion. ✓ ①

4. **Figure 3** shows a simple mercury barometer.

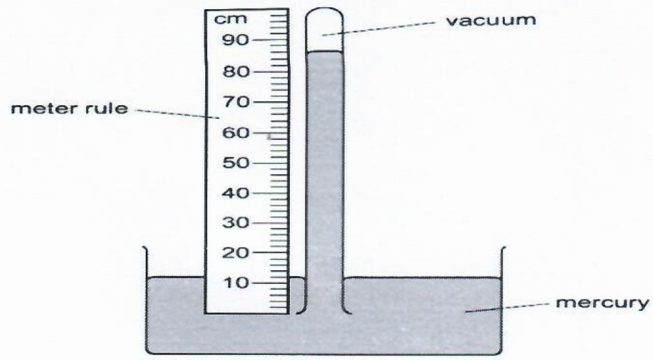


Fig. 3

(i) Determine the value of the atmospheric pressure in pascals.

Take density of mercury =13.6g/cm^3 (2mks)

h= 86-11 = 75cm Hg.

P = hρg

= 75/100 x13600 x10 = 102,000 N/m^2

(ii) State the reason why mercury is preferred to water as a barometric liquid (1mk)

It has a shorter barometric height due to its higher density

5. The diagram in **figure 4** shows the cross-section of a vacuum flask containing a hot liquid in a cold room.

X and Y are points on the inside surfaces of the walls of the flask.

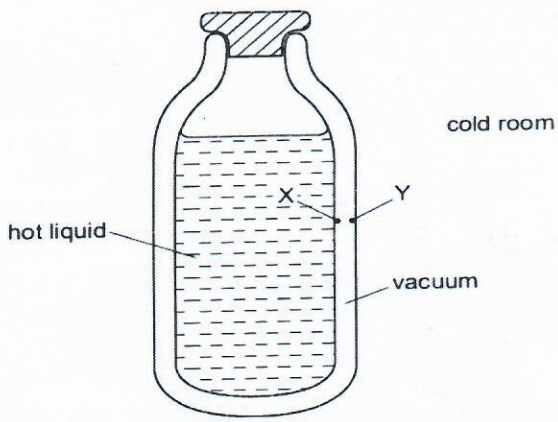
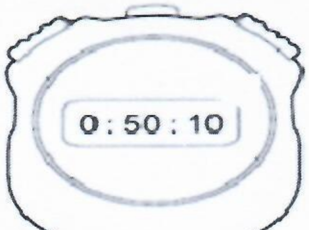


Fig. 4

Explain how heat transfer is minimized by the points X and Y (2mk)

- The double silvered wall is shinny/polished
- This minimizes heat loss through radiation.

6. A stopwatch is used to time a runner in a race. **Figures 5 and 6** show the stopwatch at the start and at the end of a lap of the race in seconds.



start of lap fig. 5

end of lap fig.6

Determine the time runner took to finish the lap of the race. (1mk)

100:10 seconds ✓ (1)

7. Figure 7 shows a system at equilibrium and pivoted at its geometric center two identical solids. Study the it and answer the questions that follow:

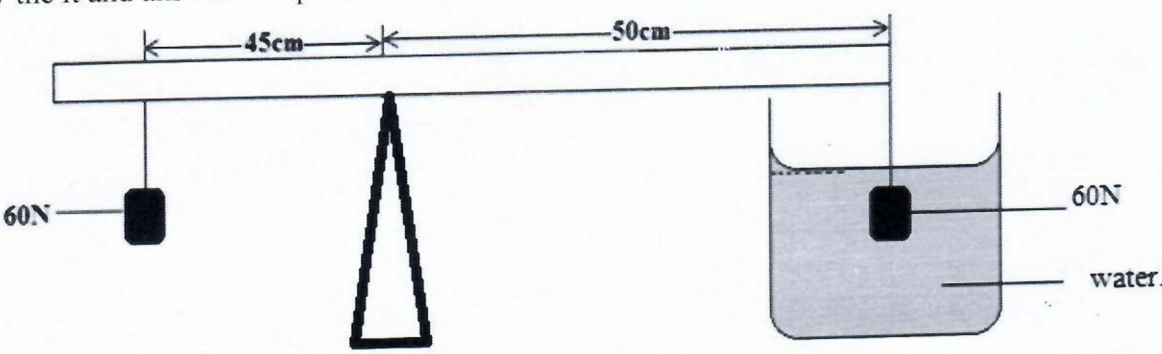


Fig.7

Determine the relative density of solids. (3mks)

clockwise moments = Anti-clockwise moments

$60 \times 45 = 50 \times x$

$x = \frac{60 \times 45}{50}$

$= 54N$ ✓1

upthrust = weight − Apparent weight

$= 60 - 54 = 6N$ ✓1

Relative Density = $\frac{\text{weight}}{\text{upthrust in water}}$ ✓1

$= \frac{60}{6.0} = 10$

(No units) (3)

8. 2 kg of iron at 80°C is placed in a copper can, mass 0.5kg, containing 1kg of water at 20°C. After stirring, the temperature of the mixture is 30°C. Find the specific heat capacity of iron.(Take specific heat capacity of water to be 4200 $Jkg^{-1}K^{-1}$ and Copper 400 Jkg^{-1}). (3mks.)

Heat lost = Heat gained ✓ 1

$2 \times C_{Fe} \times (80-30) = (1 \times 4200 \times 10) + (400 \times 0.5 \times 10)$ ✓ 1

$C_{Fe} = \frac{(400 \times 0.5 \times 10) + 42000}{100}$ 1

$= 242\ Jkg^{-1}K^{-1}$ ✓ 3

9.Explain why a hole in a ship near the bottom is more dangerous than one nearer the surface. (1mk.)

Water can sip into the ship more easily and increase its weight thereby sinking the ship ✓ 1

10.A student inverted a rounded flask with a glass tube and inserted it into water as shown in **figure 8.0** below;

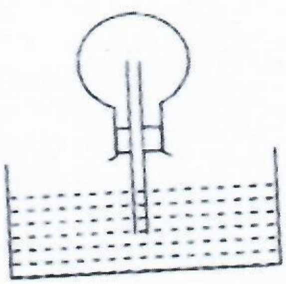


Fig. 8

(a) When the student warmed the flask by rubbing it with his hands he noticed some bubbles escaping from the end of the tube into the water. Explain. (2mks)

Rubbing produced heat which made air in the flask to expand and escape as bubbles. ✓ 1 2

(b) Explain what happens in the glass tube when the student stops rubbing and lets the flask to cool. (1mk.)

Level of water in the tube rose to occupy space created by condensed air. ✓ 1

11.) The handle of a screw jack shown in **figure 9** is 35cm long and the pitch of the screw is 0.5cm.

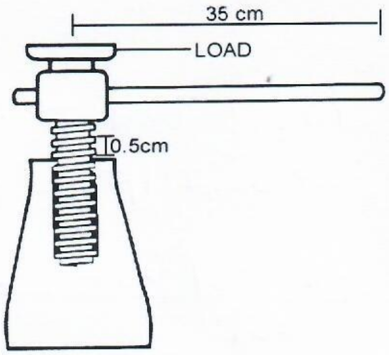


Fig. 9

(i) Determine is the velocity ratio of the system. (2mks.)

$V \cdot R = \frac{\text{Circumference}}{\text{pitch}}$

$= \frac{2 \times 3.142 \times 35}{0.5}$ ✓1

$= 439.88$ ✓1 (No units) ②

(ii) Work out the force that must be applied at the end of the handle when lifting a load of 2,000N if the efficiency of the jack is 40%. (3mks)

$\eta = \frac{M \cdot A}{V \cdot R} \times 100$

$40 = \frac{M \cdot A}{439.88} \times 100$ ✓1

$M \cdot A = 175.952$

$M \cdot A = \frac{L}{E}$

$175.952 = \frac{2000}{E}$ ✓1

$E = 11.366N$ ✓1

③

x/25

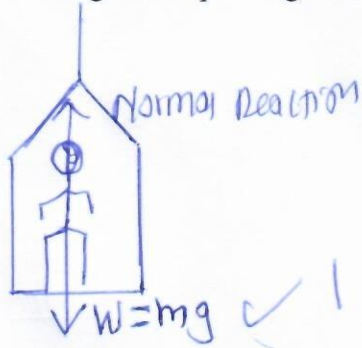
SECTION B (55 MARKS)

12. (a)The mass of a lift cage with its passenger is 500kg and the acceleration of free fall, g, is $10m/s^2$.

The lift starting from rest moves upwards as follows:

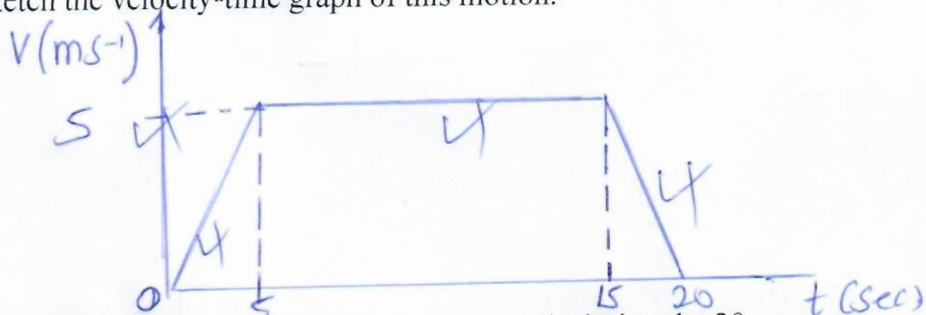
Accelerating uniformly at $1m/s^2$ for 5s; then travels at a constant speed for the next 10s and finally decelerates uniformly, coming to a stop after a further 5s.

(i)Draw the lift indicating the forces acting on the passenger. (2mks)



(2)

(ii) Sketch the velocity-time graph of this motion. (2mks.)



(2)

(iii) Determine is the total distance this lift ascends during the 20s. (2mks.)

S = Area under graph

$= \frac{1}{2}(a+b)h$

$= \frac{1}{2}(20+10)5$

= 75m

(2)

(iii) State what the passenger experiences as the lift accelerates upwards. (1mk.)

Experiences more weight.

(1)

(iv) Determine for the entire motion:

a) the potential energy. (2mks)

P.E = mgh ✓ 1

= 500 X 10 X 75 = 375,000 J ✓ 1 (2)

b) the kinetic energy gained of the lift. (2mks)

K.E = ½mv² ✓ 1

= ½ X 500 X 25 ✓ (2)

= 6250 J ✓

(c) the power developed by the lift during the of the motion. (2mks)

K.E = ½mv²

= ½ X 500 X 25

= 6

Power = Energy / time

s = ut + ½at²

0 + ½ X 1 X 25

12.5 m

500 X 10 X 12.5 / 5 ✓

12,500 J/s. (2)

13

13a) State Archimedes principle (1mk)

When an object is wholly or partially immersed in a fluid, it experiences an upthrust force which is equal to the weight of the fluid displaced. ✓ (1)

b A solid displaces 8.5 cm³ of liquid when floating on a certain liquid and 11.5 cm³ when fully submerged in the liquid. The density of the solid is 0.8 gcm³ Determine:

i) The upthrust on the solid when floating. (3mk)

U = ρVg

=

U = W

W = mg

m = ρV

= 0.8 X 11.5

= 9.2g ✓ 1

W = 9.2 X 10 / 1000 1

= 0.092N ✓ 1 (3)

ii) The density of liquid. (3mk)

U = ρVg ✓

0.092 = ρ X 8.5 X 10 / 1000000 ✓

ρ = 0.092 X 1000000 / 10 X 8.5 ✓

= 800 kg/m³ (3)

1,082.35 kg/m³

iii) The upthrust on the solid when fully submerged (3mk)

U = ρvg

= 1082.35 × 11.5 / 1000000 × 10

= 0.12447 N.

3/10

14. (a) Write the statement of the law that relates the volume of a gas to its temperature. (1 mk)

The volume of a fixed mass of a gas is ~~inversely~~ directly proportional to the ~~square root~~ absolute temperature at constant pressure

1

b) State two assumptions made for ideal gases. (2mks.)

- size of molecules are negligible
- Intermolecular forces are negligible

2

b) **Figure 10** shows an experiment set-up that may be used to investigate one of the gas laws. The glass tube has a uniform bore and it is graduated in millimetres.

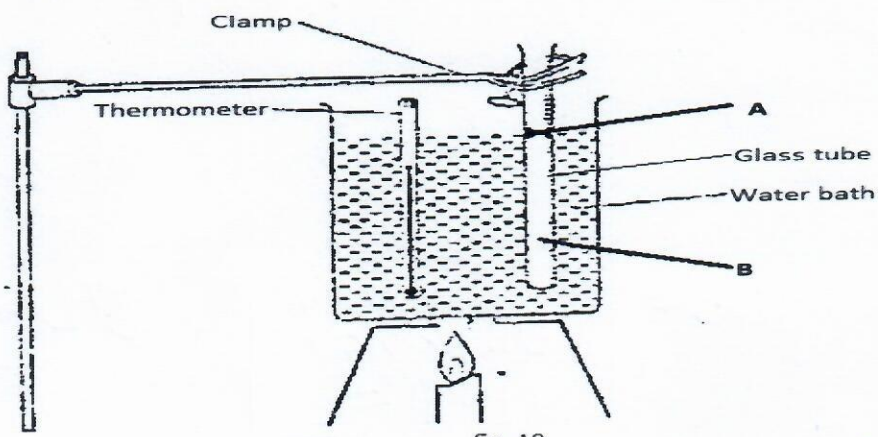


fig. 10

(i) Name the parts labelled A : Index. (1mk)

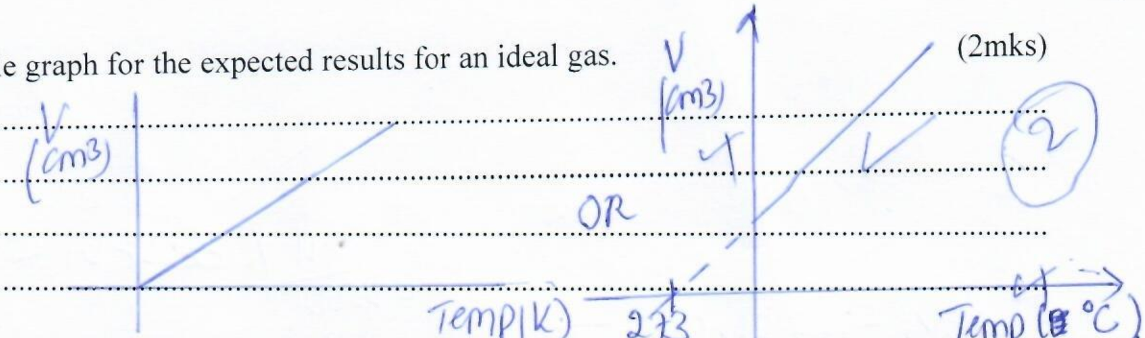
1

Describe how the set-up would be used to verify the law under investigation. (4mks)

- Heat the water bath
- Record the value of temperature and corresponding length of air
- Repeat for several values of temperature and pressure
- plot a graph of length of air column against temperature

4

iii) Sketch a suitable graph for the expected results for an ideal gas. (2mks)



iv) A mass of oxygen gas occupies a volume of 1200 cm^3 at 273^{0}C and a pressure of 1.2 atmospheres. It is compressed until its volume is 600 cm^3 and its pressure is 3.0 atmospheres. Determine the temperature of the gas after compression. (2mks)

$V_1 = 1200$ | $V_2 = 600$ | $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ | $T_2 = \frac{3.0 \times 600 \times 273}{1200 \times 1.2}$

$T_1 = 273$ | $T_2 = ?$ | $\frac{1200 \times 1.2}{273} = \frac{3.0 \times 600}{T_2}$ | $= 341.25K$

$P_1 = 1.2$ | $P_2 = 3$

15 a) Distinguish between latent heat of fusion and specific latent of fusion. (2mark)

Latent heat of fusion - Heat energy required to change a mass from solid to liquid without change in temperature.

Specific latent heat of fusion: Amount of heat energy required to change a unit mass of a solid to liquid without change in temperature

b) **Figure 11** shows a block of ice. A thin copper wire with two heavy weights hanging from its ends-passes over the block. The copper wire is observed to pass through the block of ice without cutting it.

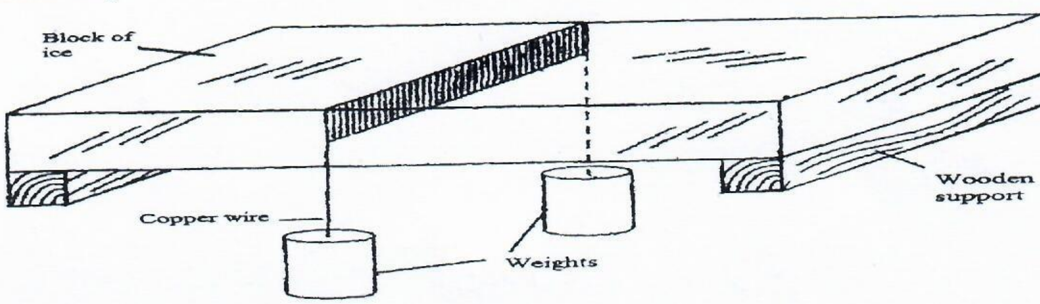


Fig. 11

(i) Explain this observation, (3mks)

- Hanging weight exerts pressure on the ice making it melt at a temperature lower than its melting point. Water formed flows over the wire and solidifies since its no longer under pressure.
- Latent heat of fusion is released and conducted by the copper wire to melt the ice below.

(ii)State and explain the effect of replacing the copper wire with a cotton thread. (2mks)

- It will not cut through the ice block. ✓1
- Cotton thread is a poor conductor of heat ✓1 (2)

(c) **Figure 12**. shows one method of measuring the specific latent heat of fusion of ice. Two funnels A and B, contain crushed ice at 0°C.

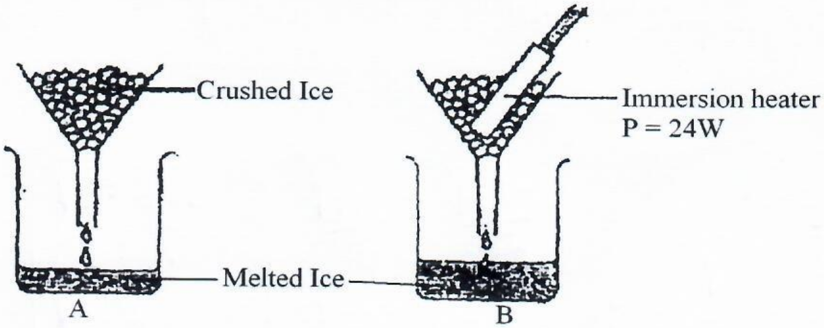


Fig. 12

The mass of melted ice from each funnel is measured after 11 minutes. The results are shown below.

Mass of melted ice in A = 24g

Mass of melted ice in B = 63g

(i) Give the reason for setting up experiment A (1mk) ✓1

To get the mass of ice that melted due to room temperature. (1)

(ii) Determine the:

I. quantity of heat supplied by the heater. (2mks)

$Q = Pt$

$= 24 \times (11{\cdot}0 \times 60)$ ✓1

$= 15840J$ ✓1 (2)

II. mass of ice melted by the heater. (1mk)

$63 - 24 = 39g$ ✓ (1)

III. specific latent heat of fusion of ice. (2mks)

$\frac{\text{Heat supplied}}{\text{mass}}$ ✓1

$= \frac{15840}{0{\cdot}039}$ ✓ $= 406{\cdot}15 \ Jkg^{-1}$ ✓1 (2)

12

16. **Figure 13** below shows a mass of 500g moving in a vertical circle having a radius of 35cm at a constant velocity. It makes 2 revolutions in one second.

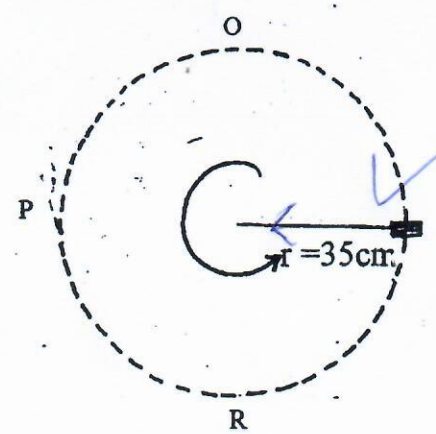


Fig. 13

a) Indicate on the diagram the direction of centripetal force. (1mk)

b) Determine:

I) the linear velocity of the mass. (3mks)

$\omega = 2\pi f$
$= 2 \times 3.142 \times 2$
$= 12.568$ rads^{-1}

$v = \omega r$
$= 12.568 \times 0.35$
$= 4.3988$ ms^{-1}

3

II) the centripetal acceleration of the object (2mks)

$a = \omega^2 r$
$= (12.568)^2 \times 0.35$
$= 55.2841$ rads^{-2}

2

III) centripetal force. (3mks)

$F_c = m\omega^2 r$
$= \frac{500}{1000} \times 55.2841$
$= 27.642$ N.

3

09.

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