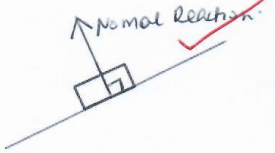
KAPSABET HIGH SCHOOL

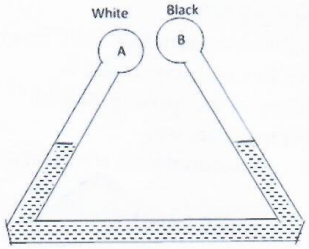
MARKING SCHEME

Section A (25 marks) Answer all the questions in the spaces provide

1. The figure below shows a body resting on an inclined plane. Indicate the normal reaction (1mark)



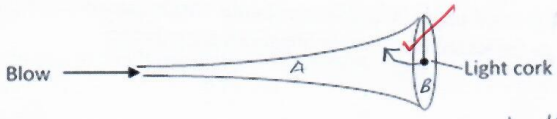
2. The figure below shows two identical bulbs A and B painted white and black respectively connected with a pipe containing water at the same level at the room temperature.



State and explain the observation made when ice cold water is poured on the bulbs (2marks)

- level of water in side B rises while on side A lowers
- Black bulb emits heat at a higher rate than the white. Air on side B contracts more causing the change of level as indicated

3. A boy blows through the mouth of a hollow vuvuzela as shown below. A light cork is suspended freely by a string as shown. Giving reason indicate the path taken by the cork (2marks)



Air passes A at a higher speed than B.
Pressure lower at A greater pressre at B
pushes the cork as shown

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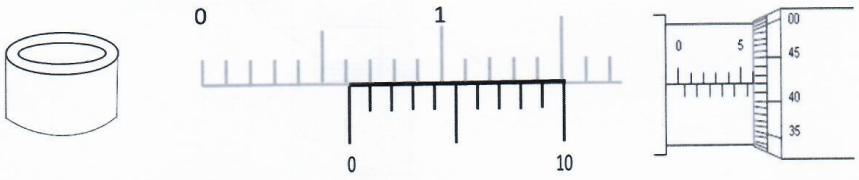
4. The figure below shows a hollow metal cylindrical tin. A student used a vernier caliper and a micrometer screw gauge to determine the external and internal diameter of the tin respectively. The readings of the instruments are as shown below



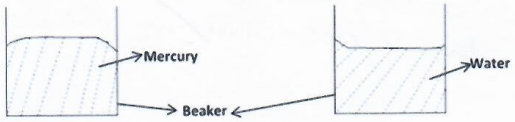
Determine the thickness of the metal used to make the tin in SI unit leaving your answer in ~~SI unit~~ standard form. (3marks)

External diameter = 0.61 cm
Internal diameter = 5.50
+ 0.42
5.92mm ✓ for both readings

Thickness = External diameter − Internal diameter / 2

= 6.1mm − 5.92mm / 2 ✓ = 0.09mm = 9×10⁻⁵m ✓

5. The figure below shows the level of mercury and water in a beaker.



Explain the difference in the shape of the meniscus (1mark)

For mercury C > A and for water A > C ✓

6. When an inflated balloon is placed in a refrigerator, it is noted that its volume reduces. Use kinetic theory to explain this observation (2marks)

A heat escapes molecules loose KE. ✓
Molecules slow down making the balloon to shrink. ✓

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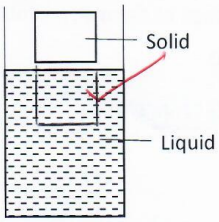
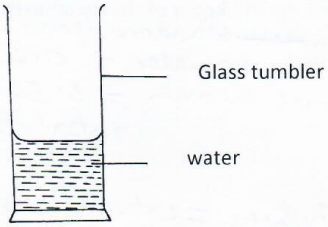
7. The figure below shows a solid just before being released into a liquid of the same density as the solid. On the same diagram draw the observation made when the solid is released (1mark) (1MK)



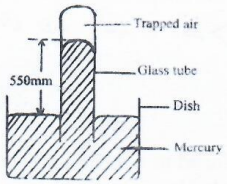
8. The figure below shows a glass tumbler partly filled with water at room temperature.



Briefly explain what happens to the stability of the tumbler when water is heated (2marks)

- Stability reduces ✓
- When heated water expands at a higher rate than glass. It rises raising the cog. ✓

9. The figure below shows some air trapped in a glass tube, the tube is inverted in a dish containing mercury.



Given that the atmospheric pressure is 760 mmHg and the height of mercury column in the glass is 550 mm determine the pressure of the air trapped in the tube in mm Hg. (2marks)

GP + CP = Atm
GP = Atm − CP
= 760 − 550 ✓
= 210mmHg ✓

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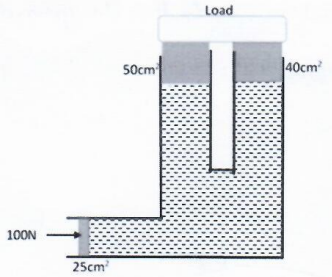
10. The figure below shows a hydraulic machine in equilibrium while supporting a load when a force of 100N is applied one of the pistons. The cross section area of the pistons are as shown. Determine the weight of the load (3marks)

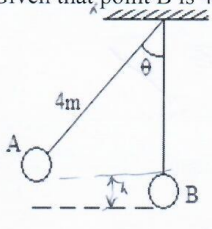


$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ ✓

$\frac{100}{25} = \frac{F_2}{90}$ ✓

$F_2 = \frac{100}{25} \times 90 = 360N$ ✓

11. A metal ball suspended vertically with a light string is displaced through an angle θ as shown in the diagram below. The body is released from A and swings past the lowest point B. Given that point B is 4 m/s, determine angle Θ (3marks)

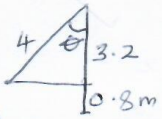


$mgh = \frac{1}{2}mv^2$

$v^2 = 2gh$

$h = \frac{v^2}{2g}$ ✓

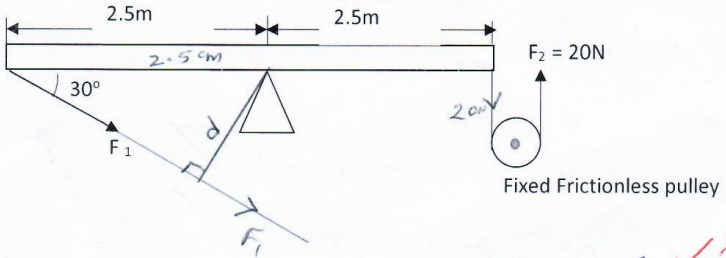
$h = \frac{4 \times 4}{20} = 0.8$ ✓



$\cos\theta = \frac{3.2}{4} = 0.8$

$\theta = 36.87°$ ✓

12. The figure below shows uniform bar balanced by forces F_1 and F_2. Determine the value of F_1 (3marks)



$\sin 30 = \frac{d}{2.5} \Rightarrow d = 2.5 \sin 30 = 1.25m$ ✓ for d

$F_1 \times 1.25 = 2.5 \times 20$ ✓ $\quad F_1 = \frac{2.5 \times 20}{1.25} = 40N$ ✓

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Section B (55 marks) Answer all the questions in the spaces provid

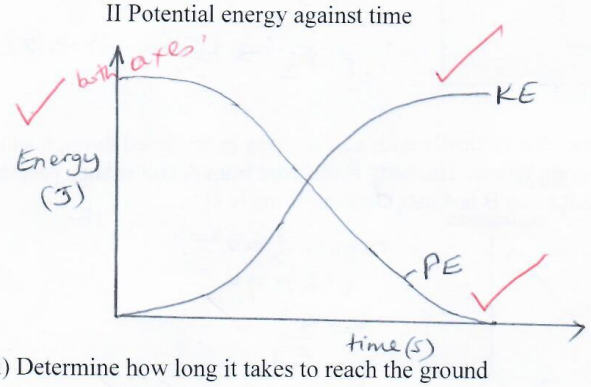
13. (a)An object of mass 50g is dropped from a height of 80m. to hit the ground below

12 For the motion.

(i) on the same axes sketch and label the graphs of : (3marks)

I. . Kinetic energy against time

II Potential energy against time



(ii) Determine how long it takes to reach the ground (3marks)

$h = \frac{1}{2}gt^2$

$80 = \frac{1}{2} \times 10 t^2$

$t^2 = 16$

$t = 4$ seconds

(iii) Determine the momentum as it hits the ground (3marks)

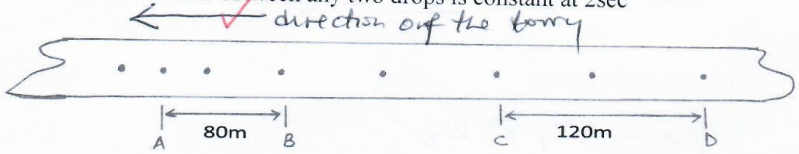
$V = gt$

$V = 10 \times 4 = 40 m/s$

Momentum $= mv$

$0.05 \times 40 = 20 kgm/s$

(b)Engine oil licks on the ground from a lorry as it decelerates uphill. The oil drops are shown below as black dots. The time between any two drops is constant at 2sec



i. On the same diagram indicate the direction of the lorry with an arrow (1mark)

ii. Determine the acceleration of the deceleration of the lorry (3marks)

$u = \frac{120}{4} = 30m/s$ ✓ for both

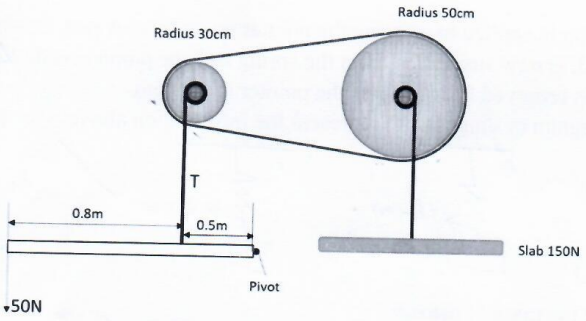
$V = \frac{80}{4} = 20m/s$

$a = \frac{V-u}{t}$ ✓

$a = \frac{20-30}{4\times2} = -1.25m/s^2$

$d = 1.25m/s^2$ ✓

14. The figure below shows a system used to lift a septic slab of weight 150N by applying a force of 50N on a light bar as shown. The radii of the pulley belt wheels are as indicated in the diagram (10)



Determine

a. Tension T of the vertical string (3marks)

$F_1d_1 = F_2d_2$ ✓

$50\times1.3 = T\times0.5$ ✓

$T = 130N$ ✓

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b. MA of the system 2mks

$MA = \frac{L}{E} = \frac{150}{50} = 3$

c. VR of the system 3mks

$VR = VR_1 \times VR_2$

$\frac{1.3}{0.5} \times \frac{50}{30} = 4.333$

d. Efficiency of the system 2mks

$Eff = \frac{MA}{VR} \times 100$

$Eff = \frac{3}{4.333} \times 100 = 69.23\%$

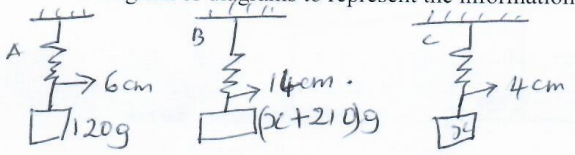
15. a) State three factors that affect the toughness of a spring (3marks)

(10)

- No of Coils or length of the spring
- Cross section area of the spring
- Material making the String

b) When a mass of 120g is applied to a spring the pointer reads 6cm. A pan, in which a mass of 210g is placed, is now suspended from the spring and the pointer reads 14cm. When the 210g mass is removed from the pan the pointer reads 4cm.

i. Draw a diagram or diagrams to represent the information above (1mark)



Any one diag.

ii. Determine the mass of the pan. (3marks)

Comparing A and B

$e = 8$

$mass = x + 210 - 120$

$= (90 + x)\,g$

Comparing A an C

$e = 2cm$

$mass = (120 - x)\,g$

Combining

$\frac{90+x}{8} = \frac{120-x}{2}$

$90 + x = (120 - x)4$

$90 + x = 480 - 4x$

$5x = 390$

$x = 78g$.

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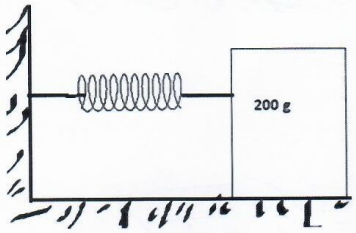
c) The figure below shows a mass 200g placed on a frictionless surface and attached to a spring. The spring is compressed and released. Given that the elastic potential energy of the compressors spring is 2.7×10^{-2}J. Determine the maximum speed with which the blocks moves after released. (3marks)



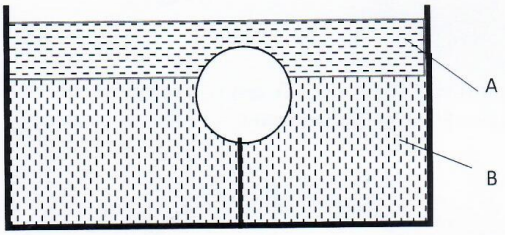
$EPE = KE$

$2.7 \times 10^{-2} = \frac{1}{2} \times 0.2V^2$

$V^2 = 0.27$

$V = 0.5196 \text{ m/s}$

16. The sphere below has a volume of 0.1 litres. It is held with a tight string at the base with ¼ of its volume in liquid A of density 380kg/m^3 while the rest is in Liquid B of density 700kg/m^3. The tension of the string is 0.32N



Find

a. Mass of liquid A displaced (2marks)

Volume of sphere $= 100 \text{cm}^3$

Volume of liquid A $= \frac{1}{4} \times 100 = 25 \text{cm}^3$

mass of A $= \rho V = 0.38 \times 25 = 9.5 \text{g}$

b. Mass of liquid B displaced (2marks)

Volume of B $= 100 - 25 = 75 \text{cm}^3$

mass of B $= \rho V = 0.7 \times 75 = 52.5 \text{g}$

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c. Upthrust experienced by the sphere (2marks)

Upthrust = Weight of fluids displaced ✓

$= 0.095 + 0.525$ ✓

$= \cancel{0.62}\ 0.62N$ ✓

d. Mass of the sphere (3marks)

$T = u - mg$

$0.32 = 0.62 - mg$ ✓

$mg = 0.62 - 0.32 = 0.3N$ ✓ ✓

$m = \frac{0.3}{10} = 0.03kg$ or $30g$

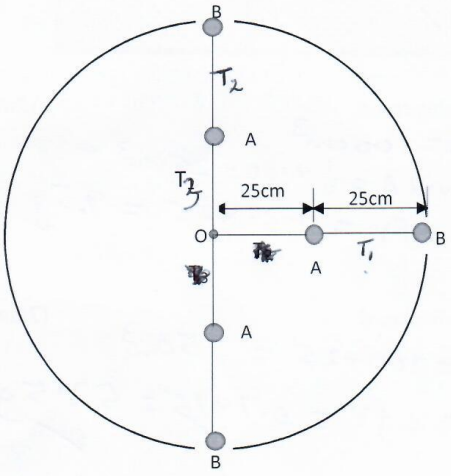
e. Density of the sphere (3marks)

$\rho = m/V = \frac{30}{100} = 0.3g/cm^3$ ✓ ✓

or $300 kg/m^3$.

17. A girl joins two 20g masses A and B on a string and whirls them in a vertical circle Centre O of radius 50cm as shown below. The bodies maintained an angular velocity of ~~56Rad s⁻¹~~ $10Rad\ s^{-1}$

(11)



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Determine:

a. The linear velocity of body A (2marks)

$V = r\omega$ ✓

$V = 0.25 \times 10$

$= 2.5 m/s$ ✓

b. Centripetal acceleration of Body B (2marks)

$a = r\omega^2$

$a = 0.5 \times 10^2$ ✓

$50 m/s^2$ ✓

c. The tension of the string

i. T_1 (3marks)

$T_1 = mr\omega^2$ or $T_1 = ma$ ✓

$= 0.02 \times 50$ ✓

$= 1N$ ✓

ii. T_2 (2marks)

$T_2 = mr\omega^2 - mg$

$1 - 0.2$ ✓

$= 0.8N$ ✓

iii. T_3 (2marks)

$T_A = mr\omega^2 - mg$

$0.02 \times 0.25 \times 10^2 - 0.2$

$0.5 - 0.2 = 0.3N$ ✓

$T_3 = T_2 + T_A$ ✓

$0.8 + 0.3 = 1.1N$ ✓

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