ANSWER ALL QUESTIONS IN THIS SECTION

1. A micrometer screw gauge is used to measure the thickness of a stuck of 10 microscope slide cover slips. The reading with the cover slips in position is as shown in figure 1.

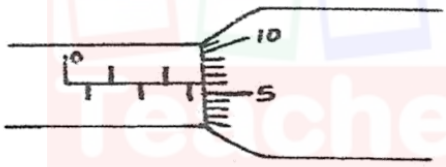


Figure 1

If the micrometer screw gauge has a negative zero error of 0.01mm, determine the thickness of each cover slip (2marks)

Sleeve scale = 2.5 mm
thimble scale = 6 x 0.01 mm
= 2.56 mm

Actual = reading + error
= 2.56 + 0.01
= 2.57 mm

2. Explain why ammonia gas released at the back of a laboratory spreads faster on a hot day than on a cold day. (1mark)

Diffusion of gases increases with temperature.

3. A piece of paper is held in front of the mouth and air blown horizontally over the paper, it is observed that the paper get lifted up. Give reason for the observation. (1mark)

When air is blown it causes a decrease in pressure (Bernoulli's) above the paper. The atmospheric pressure below the paper pushes it upwards.

4. (a) Estimate the size of an oil molecule if a drop of oil of volume 6.0×10^{-10} m^3 forms a patch of radius 32 cm on a water surface. (2marks)

Area $= \pi r^2$
$= \pi \times 0.32^2$
$= 0.3217\ m^2$

Size $= \frac{\text{Volume}}{\text{Area}}$
$= \frac{6.0 \times 10^{-10}}{0.3217}$
$= 1.865 \times 10^{-9}$ m

(b) Other than oil patch being monolayer, state any **one** other assumption in the oil drop experiment. (1mark)

→ The patch is circular.

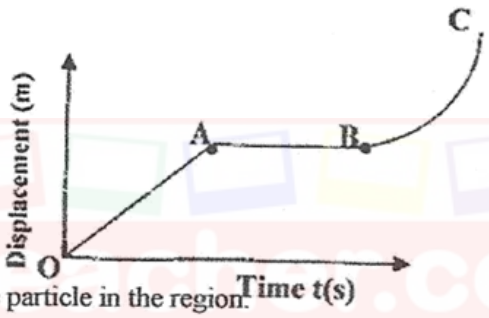
→ The oil drop is spherical.

5. In the study of free fall, it is assumed that the force F acting on a given body of mass, m, is gravitational, given by F = mg. State two other forces that act on the same body. (2marks)

→ upthrust

→ Viscous drag.

6. The figure below shows a displacement-time graph of the motion of a particle.



Describe the motion of the particle in the region. (3marks)

i. OA – uniform velocity

ii. AB – Zero acceleration / constant velocity

iii. BC – Increasing Variable Velocity

7. Figure 3 shows a uniform wooden plank which weighs 10N. The plank is balanced at 0.8m from one end by a mass of 2.5Kg.

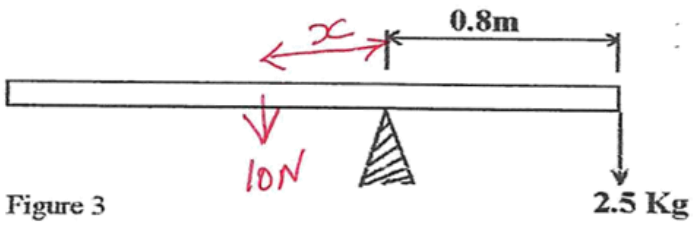


Figure 3

What is the length of the wooden plank in metres. (2marks)

Clockwise = anticlockwise

$10 \times x = 0.8 \times 25$

$x = \frac{0.8 \times 25}{10}$

$= 2m \times 2$

$= 4m$

8. State one factor that affect the spring constant of a spring. (1mark)

- Diameter of the spring.
- Number of turns.
- Thickness of the wire.
- Type of the material.

9. A girl in a school in Nakuru plans to make a barometer using a liquid of density 1.25gcm^{-3}. If the atmospheric pressure in the school is 93750Nm^{-2}. Determine the minimum length of the tube that she will require? (3marks)

$P = h\rho g$

$93750 = h \times 1250 \times 10$

$h = \frac{93750}{1250 \times 10}$

$= 7.5\ m$

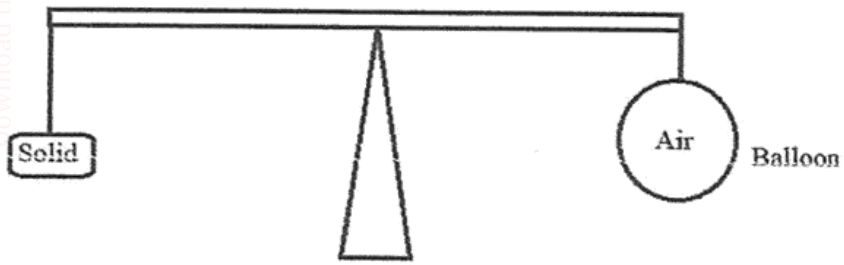
10. A form one girl observed that when mercury is put into a glass it does not wet the glass. Explain the observations made by the girl. (1 mark)

Mercury has a high cohesive compared adhesive force between its particles and that of the glass.

12 (a)State the law of floatation. (1 mark)

The law states that a floating body displaces its own weight of the fluid in which it floats.

(b) The system in the figure below is at equilibrium.



State and **explain** what may be observed as temperature of surrounding is increased (2 marks)

The balance tilts towards the side of the solid. Increases Air expands more than solid. Increase in volume ~~decreases~~ ~~density~~ the upthrust on the side of air causing it to be lifted.

(c) A hot air balloon is tethered to the ground on a windless day. The envelop of the balloon contains 1200 m^3 of hot air of density 0.8kg/m^3. The mass of the balloon *(not including the hot air)* is 400kg. The density of the surrounding air is 1.3 kg/m^3.

(i) Explain why the balloon would rise if it were not tethered. (2 marks)

The weight of the air displaced is more than the total weight of the ballon. This causes the upthrust to be more than the weight of the ballon.

(ii) Calculate the tension in the rope holding the balloon to the ground. (3 marks)

Upthrust = Total Weight of balloon + Tension.

$(1200 \times 1.3 \times 10) = (1200 \times 0.8 \times 10) + 4000 + \text{Tension}$

$15600 = 9600 + 4000 + \text{Tension}$

$\text{Tension} = 15600 - 13600$

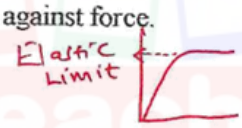
$\text{Tension} = 2000\ N$

13 The following readings were obtained in an experiment to verify Hooke's law using a spring.

Mass (g)	0	25	50	75	100	125
Reading (cm)	10.5	11.5	12.5	13.5	14.4	16.0
Force (N)	0	0.25	0.50	0.75	1.00	1.25
Extension (mm)	0	10	20	30	39	55

a) Complete the table (2marks)

b) Plot the graph of extension against force. (5marks)



c) From the graph determine the:

(i) Elastic limit (1mark)

(ii) Spring constant. (2marks)

Slope of the graph at the point where its straight.

14 a) Define the term 'heat capacity'. (1mark)

This is the quantity of heat required to raise the temperature of a given mass of a gas by one Kelvin.

b) A block of metal of mass 150g at a 100°C is dropped into a well lagged calorimeter of mass 215g and specific heat capacity $400JKg^{-1}K^{-1}$ containing 100g of water at 25°C. The temperature of the resulting mixture is 34°C. (Specific heat capacity of water = $4200JKg^{-1}K^{-1}$). Determine;

i) Heat gained by calorimeter. (2marks)

$Q = MC\Delta\theta$

$= 0.215 \times 400 \times 9$

$= 774\ J$

ii) Heat gained by water. (2marks)

$Q = mc\Delta\theta$

$= 0.1 \times 4200 \times 9$

$= 3780\ J$

iii) Specific heat capacity of the metal block. (3marks)

Heat lost = Heat gained

$MC\Delta\theta = 774 + 3780$

$0.15 \times c \times 66 = 4554$

$\frac{9.9c}{9.9} = \frac{4554}{9.9}$

$c = 460\ Jkg^{-1}K^{-1}$

15 A string of negligible mass has a metal ball tied at the end of ~~the string~~ 100cm long and the ball has a mass of 0.04kg. The ball is swinging horizontally, making 4 revolutions per second.

Determine;

(a) the angular velocity. (3 marks)

$\omega = 2\pi f$

$= 2\pi \times 4$

$= 25.13\ rad/s$

(b) the acceleration (2 marks)

$a_c = r\omega^2$

$= 0.1 \times 25.13^2$

$= 63.15\ m/s^2$

(c) The tension on the string (2 marks)

$T = mr\omega^2$

$= 0.04 \times 0.1 \times 25.13^2$

$= 2.526\ m/s^2$

(d) The linear velocity (2 marks)

$V = r\omega$

$= 0.1 \times 25.13$

$= 2.513\ m/s$