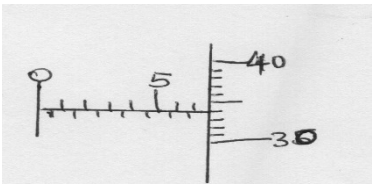
232/1
PHYSICS
PAPER 1
JULY 2017
2 HOURS

END OF TERM II EXAMINATION
MARKING SCHEME

232/1
PHYSICS
PAPER 1

SECTION A (25MKS)

1. Figure I shows a reading of a micrometer screw gauge when a metallic spherical ball of mass 31.2g is measured in it.



If the micrometer screw gauge had a zero error of -0.01; what is

a) The diameter of the sphere (2mks)

ANS: 7.00
0.34
7.34
+ 0.01
7.35mm

b) The density of the ball (2mks)

ANS: Volume $= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{0.735}{2}\right)^3$

$= 0.2080$

Density $= \frac{mass}{volume} = \frac{31.2\,g}{.02080\,cm^3}$

$= 150 g/cm^3$

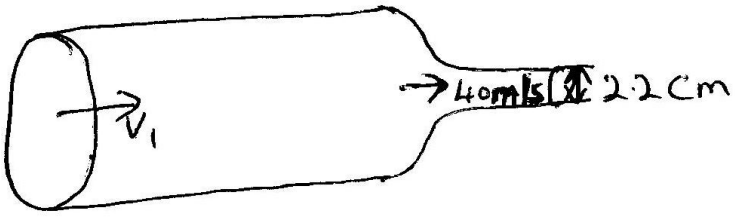
2. Name one force that may determine the meniscus of liquid in a glass (1mk)
   - Adhesive force
   - Cohesive force

3. A water pipe of diameter 8.8cm is connected to another pipe of diameter 2.2cm. The speed of the water in the smaller pipe is 40m/s. What is the speed, V_1 of the water in the larger pipe?

ANS: $A_1V_1 = A_2V_2$

$R_1^2 V_1 = R_2^2 V2$

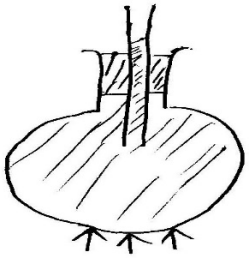
$V_1 = \frac{R_2^2 V 2}{R_1^2}$



$2.2^2 \times 40$
8.8^2

=2.5m/s

4. The figure below shows a volumetric flask fitted with a glass tube filled with coloured water which was heated to a temperature of 80^0c



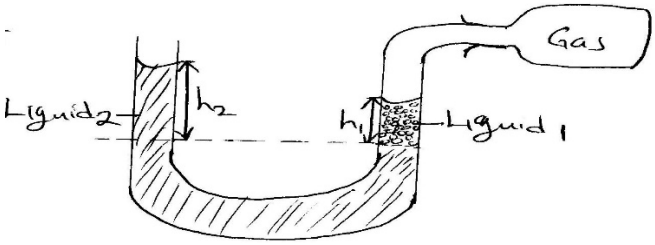
a) What was observed when the flame was withdrawn and left for some time? (1mk)

ANS: The level of the water first raises and then dropped.

b) Explain the observation made in 4(a) (1mk)

ANS: The glass will first contract causing the level to raise, but liquid contract fast than solid hence the levels go down

5. The figure below shows a u-tube connected to a gas supply containing liquids L_1 and L_2 of densities $1.8g/cm^3$ and $0.8g/cm^3$ respectively in equilibrium.



Given that h_1=8cm and h_2=12cm and the atmospheric pressure is $1.02x10^5$pa. Determine the gas pressure. (3mks)

ANS: $PA+\rho_2h_2g=Pg+\rho_1h_1g$

$1.02x10^5+0.12x800x10=Pgx0.08x1800x10$

$102000+960=pg+15168$

$Pg=1.014x10^5$pa

6. A cart of mass 35kg is pushed along a horizontal path by a horizontal force of 14N and moves with a constant velocity. The force is then increased to 21N .Determine:

a) The resistance to the motion of the cart. (1mk)

ANS: Resistance =12N

b) The acceleration of the cart. (2mks)

ANS: F=ma

21-14=35

$\frac{7}{35}=\frac{9}{9}$

$a=\frac{1}{s}$ m/s^2

$=0.2m/s^2$

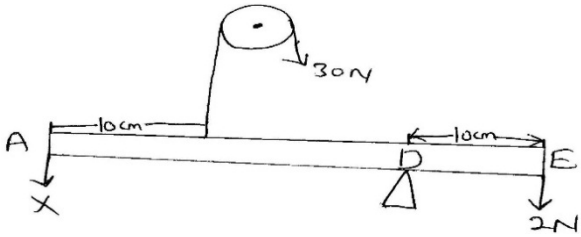
7. State the unit for spring constant. (1mk)

ANS: Newton per metre

8. (a) How does the position of C.O.G affects the stability of a body? (1mk)

ANS: The higher the position centre of gravity, the lower the stability and the lower the position centre of gravity the more the stable the body is.

(b)The figure below shows a uniform rod AE which is 40cm long .It has a mass of 2kg and pivoted at D. If 2Nis acting at a point E and 30N force is passed through a frictionless pulley, find the value of x acting at end A. (3mks)



ANS: Anticlockwise moment =clockwise moment

$0.3+20x0.1=30x0.2+2x0.1$

$0.3x =6.2-2.0$

$x=14$

9. A turntable of radius 16cm is rotating at 960 revolutions per minute .Determine the angular speed of the turntable. (2mks)

ANS: $w=2HF$

$T=\frac{960}{60}$ rev/sec=16 rev/s

$W= 2x16\pi = 32\pi$ rads/s

$W = 100.5$ rad/s

10. Distinguish between solid and liquid states of matter in terms of intermolecular forces. (1mk)

ANS: In solids the molecules are held in position by strong intermolecular forces .While in liquid the molecules are held together by weak intermolecular force hence they are able to move randomly.

11. State two environmental hazards that may occur when oil spills over a large surface area of the sea. (2mks)

ANS:

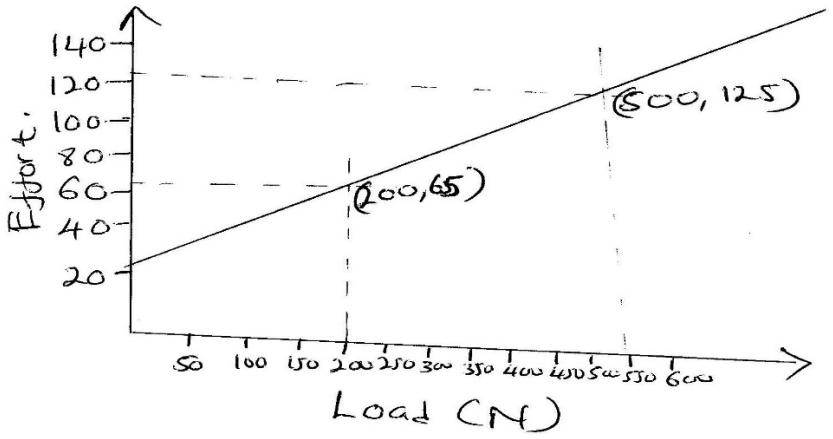
- Pollution
- Death of aquatic animals and plant

SECTION B: 55MKS

12. (a)Define mechanical advantage of a machine. (1mk)

ANS: It's the ratio of the low to the effort applied in machine.

(b)In an experiment to investigate the performance of a pulley system with a velocity ratio of 5 the following graph was plotted.



From the graph find

i. The effort when the load s 450N (1mk)

ANS: Effort =115N

ii. M.A when the load is 450N (2mks)

ANS: $M.A=\frac{Load}{effort}$

$\frac{450}{1.5}$

=3.913

iii. The efficiency corresponding to the load of 450N (2mks)

ANS: Efficiency = $\frac{M.A}{V.R} \times 100$

$=\frac{3.913}{5} \times 100$

=78.26

(C) Otieno uses the system in (b) above to exit a body of mass 50kg.It rises with a velocity of 0.15m/.Determine the power developed by Otieno. (3mks)

ANS: Power =force x speed

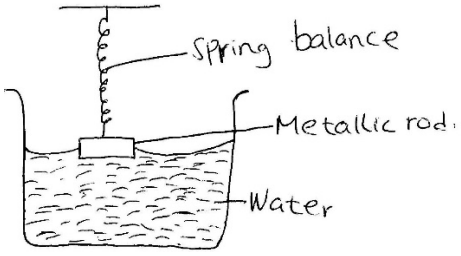
=500x0.15

=75watts

13. (a) State the law of floatation (1mk)

ANS: A floating object /body displaces its own weight in the fluid it floats

(b) The figure below shows metallic rod of length 10cm and uniform cross section area $4cm^2$ suspended from a spring balance with 7.5cm of its length immersed in water. The density of metallic rod is $1.5g/cm^3$ (Take density of water $=1.05g/cm^3$)



Determine

i. The mass of the rod (2mks)

ANS: Volume of the rod ⟹ V=BAxh

$V=A \times L = 4x10=40cm^3$

Mass $=V \times \rho$

$=40x1.5=60g$

ii. The up thrust acting on the rod (2mks)

ANS: Volume of water displayed =A x C

$=4 \times 7.5$

$=30cm^3$

Weight of water displayed $=Vg\rho$

$=1050 \times 30 \times 10^6 \times 10$

$=0.315N$

iii. The reading of the spring balance (2mks)

ANS: The spring balance =Total weight - upthrust

$=\frac{60}{1000} \times 10 - 0.315$

$=6 - 0.35$

$=5.685N$

iv. The reading of the spring balance when the rod is wholly immersed in water (3mks)

ANS: When the rod is wholly immersed the weight displaced =pvg

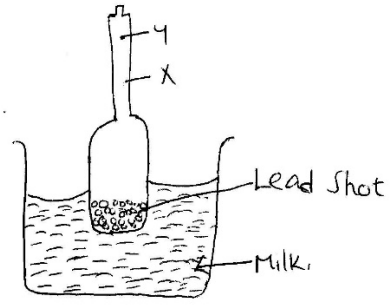
$=1050x40x10^{-6} x10$

$=0.42N$

Reading of the spring balance =0.42N

(c)The figure below shows a special type of a hydrometer for testing relative density of milk.

The range of the readings of the hydrometer is 1.015 - 1.045



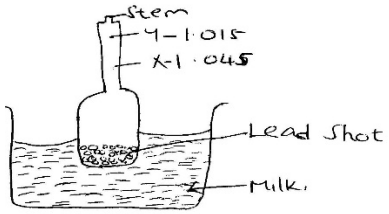
i. State the purpose of lead shot (1mk)

ANS: To enable the hydrometer float upright

ii. How would the hydrometer be made more sensitive (1mk)

ANS: Making the stem thinner.

iii. Indicate appropriately on the diagram the given range of the readings of the hydrometer that correspond to the points marked X and Y. (1mk)



iv. The milk is then mixed with another liquid whose density is higher. State what is observed on the hydrometer. (1mk)

ANS: The hydrometer will sink less in the liquid mixture

14. (a) What is meant by specific latent heat of vaporization of a substance? (1mk)

ANS: It's the amount of leaf required to change a unit mass of liquid to vapour at a constant temperature.

(b)In an experiment to determine the specific latent heat of vaporization of water steam at 100^0c was passed into water contained in a well lagged copper calorimeter .The following measurements were made.

- Mass of calorimeter=60g
- Mass of water and calorimeter=145g
- Final mass of calorimeter +water +condensed steam =156g
- Final temperature of the mixture = 48^0c

Take specific heat capacity f water =$420Jkg^{-1}k^{-1}$

Specific heat capacity of copper=$390Jkg^{-1}k^{-1}$

Determine the

i) Mass of condensed steam (1mk)

ANS: Mass of steam =156-145

=11g

ii) The gained by the calorimeter and water if the initial temperature of the calorimeter and water is 20^0c. (3mks)

ANS: Heat gained by water + heat gained by calorimeter.

= 0.055 x 4200 (48 – 20) + 0.06 x 390 x (48 – 20)

= 10651.2 J

iii) Given that Lv is the specific latent heat of vaporization of steam, write a simplified expression for the heat given out by steam. (2mks)

ANS: Heat lost by steam = Heat lost by condensing steam + Heat lost by condensed steam

= 0.11 x Lv + 0.11 x 4200 x (100 - 48)

= 0.11Lv + 2402.4

iv) Determine the value of Lv above 2mks)

ANS: Heat lost by steam + heat lost by condensed water = Heat gained by water + Heat gained by calorimeter.

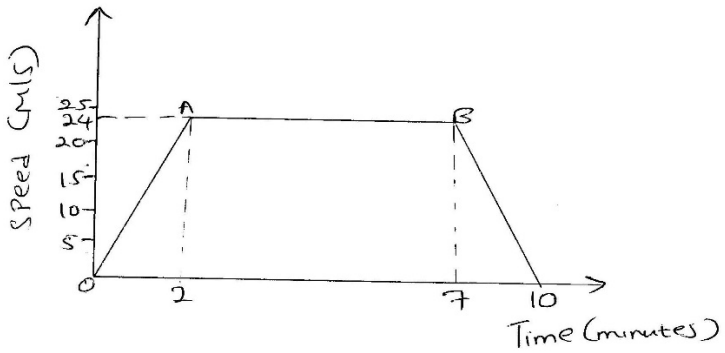
= 0.11Lv + 2402.4 = 10651.2

Lv = 749890.9091JKg^{-1}

v) State the assumption made in the experiment above (1mk)

- There are no heat loses.
- There is no change in mass.

15. (a)The speed of a train hauled by a locomotive varies as shown below as it travels between two stations along a straight horizontal track.



Use the graph to determine

i) The maximum speed of the train (1mk)

ANS: Max speed =24m/s

ii) The acceleration of the train during the first 2min f the journey(2mks)

ANS: Acceleration V=u + at

24=0 + a x 2

2a=24

a=$\frac{12}{60} ms^2$

=0.2ms^2

iii) Time during which the train is slowing down. (1mk)

ANS: 3min or 3x60=180s

iv) The total distance between the two stations (3mks)

ANS: Distance =Ares under the graph

$\frac{1}{2}$ (10+5) x2x60

=10800m

v) The average speed of the train (2mks)

ANS: $\frac{10800}{10 \times 60} = 18m/s$

(b)A string of negligible mass has a bucket tied at the end. The string is 60cm long and the bucket has a mass of 45g. The bucket is swung horizontally making 6 revolutions per second.

Calculate

i) The angular velocity (2mks)

ANS: w=2Πp

=2x$\frac{22}{7}$ x 6

=37.7 rad/s^2

ii) The angular acceleration (2mks)

ANS: a=r w^2

=0.6x37.7^2

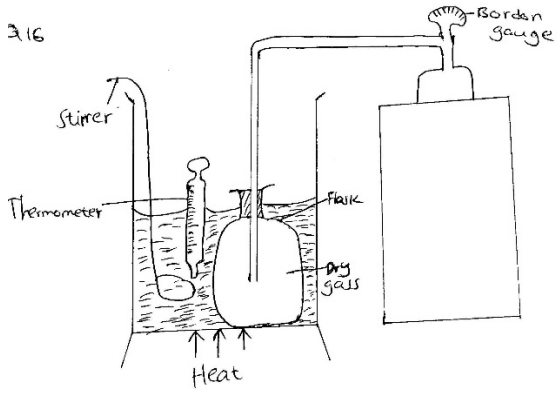
=853.42 rad/s^2

iii) The tension on the string. (2mks)

ANS: F = ma

=0.45x853
=38.4N

16. (a)The diagram below shows asset up that a student used to investigate pressure law of a gas.



i) State the measurements that should be taken in the experiment (2mks)

- Temperature
- Pressure

ii) Explain how the measurement in (i) above may be used to verify the pressure law. (1mk)

ANS:

- The air gets heated and its temperature noted with the corresponding values of pressure noted on the gauge.
- Several values of temperature (T) and corresponding pressure P are tabulated.
- Graph of P against –T is drawn which straight line is showing that pressure is directly proportional to absolute temp.

(b)Name one limitation of the gas laws. (1mk)

ANS: Gases liquefy at high pressure and very low temperatures .Real gases have parties that occupy space hence they could be compressed to the volume.

(c)Oxygen gas of volume of 2500cm^3 at 10^{0}c and pressure of 3N/m^2 is compressed until its volume is 500cm^3 at a pressure of 6N/m^2 .Determine the new pressure of the gas after this compression in Kelvin. (2mks)

ANS:

$\frac{P_1V_1}{T_1}=\frac{P_2V_2}{T_2}$

$\frac{3x2500}{283}=\frac{6x500}{T_2}$

T_2=113.2k