KIGALI CITY

GASABO DISTRICT

2023-2024 SECOND TERM EXAMINATIONS

SUBJECT NAME: PHYSICS THEORY

LEVEL: SENIOR TWO ORDINARY LEVEL.

EXAMINATION DURATION: 3Hours **DATE: 14 March, 2024**

TOTAL MARK: 100marks

INSTRUCTIONS:

- This paper consists of **TWO** sections: **A** and **B.**
  SECTION A: This section is **compulsory**. **(70 marks)**
  SECTION B: Attempt any **three** questions. **(30 marks)**

- Calculators and mathematical instruments may be used.
- Use only a **blue** or **black** pen for writing and a **pencil** for drawing.

SECTION A (Attempt all Questions / 70marks)

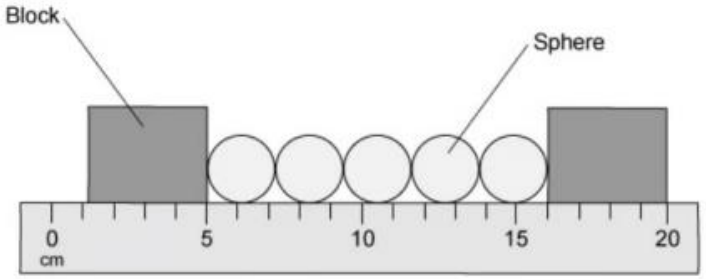
1. a) Define term absolute errors **(1mark)**

b) Give two Types of errors in measurement of physical Quantity **(2marks)**

2. Answer True or False for the following questions **(2marks)**

a) External disturbances can not cause errors
b) 245.7 has 4 significant digits
c) Friction force is the force exerted between two bodies in contact but only at rest
d) The rate of increasing velocity of moving bodies is called retardation

3. Five identical spheres are placed between two blocks in order to measure their diameter



What is thediameterofa single sphere? **(2marks)**

4.a) what mean by work energy theorem **(1mark)**

b) Match each of the following physical quantities **(column A)** with its meaning **(column B)**. **(4marks)**

column A	**column B**
a) Energy	i) Energy that is stored in an object due to its position relative to some zero position.
b) Power	ii) Capacity to do work
c)Kinetic energy	iii) Rate at which work is done.
d)Potential energy	iv) Energy which a body possesses by virtue of being in motion.

c)The driver of a 1 000 kg car traveling at a speed of 16.7 m/s applies the car's brakes when he sees a red robot. The car's brakes provide a frictional force of 8000 N. Determine the stopping distance of the car. **(3marks)**

5. a) State the law of conservation of mechanical energy **(1mark)**

b) In simple pendulum, the P.E changes to K.E and K.E changes P.E as the bob swings. Using a stand, a cotton thread and a bob, draw a diagram of the swinging pendulum and show the transformation of P.E to K.E and vice versa. **(2 marks)**

c) A 150g balls falls vertically downwards from a height of 1.8m on a horizontal plate. On hitting the plate, the ball rebounds to a height of 1.25m. Find:

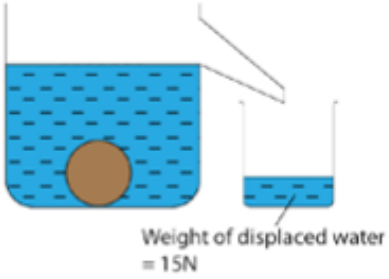
(i) The velocity of the ball just before hitting the plate, **(1mark)**
(ii) The kinetic energy of the ball as it hits the plate, **(2 marks)**
(iii) The velocity of the ball as it leaves the plate **(1mark)**
(iv) The kinetic energy of the ball as it leaves the plate. **(2 marks)**

(Take g=10m/s^2).

6. a) State Archimedes' principle **(1mark)**

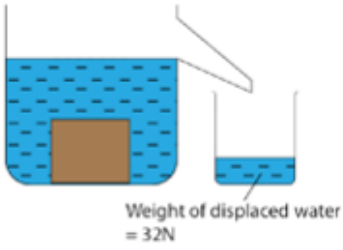
b) Determine the upthrust acted on the objects immerse in the water below **(3marks)**

i)



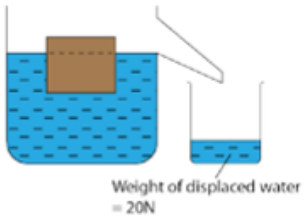
Upthrust =

ii)



Upthrust =

iii)



Upthrust =

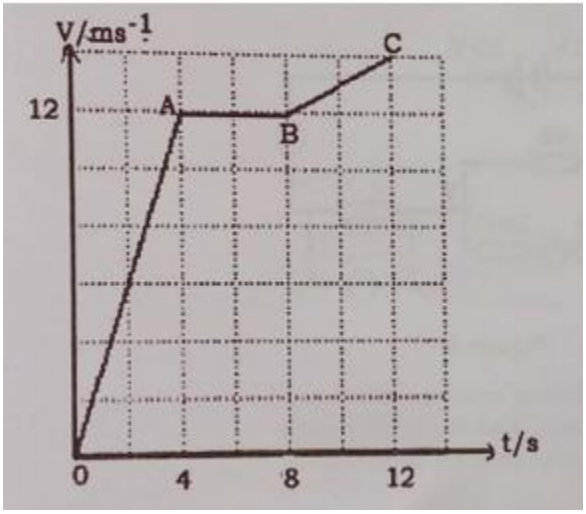
C) A metal block of density 7 800 kg/m^3 weighs 117 N in air and 105 N in liquid when wholly immersed. Find i) Volume of the metal block. **(2 marks)**

ii) the density of the liquid. **(2 marks)**

(use The acceleration due to gravity g=10m/s^2)

7. a) Distinguish between uniform linear motion and non-uniform linear motion **(2marks)**

b) Study the velocity-time graph for a moving body shown in ***figure*** below and answer the questions that follow

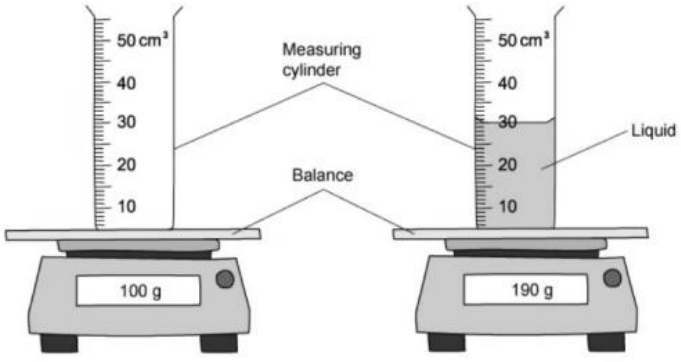


(i) Describe the motion of the moving body from 0 to A (**1mark)**
(ii) Calculate acceleration of the moving body from 0 to A **(1mark)**
(iii) What is the distance travelled by an object from 0 to 8 s (**2marks)?**

8.a) What is meant by the term density of body. **(1 marks)**

b) A body has a volume of 15 cm^3 and mass of 27 g what is its density? Give the answer in kg/m^3. **(2 marks)**

c. The diagram below shows a measuring cylinder containing a liquid, and that same measuring cylinder when it is empty



What is the density of the liquid in g/cm^3? **(2marks)**

9. a) Define friction forces (**1mark)**

b) State:

i. Two advantages of friction forces (**2marks)**
ii. Two disadvantages of friction forces (**2marks)**

c) i) State 2 Factors affecting friction forces (**2marks)**

ii) Give 2 ways of reducing friction forces on contact surface (**2marks)**

10. (a) Define pressure and state its SI unit. **(2marks)**

(b) Find the pressure in Pa of force, F = 45N and applied on a triangle of base of 5m and height of 3m. **(2marks)**

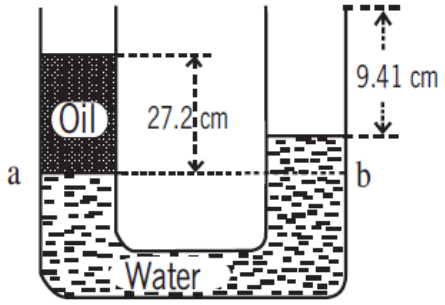
c) Which of the shoes shown below causes most damage and explain your answer? **(2marks)**



(a) **(b)**

11. Water and oil are poured into the U-shaped tube (**see figure below**) open at both ends, and do not mix. They come to equilibrium as shown in the fig. below. What is the density of the oil?

(use Density of water $\rho_w = 1 g/cm^3$**)** **(3marks)**



12. A motorcyclist moves along a straight road with a constant acceleration of $4 m/s^2$. If initially she was at a position of 5m and had a velocity of 3m/s, calculate

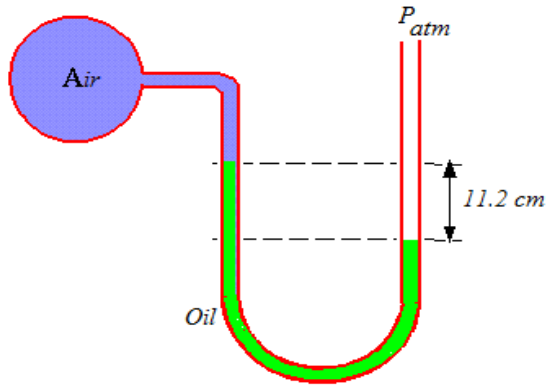
(i) the position and velocity at time t = 2s, and **(3marks)**

(ii) the position of the motorcyclist when its velocity is 5m/s. **(3marks)**

13. The electric motor of a model train accelerates the train from rest to 0.620 m/s in 21.0milliseconds. The total mass of the train is 875 g. Find the average power delivered to the train during the acceleration **(3marks)**

SECTION B (Attempt only 3 Questions / 30marks)

14. Figure below shows, not to scale, a sealed container filled with air and attached to manometer. The liquid in the manometer is an oil of density 860kg/m^3. The atmospheric pressure is P_{atm}=101.2kPa and the acceleration due to gravity is g=9.81m/s^2. The vertical distance between the two oil is 11.2 cm.



a) What are the two real-life applications of manometer? **(2marks)**

b) Express i) the given atmospheric pressure (P_{atm}) in N/m^2 **(1mark)**

ii) The distance between two oil surfaces in m. **(1mark)**

c) Observe carefully the above manometer and answer the following sub-questions

(i) Does air in the sealed container have more pressure than the atmospheric pressure? Justify your answer. **(2marks)**

(ii) Calculate the pressure, P_{oil}, due to oil only **(1mark)**

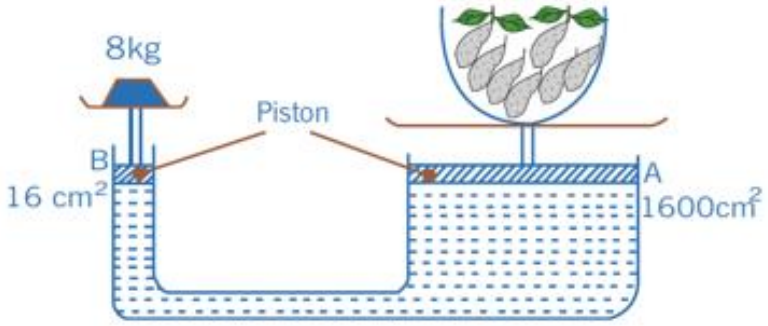
(iii) A learner A says that the formula to be used to be used to calculate the pressure of air, P_{air} , in the sealed container is $\mathbf{P_{atm} - P_{air} = P_{oil}}$, A learner B propose another formula $\mathbf{P_{atm} + P_{air} = P_{oil}}$ Who is right? **(1mark)**

(iv) Apply the correct expression to calculate the pressure of air (P_{air}) in the sealed container. **(2marks)**

15. a) state Pascal's principle (**1mark)**

b) State 2 application of Pascal's principle **(2 marks)**

c) **Figure below** shows a hydraulic weight bridge which works on the principle of Pascal's law.



i) What is the pressure at B? **(2marks)**

ii) What is the pressure at A? **(2marks)**

iii) What is the weight of the vegetable on the large piston A if the weight bridge is in equilibrium? (use acceleration due to gravity g=10m/s^2) **(3marks)**

16. a) State the following ideal gas laws

i. Boyle's law **(2marks)**

ii. Charles' law **(2marks)**

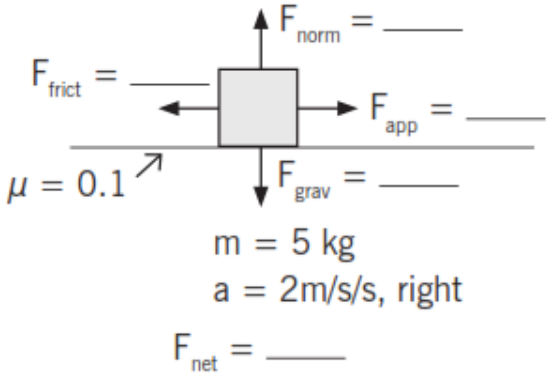
iii. Guy-Lussac law (pressure law) **(2marks)**

b) A helium party balloon, assumed to be a perfect sphere, has a radius of 18.0cm at room temperature (20^0C), its internal pressure is 1.05atm. Find the number of moles of helium in the balloon and the mass of the helium needed to inflate the balloon to these values. (take $R = 8.314 J/mol.K$, Mm (He =4g/mol, 1atm = 1.013x10^5 Pa) **(4 marks)**

17. **a)** Describe 2 types of friction force (**2marks)**

b) A person applies a 4.5 N rightward force to a 0.5 kg book to accelerate it across a table top. The coefficient of friction between the book and the table top is 0.410. Determine the acceleration of the book (take g=10 m/s^2). **(3marks)**

c) A rightward force is applied to a 5kg object to move it across a rough surface with a rightward acceleration of 2m/s^2. The coefficient of friction between the object and the surface is 0.1. Use the diagram to determine the gravitational force, normal force, applied force, frictional force, and net force. (Neglect air resistance). **(5marks)**



18.a) A solid weighs 600g in air, 450g in water and 480g in a liquid. Find the:

(i) volume of the solid, **(2marks)**

(ii) Relative density (R.D) of the solid **(2marks)**

(iii) Relative density (R.D) of the liquid. **(2marks)**

b) A body weighs 20g in air, 18.2g in a liquid and 18.0g in water. Calculate:

(i) the relative density of the body, **(2marks)**

(ii) and relative density of the liquid. **(2marks)**

END!