PHYSICS

Date: 18th June 2024
Period: 8:30 am-11:30 am

NESA | NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATION

QUESTION PAPER

GRADE: SENIOR TWO (S2)

LEVEL: ORDINARY

COMBINATION: -

DURATION: **3 HOURS**

MARKS:

.... /100

CAMIS(Theory+Practical): ....../40

INSTRUCTIONS

1) This paper has **two** sections: **A** and **B**

SECTION A: Attempt all 15 questions. **(70 marks)**

SECTION B: Attempt any three out of 5 questions. **(30 marks)**

2) The total marks on school report will be the results of adding Theory and Practical Examinations' marks then converted to 40 marks

SECTION A: ATTEMPT ALL QUESTIONS (70 MARKS)

1) Write true if the statement is correct or false if the statement is wrong.

a) Permanent magnets get easily demagnetized. **(1mark)**

b) The main advantage of a permanent magnet over an electromagnet is that a permanent magnet does not require a continuous supply of electrical energy to maintain its magnetic field. **(1mark)**

c) The mass number of the element is the sum of the number of protons and neutrons. **(1mark**

d) The atomic number of an element is equal to number of neutrons.

(1mark)

e) Stroking is a method of demagnetization. **(1mark)**

2) Complete the following statements using five terms from the box.

- Higher the voltage across it
- Parallel
- The number of resistors in a series circuit increases
- Supply voltage.
- Series
- same potential difference
- same electric current

a) The sum of voltages across all the resistors in a series circuit is equal to the... .... **(1mark)**

b) The higher the resistance of a resistor, the.............................**(1mark)**

c) **In a ....circuit, the total resistance is smaller than the smallest resistance in the circuit**. **(1mark)**

d) When resistors are connected in parallel, they have the .... across them. **(1mark)**

e) The total current decreases if... .... **(1mark)**

3) Choose the best alternative answer that satisfies the statement below.

a) Rays of light travelling parallel to the principal axis of a concave mirror will come together......

    i) at the centre of curvature.

    ii) at the focal point.

    iii) at infinity.

    iv)at a point half way to the focal point.

(1mark)

b)The expression of focal length $f = \frac{R}{2}$ is valid for

    i)convex mirrors only

    ii)planar mirror

    iii)concave mirrors only

    iv)concave and convex mirrors.

(1mark)

c)A concave mirror **CANNOT** be used as...

    i) a magnifying mirror

    ii) a torch reflector

    iii) a real view mirror

    iv) a dentist's mirror

(1mark)

d) Which of the following best describes the image formed by a convex mirror?

    i) virtual, upright and reduced

    ii) real, inverted and reduced

    iii) virtual, upright and enlarged

    iv)real, inverted and enlarged

(1mark)

4) Write true if the statement is correct and false if the statement is wrong.

  a) The simplest electronic component/semiconductor device used as rectifier

is transistor. **(1 mark)**

b) The simplex semiconductor device /electronic component used as amplifier is diode. **(1mark)**

c) A pentavalent impurity has 5 valence electrons. **(1mark)**

d)The most commonly used semi-conductor is silicon. **(1mark)**

e) The following electronic component is transistor.

(1mark)

5) Match the physical quantities and their formula in the following table.

The symbols have their usual meanings.

Physical quantities	Formula
a)Speed	i)$T = 2\pi\sqrt{\frac{L}{g}}$
b) Acceleration	ii) $x = ut + \frac{1}{2}at^2$
c) Period of oscillation	iii) $v = u + at$
d) Distance travelled	iv) $a = \frac{\Delta v}{\Delta t}$

(4 marks)

6) Select the correct alternative

a) An object is released from a certain height above the ground. Just at the time it touches the ground, it will possess

i)heat energy   ii) chemical energy   iii) kinetic energy   iv) potential energy

(1 mark)

b) Energy is

i)work   ii) ability to do work

iii) quantification of work   iv) force multiplied by velocity

(1mark)

c)Power is

i)rate of doing work   ii) ability to do work   iii) rate of energy creation

iv)equivalent to work
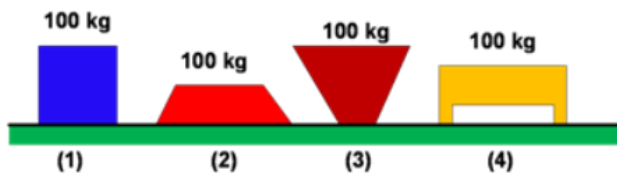
(1mark)

d)A learner pushes a wall and fails to displace it, he/she does

i)no work at all   ii) positive work

iii) negative work   iv) maximum work

(1mark)

7) Choose the correct answer

a) Given four bodies with mass 100 kg each

Which one exerts the smallest pressure at the surface of the table? **(1mark)**

b) Static fluid pressure at any given depth in the fluid depends on

i)the total mass   ii) the surface area

iii)the distance below the fluid's surface   iv) shape of the container

(1mark)

c)Why does a nail have a pointed tip?

i)The force acting on a smaller area exerts a smaller pressure

ii)The force acting on a larger area exerts a zero pressure

iii)The force acting on a smaller area exerts a larger pressure

iv)The force acting on a larger area exerts a larger pressure

(1 mark)

d)Where is the atmospheric pressure the greatest?

i)Mountain top   ii) Flying in an airplane   iii) Classroom   iv) sea level

(1 mark)

e) A block of iron dropped in a vessel of water sinks to the bottom.

   This is because

   i)the vessel is not deep enough to allow the block to float

   ii)the weight of the water displaced by the block is less than the weight of the

   block.

   iii)the weight of the block is less than the weight of the water displaced by

   the block.

   iv)the density of water is more than the density of the block.

   (1mark)

8) Write true or false if the statement is correct or wrong respectively.

   a) Pressure in a fluid at rest is the same at all points if they are at the same

   level.   **(1mark)**

   b) In a hydraulic lift the force exerted on a small piston produces an equal

   force on the large piston.   **(1mark)**

   c) Pascal's principle explains why light object floats.   **(1mark)**

   d) A change in pressure applied to enclosed incompressible fluid is

   transmitted undiminished to every portion of the fluid and to the walls of

   its container.   **(1mark)**

9) a) What do you understand by the following terms?

   i)Apparent weight of an object completely or partially immersed in a liquid.

   (1mark)

   ii) Archimedes principle.   **(1mark)**

   b) State and explain the factors affecting the buoyant force/up thrust.

   (4 marks)

10) a) How does the density of a gas vary with temperature? Explain. **(2 marks)**

b) How does the pressure of a gas vary with temperature if the volume is kept constant? Explain. **(2 marks)**

c)Dalton's law that you studied is also known as law of partial pressures.

i)What do you understand by partial pressure in mixture of gases? **(1mark)**

ii)How did Dalton state this law? **(1mark)**

11) Gas in a balloon occupies 3.3 l.
   a) What volume will it occupy if the pressure is changed from 100 kPa to 90 kPa at a constant temperature of 37°C? Use absolute temperature.

(4 marks)

   b) What will happen to the balloon if the pressure becomes too great? Justify your answer. **(2 marks)**

12) What force is the minimum you have to apply horizontally to get a 1.5 kg block of wood at rest to move on a wooden table surface?
Hint. Find the weight of the block before determining the static friction force.
(4 marks)

13) The voltage across a wire is (100 ± 5) V and the current passing through it is (10±0.2) A. Find the resistance of the wire with its absolute error.
(5 marks)

14) Theoretically speaking, what happens if the lightning rod is not earthed?
(3 marks)

15) What will happen to measurements if the following errors are not minimized?
   a)Systematic errors. **(2 marks)**
   b)Random errors. **(2 marks)**

   SECTION B :ATTEMPT ONLY THREE QUESTIONS. **(30 MARKS)**

16) a) Identify the measuring instrument used to measure the
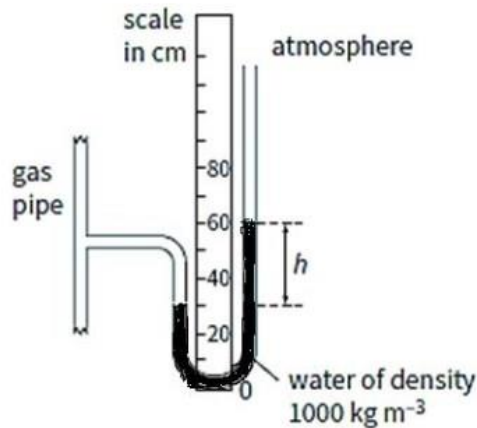   i)atmospheric pressure. **(1mark)**
   ii)pressure of a liquid. **(1mark)**

   b) The figure below shows a manometer used to measure the pressure of a gas supply. Atmospheric pressure is P_0=101 325 Pa

i) Is the gas pressure greater than atmospheric pressure?

    Justify your answer. **(2 marks)**

ii) Calculate the pressure difference between the gas inside the pipe

    and atmospheric pressure. **(4 marks)**

iii)Determine the gas pressure. **(2 marks)**

17) a) Draw a labelled hydraulic lift. **(2 marks)**

  b) Two pistons of a hydraulic lift have diameters of 60 cm and 5 cm

  i) Find the radius of each piston. **(3 marks)**

  ii)Find the cross-sectional area of each piston. **(3 marks)**

  iii) What is the force exerted by the larger piston when 50 N is applied on

    the smaller piston? **(2 marks)**

18) a) A cylinder of height 30 cm and radius 7 cm is immersed completely in a

    fluid of density 1.3×10^3 kg/m³.

    i)Calculate the volume of the cylinder. **(2 marks)**

    ii)What is the buoyant force acting on it? Take g = 10 m/s². **(2 marks**

  b) A body weighs 600 g in air and 400 g in water. Calculate

    i) up thrust on the body. **(4 marks)**

    ii) relative density of the solid. **(2 marks)**

19) a) State the types of potential energy. **(2 marks)**

b) Differentiate between open and isolated systems.   **(2 marks)**

c) What do you understand by the term potential energy.   **(1 mark)**

d) A ball with mass of 2 kg is dropped from the top of a building that is 30 m high.

Acceleration due to gravity g= $10m/s^2$ and air resistance is negligible.

i)Find the potential energy of the object at 30 m.   **(2 marks)**

ii)What is the velocity of the ball when it is 10 m above the ground?

                                                                      (3 marks)

20) a) State any two applications of electrostatics.   **(2 marks)**

b)Two electric charges $Q_1 = 5.0x10^{-6}C$ and $Q_2 = 8.0x10^{-6}C$ are placed at 3.0 m from the point P as shown below. Coulomb's constant k= $9x10^9$ Nm²/C²
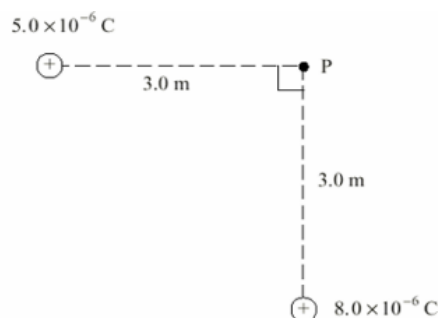
Find i) The electric field created at point P due to Q₁.   **(2 marks)**

ii)The electric field created at point P due to Q₂.   **(1 mark)**

iii)Copy the diagram and draw the vector that represents the electric field created by each of the two electric charges and the resultant electric field.   **(3 marks)**

iv)What is the magnitude of the electric field at point P due to two fixed electric charges as shown above?   **(2 marks)**

                                -END-

PHYSICS

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NESA | NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATION

MARKING GUIDE

GRADE: **SENIOR TWO (S2)**

LEVEL: **ORDINARY**

COMBINATION: **ORDINARY LEVEL**

DURATION: **3 HOURS**

MARKS: **.... /100**

CAMIS(Theory+Practical): **....../40**

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SECTION A: ATTEMPT ALL QUESTIONS (70 MARKS)

1) a) False **(1mark)** b) True (**1mark)** c) True**(1mark)** d) False **(1mark)** e) False **(1mark)**

2) a) Supply voltage. **(1mark)**

b) Higher the voltage across it. **(1mark)**

c)Parallel (**1mark)**

d) Same potential difference **(1mark)**

e) the number of resistors in a series circuit increases**. (1mark)**

3). a) (ii) **(1mark)** b) (iv) **(1mark)** c) (iii) **(1mark)** d) i) **(1mark)**

4)a) False **(1mark)** b) False **(1mark)** c) True **(1mark)** d) True **(1mark)** e) False **(1mark)**

5) a)→iii) **(1mark)**   b)→iv) **(1mark)**   c)→i) **(1mark)**   d)→ii) **(1mark)**

6)a) iii) kinetic energy **(1mark)** b) ii) ability to do work **(1mark)**

c)i) rate of doing work **(1mark)** d) i) no work at all **(1mark)**

7)a) (2) **(1mark)** b) iii) **(1mark)** c) iii) **(1mark)** d) iv) **(1mark)** e) ii) **(1mark)**

8)a) True **(1mark)** b) False **(1mark)** c) false **(1mark)** d) True**(1mark)**

9)a) i) Apparent weight = weight of the object in air – thrust force /buoyancy

(1mark)

ii)Archimedes principle states that when un object is completely or partially immersed in a liquid, the apparent weight loss of weight is the same as the weight of the liquid displaced by it. **(1mark)**

b) Buoyant force depends on the density of the liquid **(1mark)** and the volume of the liquid displaced **(1mark)** g is a constant.

Density of an object is defined as the amount of mass per unit volume of the given object. **(1mark)**

Volume is the amount of space that an object occupies **(1mark)** within the boundaries of an object.

10)a) There is a decrease in density of a gas when there is an increase in

temperature **(1mark)** because the intermolecular spaces between the gas

molecules increase as a result volume increases **(1mark)** and thus the

density decreases.

b) The pressure increases when the temperature of the gas increases. **(1mark)**

Due to increase in temperature, the molecules gain more heat energy, get

more excited and start more frequent random motion with high velocities

(0.5 marks). They collide with the walls of the container more often with

high velocities and these collisions develop pressure on the walls

(0.5 marks)

c)i) The pressure that would be exerted by one of the gases in a mixture if it

occupied the same volume on its own. **(1mark)**

ii)The total pressure exerted by a mixture of gases is equal to the sum of the

partial pressures of the gases in the mixture. **(1mark)**

11)a) $T_k = 273 + T_c$ **(1mark)**

= (283+37) K

=310 K **(1mark)**

The final volume $V' = V\frac{P'}{P}$ **(1mark)**

$$=3.3\text{x}\frac{100}{90}l = 3.67l \text{ (1mark)}$$

b) This difference in pressure will cause the gas inside the balloon to

expand and the volume of the balloon to increase. **(1mark)**

This will eventually stretch the rubber of the balloon to a point where it

bursts**(1mark).**

12) Find normal force by finding weight

The magnitude of normal force F_N is equal that of the weight of the block W

F_N = mg **(1 mark)**

F_N = (1.5) (10)

= 15N **(1mark)**

Find the force of static friction

F_f = μF_N **(1mark)**

F_f = 0.25x 15 N = 3.75N**(1mark)**

13) The resistance is given by Ohm's law $R = \frac{V}{I}$ **(1mark)**

=100 V/10 A

=10Ω **(1mark)**

Percentage error $\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$ **(1mark)**

Absolute error $\mathbf{\Delta R = 10\ (\frac{5}{100} + \frac{0.2}{10})\ \Omega = 0.7\Omega}$ **(1mark)**

The resistance R= (10 ±0.7)Ω **(1mark)**

14)A Lightning rod which is higher than the rest of the building without earthing, is as good as any other good conductor of electricity laying stray in open. It will attract more lightning to that building.

If it is not earthed, then it won't work at all**(1mark).** An improper grounding connection can cause disaster sometimes as the lightening may find another route like plumbing, electrical cables, people or other conductors to reach to the ground, which will produce the same effect as that of a lightning striking any building or people and can result in fire**(1mark)** damage to electrical devices, injury even death **(1mark)**

15) a)The measurements will be different from the true value by the same value due to a measuring device that is improperly calibrated. **(1 mark).**

The simplest example occurs   so that it consistently overestimates (or underestimates) the measurements by X units.

For two physical quantities that are directly proportional such as V=RI,

The graph v against I will have the y-intercept different from zero

(1mark)

b) The measurements will be always imprecise **(1mark)** and inaccurate

(1mark) because random error corresponds to imprecision, and bias to

inaccuracy.

SECTION B :ATTEMPT ONLY THREE QUESTIONS (3 MARKS)

16)a) i) Barometer **(1mark)**

ii)Manometer **(1mark)**

b) i) Yes **(1mark** Because the level of water on the side of the tube next to

the gas pipe is lower than that on the side open to the atmosphere, the

pressure in the gas pipe is above atmospheric pressure. **(1mark)**

ii) The difference in height h of the water on the two sides

of the manometer. h = 60 − 30 = 30 cm **(1mark)**

$$=0.30m \quad \textbf{(1mark)}$$

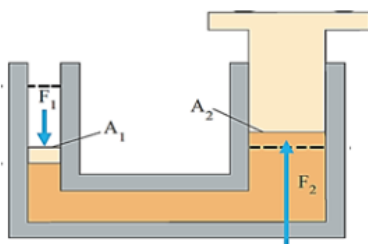Pressure difference $= \rho g h$ **(1mark)**

$$= 1000 kgm^{-3} \times \frac{9.81m}{s^2} \times 0.30m$$

$$= 2940 P_a \quad \textbf{(1mark)}$$

iii)Pressure in the gas $\;P = P_0 + \rho g h\;$ **(1mark)**

$$=101325 \text{ Pa} + 2940 \text{ Pa} = 104\ 265 \text{ Pa} \textbf{(1mark)}$$

17)a) Hydraulic lift. **(2 marks)**

b)i)The radius of the small piston $r = \frac{D}{2}$ **(1mark)**

$$r_1 = 5\frac{cm}{2} = 2.5\ cm\ \textbf{(1mark)}$$

The radius of the big piston $r_2 = 60\frac{cm}{2} = 30\ cm$ **(1mark)**

ii)Cross-sectional area of small piston $A = \pi r^2$ **(1mark)**

$$A_1 = 3.14x(0.025)^2 m^2 = 1.9625x10^{-3}m^2\ \textbf{(1mark)}$$

Cross-sectional area of small piston

$$A_2 = 3.14x(0.30)^2 m^2 = 0.2826\ m^2\textbf{(1mark)}$$

iii)The force is given by $\qquad \frac{F_1}{F_2} = \frac{F_2}{A_2}$ **(1mark)**

$$F_2 = 50x\frac{0.2826}{1.9625\ x10^{-3}}N = 7200\ N\ \textbf{(1mark)}$$

18)a) i) The volume of the cylinder is given by

$V_C = \pi r^2 h$ **(1mark)**

$= 3.14 \times (7 \times 10^{-2})^2 \times (30 \times 10^{-2}) = 4.62 \times 10^{-3}\ m^3$ **(1 mark)**

ii)F_B = density of fluid x volume of cylinder x g **(1mark)**

$F_B = 1.3 \times 10^3 \times 4.62 \times 10^{-3} \times 10 = 60\ N$ **(1 mark)**

b)i)Weight of the body in air w_a=mg **(1 mark)**

=0.600x10 N=6 N **(1 mark)**

Weight of the body in water w_w =0.400x10 N= 4 N **(1 mark)**

Buoyant force(F_B) = 6 N-4N=2 N **(1 mark)**

ii)Relative density $\rho_{rel} = \frac{w_a}{w_a - w_w}$ **(1mark)**

= 6/2=3**(1mark)**

19) a) Gravitational potential energy**(1mark)**

Chemical energy**(1mark)**

Nuclear energy.

Elastic potential energy, also called spring energy.

Electrical potential energy especially in a capacitor

b) Open system is a system that allows energy, charge and mass to pass

across the system boundary**(1mark)** and thus exchanges energy or mass or charge with the object(s) surroundings. An isolated system allows neither mass or energy or charge to pass across the system boundary.

(1mark)

c) Potential energy is defined as the stored form of energy due to its position **(1mark)**

d)i) P= mg$h$ **(1mark)**

$\qquad$ = 2x10x 30 N=600 J**(1mark)**

ii)Change in potential energy from 30 m to 10 m above the ground

$\qquad$ P= mgΔh

$\qquad$ = 2x10x (30-10) N=400 J**(1mark)**

According to the law of conservation of mechanical energy

Kinetic energy at 10 m is KE=400 J

$\qquad$ 400J =1/2 mv^2 **(1mark)**

$\qquad$ V=20m/s^2 **(1mark)**

20) a) i) Electric field due to Q_1

$$E = k\frac{Q_1}{d^2} \quad \textbf{(1mark)}$$

$$E_1 = \frac{9x10^9\frac{5.0x10^{-6}}{3^2}N}{C} \textbf{(1mark)}$$

$$= 5.0x10^3N/C \textbf{(1mark)}$$

b) Electric field due to Q_2

$$E_2 = 9x10^9\frac{8.0x10^{-6}}{3^2}N/C \textbf{(1mark)}$$

$$= 8.0x10^3N/C \textbf{(1mark)}$$

c)
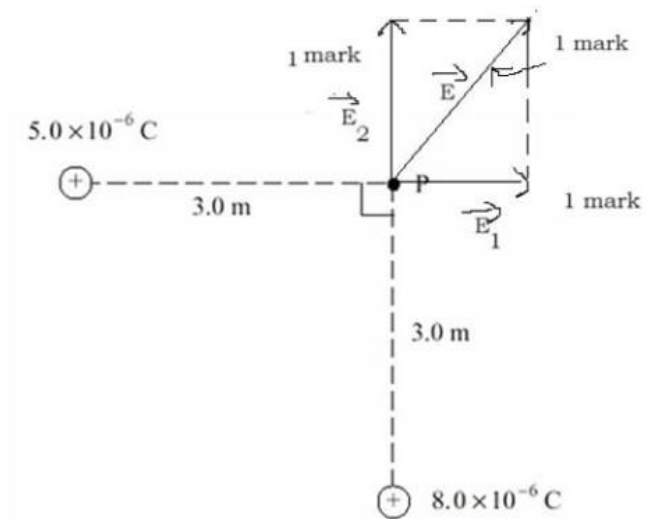
The resultant electric field $E = \sqrt{E_1^2 + E_2^2}$ **(1mark)** Pythagorean
theorem

$$= \sqrt{8^2 + 5^2}x10^3 N/C = 9.43 \text{ x}10^3 \text{N/C } \textbf{(1mark)}$$

-END-

ALTERNATIVE TO PHYSICS PRACTICAL

DATE: 19th June 2024

Period: 8:30 am -10:00 am

NESA | NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

END OF TERM III EXAMINATION
QUESTION PAPER

GRADE: SENIOR TWO (S2)

LEVEL: ORDINARY

COMBINATION: -

DURATION: 1 H 30 MIN

MARKS: .... /20

CAMIS(Theory+Practical): ....../40

INSTRUCTIONS

1) This paper is composed of **ONE** compulsory question

2) Non programmable calculator may be used.

3) Use only a blue or black pen.

4) The total marks on school report will be the results of adding Theory and Practical Examinations' marks then converted to 40 marks

ATTEMPT ALL QUESTIONS (20 MARKS)

Aim of the experiment:

In experiment to study the relation between force of limiting friction F_L and the normal reaction R, a S2 learner followed the following procedures.

Experimental set up
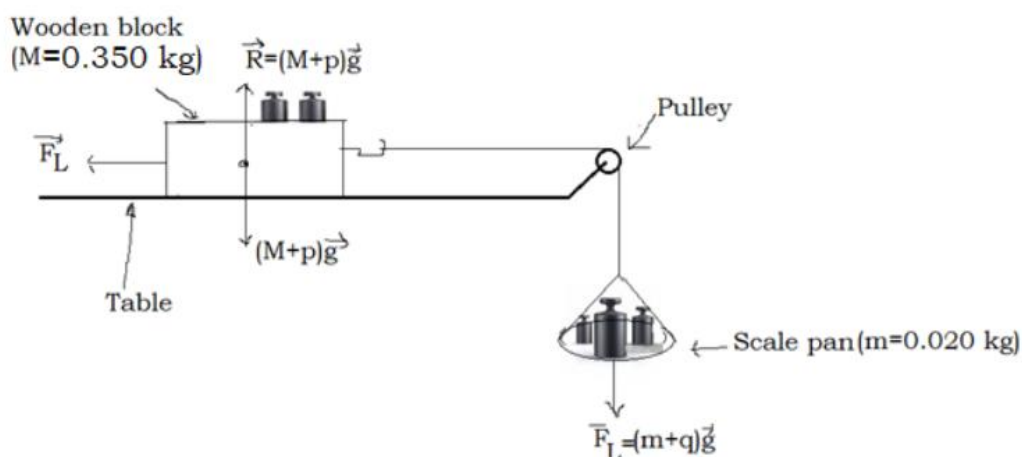
Procedures

a) Put some mass q on the scale pan when no mass(p=0) is put on the wooden block.

b) Tap the table top gently using a pen /pencil and adjust the mass q in pan gradually so that the block just starts sliding on tapping the table top.

c) Record the normal force R and the limiting force F_L to one decimal places in the table.

Limiting friction FL or sliding friction is the friction force on a body just before it starts moving. Limiting friction can be viewed as a threshold friction used to avoid motion when an external force is applied, kinetic friction comes into play when the external force has reached the limiting friction value, the friction now applied is kinetic friction.

Acceleration due to gravity g=9.8 m/s²

d)Repeat procedures a) to c) by adding every time 0.050 kg on the wooden block.

Table of obtained results

Mass on the wooden block p/kg	Normal force R/N where R= (M+ p) g	Mass in the scale pan q/kg	Limiting force FL/N where FL= (m +q)g
0		0.110	
0.050		0.130	
0.100		0.150	
0.150		0.170	
0.200		0.190	
0.250		0.200	

Questions

a) Calculate normal force R= (M+ p) x g and Limiting force FL= (m +q) x g

  to one decimal place and complete the table including only R and FL.

(6 marks)

b) Use graph paper to plot a graph of FL(y-axis) against R (x-axis).

  Draw a line of best fit.   **(6 marks)**

c)i) Calculate the slope S, of the graph.   **(2 marks)**

  ii)What does the slope, S, represent? Justify your answer.   **(2 marks)**

d)i) Propose any two precautions that should be taken to ensure accurate

  results in this experiment?   **(1 mark)**

  ii) Why do roads become slippery after rains?   **(1mark)**

e) Describe situations when friction force is welcome to the human beings

  and when it is not.   **(2 marks)**

-END-

ALTERNATIVE TO PHYSICS PRACTICAL

DATE: 19th June 2024

Period: 8:30 am -10:00 am

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END OF TERM III EXAMINATION

MARKING GUIDE

GRADE: **SENIOR TWO (S2)**

LEVEL: **ORDINARY**

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a) Table or results

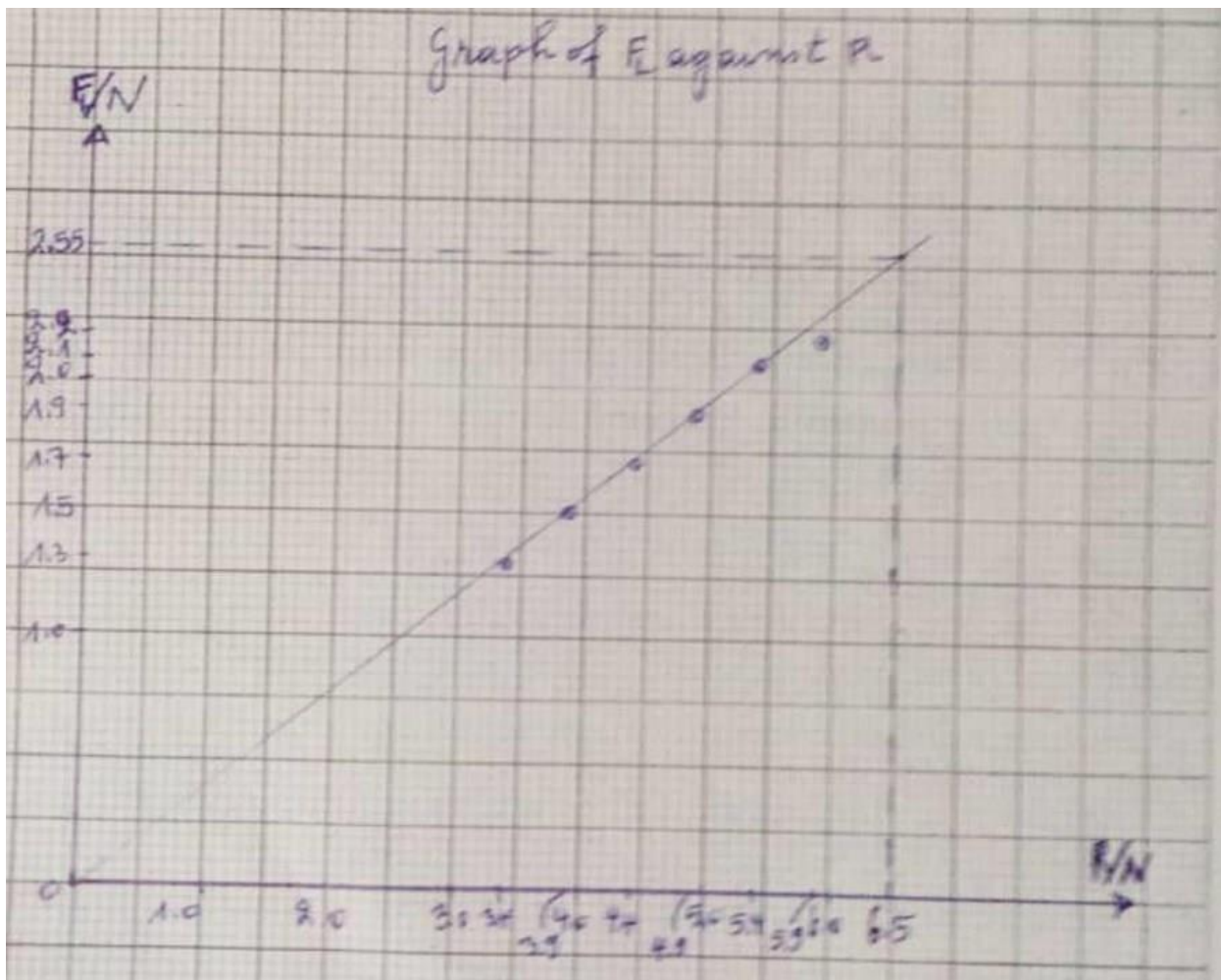| Normal force R/N where R= (M+ p) g	Limiting force FL/N where FL= (m +q)g
3.4**(0.5 marks)**	1.3**(0.5 marks)**
3.9**(0.5 marks)**	1.5**(0.5 marks)**
4.4**(0.5 marks)**	1.7**(0.5 marks)**
4.9**(0.5 marks)**	1.9**(0.5 marks)**
5.4**(0.5 marks)**	2.1**(0.5 marks)**
5.9**(0.5 marks)**	2.2**(0.5 marks)**

b) Graph:

Labelled axes   0.5 marks x2 =**1 mark**

Uniform scales **0.5 marks x2= 1 mark**

Plotted points **0.5 marksx6=3 marks**

Best fit line **:1 mark**

Graph of F_L against R

c)i) slope s=$\frac{\Delta F_L}{\Delta R}$ **(1mark)**

s=$\frac{2.55-0}{6.5-0}$ = 0.39   **(1mark)**

ii)Coefficient of friction **(1mark)** because $F_L = \mu R$ **(1 mark)**

d)i) **Precautions**

The table-top should be horizontal. **(1 mark)**

The thread between block and pulley should be horizontal.

The pan should not oscillate or rotate and the weight should be added in

small quantities.

Tap the table top gently.

The frictionless pulley should be used.

ii)Friction between the feet and road reduces when there is a thin layer of

rainwater between them**(1mark)**. So the roads become slippery after
rains.

e) **Advantages**

Ability to walk **(1mark),** ability to sit, ability to grasp objects

Tied shoe laces, eyeglasses used; tied belts, wearing baseball caps,

Wearing a wedding ring, erasing a board, Stop a car etc.

Disadvantages

Friction causes wear and tear on machines and engine parts as they rub

each other**. (1mark)**

It reduces the efficiency of a machine. It reduces motion.

It causes the heating of engines. Friction makes work tedious

Friction produces heat that causes objects to wear out.