

PHYSICS
Date: 29 /06 /2022
Period: 8:30 am-11:30 am



END OF TERM III EXAMINATIONS

GRADE : S 1
COMBINATION : O'LEVEL

DURATION: 3 HOURS

MARKS:

..... / 100

INSTRUCTIONS

This paper is composed of two Sections **A** and **B**

Section A: Attempt all 15 questions **(60 marks)**

Section B: Attempt all 5 questions **(40 marks)**

SECTION A: ATTEMPT ALL QUESTIONS (60 MARKS)

1) State

- a) One phenomena that proves the rectilinear propagation of light **(1mark)**
- b) One luminous object **(1mark)**
- c) One law of reflection of light **(1mark)**

2) Identify the choice that best answers the question

a) Choose the best definition of the term force

(i) A force is any cause that can change the shape of an object, or can change the state of motion of an object.

(ii) A force is energy that can change the shape of an object, or can change the state of motion of an object.

(iii) A force is any cause that can change the velocity of an object but cannot change the shape of an object.

(iv) A force is any cause that can change the shape of an object but cannot change the velocity of an object.

(1mark)

b) What is the true statement among the following?

(i) The weight is the mass of an abject.

(ii) The weight is any force acting on an object.

(iii) The weight is the force of the gravity on an object.

(iv) The weight is any vector quantity

(1mark)

c) Which of the following forces is a contact force?

(i) Gravitational force

(ii) Friction force

(iii) Electric force

(iv) Magnetic force

(1 mark)

d) Two objects repel each other. This repulsion could be due to

- (i) frictional force only
- (ii) electrostatic force only
- (iii) magnetic force only
- (iv) either a magnetic or an electrostatic force

(1 mark)

3) List

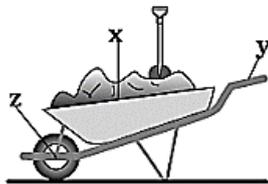
a) Any two forms of energy.

(2 marks)

b) Any two sources of energy.

(2 marks)

4) Observe the following parts of wheelbarrow. It may be considered as simple machine.



a) Name the parts X, Y and Z of the simple machine shown above.

(3 marks)

b) What type of simple machine is this simple machine?

(1 mark)

5) a) Name any two states of matter.

(2 marks)

b) Define the following terms

(i) Malleability

(1 mark)

(ii) Melting point

(1 mark)

6) Use true or false to answer the following sub questions

a) Magnet is any material that produces a magnetic field.

(1 mark)

- b) Unlike magnetic poles attract **(1 mark)**
- c) Copper is a magnetic material **(1 mark)**
- d) Cobalt is a non-magnetic material **(1 mark)**

- 7)** a) Describe the right way to mix water and acid. **(1 mark)**
- b) Explain the main purpose of wearing goggles and other eye protection devices. **(1 mark)**
- c) What should you do after working with biological specimens, chemicals and lab substances? **(1 mark)**
- d) Observe the following laboratory safety symbol.



What can you do if you have to use the chemical having such symbol?

(1 mark)

- 8)** Differentiate between the following
- a) Distance and the displacement. **(2 marks)**
 - b) Velocity and acceleration **(2 marks)**
- 9)** a) Why it is not possible to push a car from inside? **(1 mark)**
- b) Can a single isolated force exist in nature? Explain your answer. **(2 marks)**
- c) What causes the weight that each student feels? **(1 mark)**
- d) Why does acceleration due to gravity vary from place to place on the Earth? **(1 mark)**

10) Explain any two states of static equilibrium. **(4 marks)**

11) a) Two satellites in space, each with a mass of 1723 kg, are 890 m apart from each other. $G=6.67 \times 10^{-11} \text{ m}^3/\text{kg s}^2$

What is the force of gravity between them? **(2 marks)**

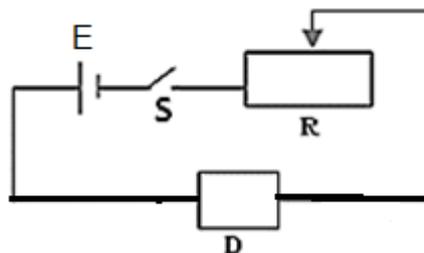
b) What is the mass of an object that requires a force of 90 N to accelerate at a rate of 2.6 m/s^2 ? **(2 marks)**

12) a) A body of mass 12 kg is moved through a distance of 150 m from the ground to the top of a house. Acceleration due to gravity $g=9.8 \text{ m/s}^2$

Calculate the potential energy of the body. **(2 marks)**

b) Determine the mass of an object which has 2400 J of kinetic energy when travelling at 8 m/s . **(2 marks)**

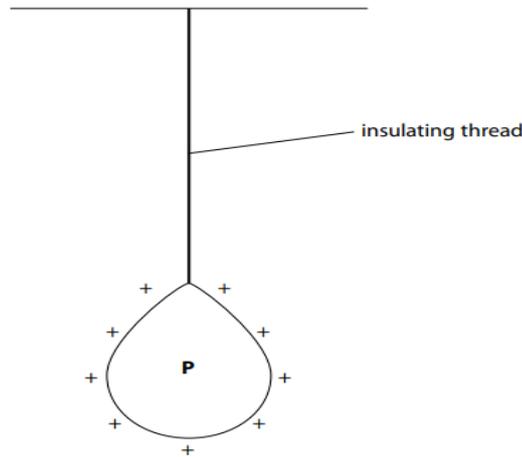
13) a) Copy the diagram and complete the circuit to show how you would connect a voltmeter to measure the potential difference across resistor D and ammeter to measure the current through D **(2 marks)**



b) Why are components R and S used in the above electric circuit?

(2 marks)

14) a) Balloon P hangs from an insulating thread. A teacher gives the balloon a positive electric charge, as shown in figure below

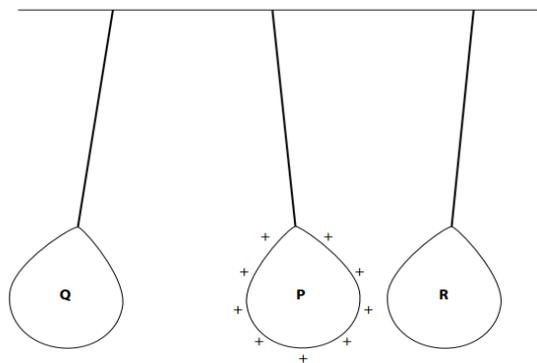


(i) Identify the method used by the teacher to charge the balloon P

(1 mark)

(ii) Why do positive electric charges appear on the balloon P? **(1 mark)**

b) Two more balloons, Q and R, are charged and placed either side of balloon P. The balloons move to the positions shown in the figure below. Add the charges on balloons Q and R in figure



(2 marks)

15) a) Draw a diverging beam of light.

(1 mark)

b) (i) Calculate the height of the image formed by a pinhole camera of length 12 cm used to photograph an object 60 cm away from the hole and 70 cm high.

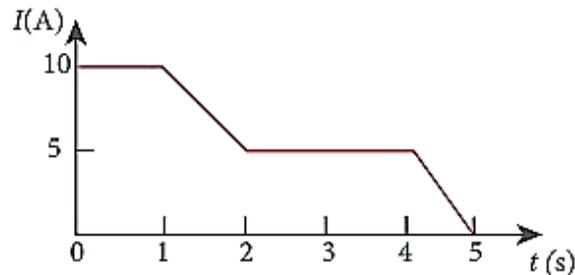
(2 marks)

(ii) State any one property of the image formed by this pinhole camera.

(1 mark)

SECTION B: ATTEMPT ALL QUESTIONS (40 MARKS)

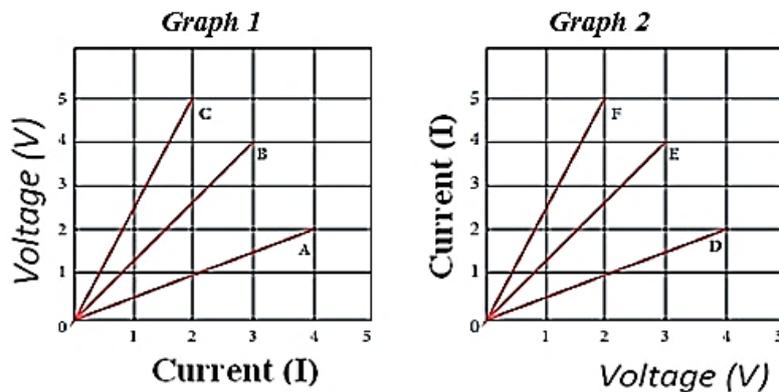
16) a) The current through an element is shown in the figure below.



Determine the total charge that pass through the element at

(i) $t = 0$ s, (ii) $t = 2$ s **(3 marks)**

b) The following graphs represent the current versus voltage and voltage versus current for the six conductors A, B, C, D, E and F.



Find the resistances of given conductors.

Which conductor has least resistance and which has maximum resistance ? **(7 marks)**

17) Plan an experiment that you would perform to determine the volume of an irregular stone.

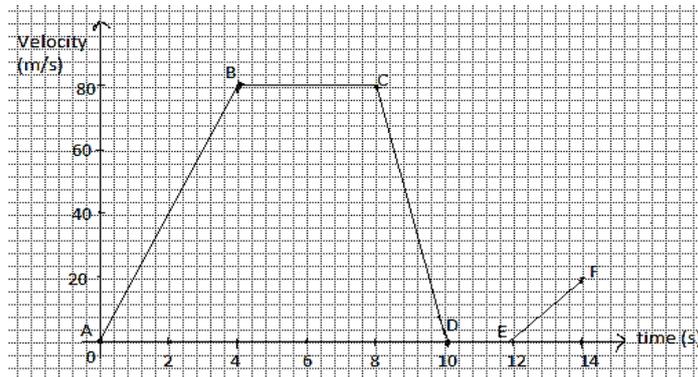
Your plan should include the materials to be used and the procedures to be followed. **(7 marks)**

18) The time-honoured mercury thermometer is being phased out

a) Why are mercury thermometers being replaced? **(2 marks)**

b) Propose other alternatives to mercury thermometer **(2 marks)**

19) Study the following distance-time graph for a motorist and answer the questions below.



a) What type of motion does each of the following sections of the graph represent? For each section explain your answer.

(i) Section AB **(2 marks)**

(ii) Section BC **(2 marks)**

(iii) Section CD **(2 marks)**

(iv) Section DE **(2 marks)**

(v) Section EF **(2 marks)**

(b) Use the data from the graph to find the distance travelled by the motorcyclist from B to C. **(2 marks)**

20) a) Two point positive charges $Q = 8 \mu\text{C}$ and $Q' = 5 \mu\text{C}$ are separated by a distance $r = 10 \text{ cm}$.

(i) What is the magnitude of the electrostatic force between the two charges? The constant $k = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ **(2 marks)**

(ii) Is this electrostatic force attractive or repulsive?

Explain. **(2 marks)**

- b) Find the magnitude and direction of an electric field that exerts
a 4.80×10^{-17} N westward force on an electron.

Charge of electron $e = -1.6 \times 10^{-19}$ C

(3 marks)

End

END OF TERM III EXAMINATIONS 2021- 2022

S1 PHYSICS

MARKING SCHEME

SECTION A

1) a) Formation of shadow **(1mark)** eclipses

b) Sun **(1mark)** torch, other stars fireflies, burning candles, electric bulbs etc.

c) The incident ray, reflected ray and the normal line at the point of incidence all lie in the same plane. **(1mark)**

The angle of incidence is equal to the angle of reflection.

2) a) (i) **(1mark)** A force is any cause that can **change the shape** of an object, or can change the **state of motion** of an object.

a) (iii) **(1mark)** The weight is the force of the gravity on an object.

b) (ii) **(1mark)** Friction force

c) (iv) **(1mark)** either a magnetic or an electrostatic force

3) a) Potential energy **(1mark)**, kinetic energy **(1mark)** heat energy, light energy, chemical energy, mechanical energy etc.

b) Solar energy **(1mark)** geothermal energy **(1mark)**, hydroelectric energy, wind energy etc.

4) a) X is load **(1mark)** Y is effort **(1mark)** z is pivot **(1mark)**

b) Lever **(1mark)** second class lever

5) a) Solid state **(1 mark)**, liquid state **(1 mark)** and gas state

b)(i) It is a physical property of metals by which they can be hammered, shaped and rolled into a very thin sheet without rupturing. **(1mark)**

(ii) Melting point is the constant temperature at which a substance in solid state changes into the liquid state **(1mark)** or

The **melting point** of a substance is the temperature at which a

solid and liquid phase may coexist in equilibrium

6) a) True (1mark) b) True (1mark) c) False (1mark) d) False (1mark)

7) a) Slowly add acid into the water while stirring the solution(1mark)

b) To prevent glassware, heat, or chemicals from coming in contact with your eyes(1mark)

c) Wash hands with water and soap (1mark)

d) Chemicals labelled as flammable have the tendency to ignite and should be stored accordingly.

Keep the chemicals away from flames, sparks, and oxidizing substances (1mark)

8) a)

Differentiating Property	Distance	Displacement
Definition	The complete length of the path between any two points is called distance(1 mark).	Displacement is the direct length between any two points when measured along the minimum path between them(1mark).
Quantity	Distance is a scalar quantity as it only depends upon the magnitude and not the direction.	Displacement is a vector quantity as it depends upon both magnitude and direction.

b) Velocity is the rate of change of displacement (1mark).

Acceleration is the rate of change of velocity (1mark).

9)a)(i) When you push a car from inside, the reaction force of your pushing is balanced out by your body moving backward.(1mark)

(ii) The seat behind you pushes against to bring things to static equilibrium.

b)No,(1mark) a single isolated force cannot exist in nature because it violates the Newton's third law(1mark).

c) Gravitational attraction by the Earth (1mark)

d) The variation in gravitational acceleration at different locations on Earth

is caused by the distance between the centres of mass of two objects **(1mark)** $g = GM_T/r^2$

10) a) Stable equilibrium (1mark).

A body is said to be in stable equilibrium if after a slight tilt it returns to its previous position **(1mark)**

b) Unstable equilibrium **(1mark)**. If a body does not return to its previous position when set free after the slightest tilt is said to be in unstable equilibrium **(1 mark)**

Neutral equilibrium. If a body remains in its new position when disturbed from its previous position, it is said to be in a state of neutral equilibrium.

11) a) Newton's law of universal gravitation

$$\begin{aligned} F &= Gm_1m_2/r^2 \quad \mathbf{(1mark)} \\ &= (6.67 \times 10^{-11} \times 1723 \times 1723 / 890^2) \text{N} \\ &= 2.5 \times 10^{-10} \text{N} \quad \mathbf{(1mark)} \end{aligned}$$

b) The mass $m = F/a$ **(1mark)**

$$= 90 \text{ kg} / 2.6 = 34.6 \text{ kg} \quad \mathbf{(1mark)}$$

12) a) The potential energy $PE = mgh$ (1 mark)

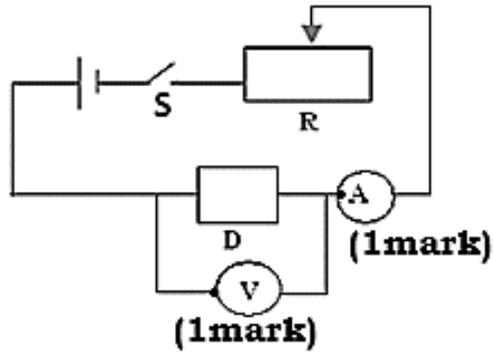
$$\begin{aligned} &= 12 \times 9.8 \times 150 \text{ J} \\ &= 17\,640 \text{ J} \quad \mathbf{(1 mark)} \end{aligned}$$

b) The kinetic energy $KE = \frac{1}{2}mv^2$ **(1mark)**

$$\text{implies } m = \frac{2KE}{v^2}$$

$$\text{Then, } m = \frac{2 \times 2400}{8^2} = \frac{4800}{64} = 75 \text{ kg} \quad \mathbf{(1 mark)}$$

13) a) Connecting ammeter and voltmeter



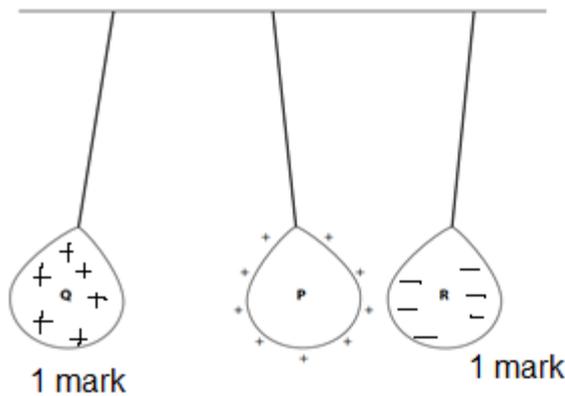
b) R is Rheostat used to vary the amperage. **(1mark)**

S is Switch used to open or close the electrical circuit **(1mark)**

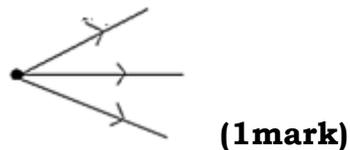
14) a)(i)Charging by induction (1mark) rubbing/friction or by contact

(ii)Loss of electrons during charging (1mark)

b)



15) a)(i)Diverging beam



b)(i)The height $P'/P=i/o$ **(1 mark)**

$$i=12 \text{ cm} \times 70/60 = 14 \text{ cm} \text{ (1mark)}$$

(ii)Inverted image (1mark) Smaller than the object and real

SECTION B

16) a) (i) Electric charge $Q = It$ **(1 mark)**

$$= 10 \times 0 = 0C \quad \textbf{(1 mark)}$$

(ii) $Q = 5 \times 2C = 10 C$ **(1 mark)**

(b) In graph 1

Resistance is given by the slope.

$$\text{Slope A i.e } R_A = \frac{\Delta V}{\Delta I} \textbf{(1 mark)}$$

$$= \frac{2}{4} = 0.5\Omega \textbf{(0.5 marks)}$$

$$\text{Slope B i.e } R_B = \frac{\Delta V}{\Delta I} = \frac{4}{3} = 1.33\Omega \textbf{(0.5 marks)}$$

$$\text{Slope C i.e } R_C = \frac{\Delta V}{\Delta I} = \frac{5}{2} = 2.5\Omega \textbf{(0.5 marks)}$$

➤ In graph 2

Resistance is given by the reciprocal of the slope.

$$R_D = \left(\frac{1}{\text{Slope of D}} \right) \textbf{(1 mark)}$$

$$= \frac{4}{2} = 2\Omega \quad \textbf{(0.5 marks)}$$

$$R_E = \left(\frac{1}{\text{Slope of E}} \right) = \frac{3}{4} = 0.75\Omega \textbf{(0.5 marks)}$$

$$R_F = \left(\frac{1}{\text{Slope of F}} \right) = \frac{2}{5} = 0.4\Omega \textbf{(0.5 marks)}$$

Least is $R_F = 0.4\Omega$ **(1 mark)**

Maximum is $R_C = 2.5\Omega$ **(1 mark)**

17) Determination of volume of an irregularly shaped stone

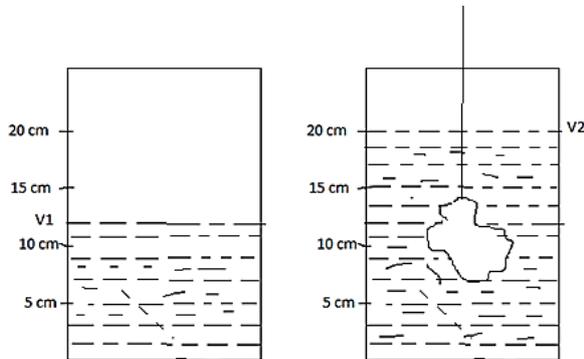
Materials required:

Light thread, irregular stone, water, measuring cylinder **(2 marks)**

Procedure:

-Fill a measuring cylinder with water and record the initial volume of the water V_1 . (1mark)

Carefully lower the stone into the water in the measuring cylinder (as shown in figure). (1mark)



-Record the new volume of the water V_2 . (1mark)

-Find the volume of the water displaced,

$(V_2 - V_1)$. (1mark)

-The volume of the displaced water = volume of the stone. (1mark)

18)

a)Mercury is toxic (1mark)therefore it is a danger for human beings and environment (1mark)

The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal

b) Alcohol thermometer (1mark)

Digital thermometers (1mark) Spirit thermometers, traceable Printing thermometers -Channel Thermometers etc.

19) a) (i) Section AB: Uniformly accelerated rectilinear motion (1mark)

Velocity/speed increases (1mark) from 0 to 80 m/s

(ii)Section BC: Uniform rectilinear motion (1mark)

Velocity /speed remains constant (1mark) $v=80$ m/s

(iii)Section CD: Uniformly decelerated rectilinear motion (1mark)

Velocity/speed decreases **(1mark)** from 0 to 80 m/s

(iv)Section DE: The motorist is at rest **(1mark)**.

The velocity /speed is 0 m/s.**(1mark)**

(v)Section EF : Uniformly accelerated rectilinear motion **(1mark)**

Velocity/speed increases **(1mark)** from 0 to 20 m/s

b)Travelled distance $X=Vt$ **(1mark)**

$$80 \text{ m/s} (8 \text{ s}-4\text{s})= 320 \text{ m}(\mathbf{1mark})$$

20) a) (i)The electrostatic force between

$$F = k \frac{QQ'}{d^2} \quad (\mathbf{1mark})$$

$$F = 9 \times 10^9 \times \frac{8 \times 10^{-6} \times 5 \times 10^{-6}}{(10 \times 10^{-2})^2} = 3.60 \times 10^{-8} \text{ N} \quad (\mathbf{1mark})$$

(ii) Repulsive **(1mark)** because the two charges are positive **(1mark)**

b)The magnitude of the electric field $E = \frac{F}{|Q|}$ **(1mark)**

$$E = \frac{4.80 \times 10^{-17}}{|-1.6 \times 10^{-19}|} \text{ N/C} = 300 \text{ N/C} \quad (\mathbf{1mark})$$

Direction: Eastwards **(1mark)** because the electric charge is negative

End.

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SECTION A: ATTEMPT ALL QUESTIONS (60 MARKS)

1) State

- a) One phenomena that proves the rectilinear propagation of light **(1 mark)**
- b) One luminous object **(1 mark)**
- c) One law of reflection of light **(1mark)**

2) Identify the choice that best answers the question

a) Choose the best definition of the term force.

(i) A force is any cause that can change the shape of an object, or can change the state of motion of an object.

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(1mark)

b) What is the true statement among the following?

(i) The weight is the mass of an abject.

(ii) The weight is any force acting on an object.

(iii) The weight is the force of the gravity on an object.

(iv) The weight is any vector quantity.

(1mark)

c) Which of the following forces is a contact force?

(i) Gravitational force

(ii) Friction force

(iii) Electric force

(iv) Magnetic force

(1mark)

d) Two objects repel each other. This repulsion could be due to

- (i) frictional force only
- (ii) electrostatic force only
- (iii) magnetic force only
- (iv) either a magnetic or an electrostatic force

(1 mark)

3) List

a) Any two forms of energy.

(2 marks)

b) Any two sources of energy.

(2 marks)

4) a) What simple machine would stairs be an example?

(1mark)

b) Give two examples of wedge

(2 marks)

c) What type of lever is a wheelbarrow?

(1 mark)

5) a) Name any two states of matter.

(2 marks)

b) Define the following terms

(i) Malleability

(1 mark)

(ii) Melting point

(1 mark)

6) Use true or false to answer the following sub questions

a) Magnet is any material that produces a magnetic field.

(1mark)

b) Unlike magnetic poles attract

(1mark)

c) Copper is a magnetic material

(1mark)

d) Cobalt is a non-magnetic material

(1mark)

7) a) Why force is called derived physical quantity?

(2 marks)

b) Copy and complete the following table

Physical quantity	Symbol of S I unit	Measuring instrument
		Vernier caliper
	V	

(2 marks)

8) Differentiate between the following

a) Distance and displacement. **(2 marks)**

b) Velocity and acceleration. **(2 marks)**

9) a) Why it is not possible to push a car from inside? **(1 mark)**

b) Can a single isolated force exist in nature? Explain your answer.

(2 marks)

c) What causes the weight that each student feels? **(1 mark)**

d) Why does acceleration due to gravity vary from place to place on the Earth?

(1 mark)

10) Explain any two states of static equilibrium. **(4 marks)**

11) a) Two satellites in space, each with a mass of 1723 kg, are 890 m apart from each other. $G=6.67 \times 10^{-11} \text{m}^3/\text{kg s}^2$

What is the force of gravity between them? **(2 marks)**

b) What is the mass of an object that requires a force of 90 N to accelerate at a rate of 2.6 m/s^2 ? **(2 marks)**

12) a) A body of mass 12 kg is moved through a distance of 150 m from the ground to the top of a house. Acceleration due to gravity $g=9.8 \text{ m/s}^2$

Calculate the potential energy of the body. **(2 marks)**

b) Determine the mass of an object which has 2400 J of kinetic energy when travelling at 8 m/s. **(2 marks)**

13) a) How are the following measuring instruments connected in the

electric circuit?

(i) Voltmeter **(1 mark)**

(ii) Ammeter **(1 mark)**

b) What is the importance of the following components of an electric circuit?

(i) Switch **(1 mark)**

(ii) Dry cell **(1 mark)**

14) Two light charged balls are suspended on nylon threads and then released. Immediately the balls come to rest with the threads making equal angles with the vertical.

a) What can you say about the charges on the balls?

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

b) What would happen to the balls if somebody touches one of the balls? **(2 marks)**

15) a) What kind of beam of light is formed by flash light of a torch? **(1 mark)**

b) (i) Calculate the height of the image formed by a pinhole camera of length 12cm used to photograph an object 60cm away from the hole and 70cm high. **(2 marks)**

(ii) State any one property of the image formed by this pinhole camera. **(1 mark)**

SECTION B: ATTEMPT ALL QUESTIONS (40 MARKS)

16) a) Whenever you work with power tools or on electrical circuits, there is a risk of electrical hazards. Anyone can be exposed to these hazards at home or at work.

(i) Propose any two electrical hazards. **(2 marks)**

(ii) What can people do to avoid electrical hazards? **(2 marks)**

b) A steady current of 4A flows for 5 seconds.

Find the total charge passing any point in the circuit. **(2 marks)**

c) A 3 kW immersion heater is used to heat water.

Calculate the electrical energy converted into heat energy in 40 minutes. **(2 marks)**

d) If 750 μA electric current is flowing through 11 k Ω resistor, what is the voltage drop across the resistor? **(2 marks)**

17) Plan an experiment that someone else would perform to determine the volume of an irregular stone.

Your plan should include the materials to be used and the procedures to be followed. **(7 marks)**

18) The time-honoured mercury thermometer is being phased out

a) Why are mercury thermometers being replaced? **(2 marks)**

b) Propose other alternatives to mercury thermometer **(2 marks)**

19) a) An object travels a distance $X = 2t + 4$ along a straight line in time t where t is measured in seconds, x in meters.

Analyse the given equation to answer related questions

(i) What is the type of this motion? **(1 mark)**

(ii) Identify the initial position of the object **(1 mark)**

(iii) Find its speed **(1 mark)**

(iv) Determine the position of the object at $t = 40$ s **(1 mark)**

b) The velocity time relation for an object moving along a straight line

is given by $v = 3t+5$ where v is in m/s and t in s

(i) Determine the acceleration of the object. **(1 mark)**

(ii) Find the initial speed **(1 mark)**

(iii) Calculate the travelled distance at a time $t=10$ s. **(2 marks)**

c) A race car accelerates uniformly from 18.5 m/s to 46.1 m/s in 2.47 seconds. Determine

(i) The acceleration of the car. **(2 marks)**

(ii) The distance travelled. **(2 marks)**

20) a) Two point positive charges $Q = 8 \mu\text{C}$ and $Q' = 5 \mu\text{C}$ are separated by a distance $r = 10$ cm.

(i) What is the magnitude of the electrostatic force between the two charges? The constant $k = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ **(2 marks)**

(ii) Is this electrostatic force attractive or repulsive? Explain. **(2 marks)**

b) Find the magnitude and direction of an electric field that exerts

a 4.80×10^{-17} N westward force on an electron.

Charge of electron $e = -1.6 \times 10^{-19} \text{C}$ **(3 marks)**

End

END OF TERM III EXAMINATIONS 2021- 2022

S1 PHYSICS FOR BLIND STUDENTS

MARKING SCHEME

SECTION A

- 1) a) Formation of shadow **(1mark)** eclipses
- b) Sun **(1mark)** torch, fireflies, burning candles, electric bulbs, other stars etc.
- c) The incident ray, reflected ray and the normal line at the point of incidence all lie in the same plane. **(1mark)**
- The angle of incidence is equal to the angle of reflection.
- 2) a) (i) **(1mark)** A force is any cause that can **change the shape** of an object, or can change the **state of motion** of an object.
- a) (iii) **(1mark)** The weight is the force of the gravity on an object.
- b) (ii) **(1mark)** Friction force
- c) (iv) **(1mark)** either a magnetic or an electrostatic force
- 3) a) potential energy **(1mark)**, kinetic energy **(1mark)** heat energy, light energy, chemical energy, mechanical energy etc.
- b) Solar energy **(1mark)** geothermal energy **(1mark)**, hydroelectric energy, wind energy etc.
- 4) a) Inclined plane **(1mark)**
- b) Shovel **(1mark)** pick axe **(1mark)** saw, axe, needle etc.
- c) A wheelbarrow is an example of a second class lever. **(1 mark)**
- 5) a) Solid state **(1 mark)**, liquid state **(1 mark)** and gas state
- b) (i) It is a physical property of metals by which they can be hammered, shaped and rolled into a very thin sheet without rupturing. **(1mark)**
- (ii) Melting point is the constant temperature at which a substance in solid state changes into the liquid state **(1mark)** or

The **melting point** of a substance is the temperature at which a solid and liquid phase may coexist in equilibrium

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

7)a) force is called derived unit because force can be expressed in terms of mass **(1mark)** and acceleration **(1mark)**. OR

Unit of force can be expressed as

kgm/s^2 which can be expressed in terms of fundamental quantities namely mass, length and time

b)

Physical quantity	S I unit	Measuring instrument
Length (0.5 marks)	m (0.5 marks)	Vernier caliper
Voltage (0.5 marks)	V	Voltmeter (0.5 marks)

8) a)

Differentiating Property	Distance	Displacement
Definition	The complete length of the path between any two points is called distance (1 mark) .	Displacement is the direct length between any two points when measured along the minimum path between them (1mark) .
Quantity	Distance is a scalar quantity as it only depends upon the magnitude and not the direction.	Displacement is a vector quantity as it depends upon both magnitude and direction.

b) Velocity is the rate of change of displacement **(1mark)**.

Acceleration is the rate of change of velocity **(1mark)**.

9)a)

(i) When you push a car from inside, the reaction force of your pushing is balanced out by your body moving backward.**(1mark)**

(ii) The seat behind you pushes against to bring things to static equilibrium.

b) No, **(1 mark)** a single isolated force cannot exist in nature because it violates Newton's third law **(1 mark)**.

c) Gravitational attraction by the Earth **(1 mark)**

d) The variation in gravitational acceleration at different locations on Earth is caused by the distance between the centres of mass of two objects **(1 mark)** $g = GM_T/r^2$

10) a) Stable equilibrium (1 mark).

A body is said to be in stable equilibrium if after a slight tilt it returns to its previous position **(1 mark)**

b) Unstable equilibrium **(1 mark)**. If a body does not return to its previous position when set free after the slightest tilt is said to be in unstable equilibrium **(1 mark)**

Neutral equilibrium. If a body remains in its new position when disturbed from its previous position, it is said to be in a state of neutral equilibrium.

11) a) Newton's law of universal gravitation

$$\begin{aligned} F &= Gm_1m_2/r^2 \quad \mathbf{(1\ mark)} \\ &= (6.67 \times 10^{-11} \times 1723 \times 1723 / 890^2) \text{ N} \\ &= 2.5 \times 10^{-10} \text{ N} \quad \mathbf{(1\ mark)} \end{aligned}$$

b) The mass $m = F/a$ **(1 mark)**

$$= 90 \text{ kg} / 2.6 = 34.6 \text{ kg} \quad \mathbf{(1\ mark)}$$

12) a) The potential energy $PE = mgh$ (1 mark)

$$\begin{aligned} &= 12 \times 9.8 \times 150 \text{ J} \\ &= 17\,640 \text{ J} \quad \mathbf{(1\ mark)} \end{aligned}$$

b) The kinetic energy $KE = \frac{1}{2}mv^2$ **(1 mark)**

$$\text{implies } m = \frac{2KE}{v^2}$$

$$\text{Then, } m = \frac{2 \times 2400}{8^2} = \frac{4800}{64} = 75 \text{ kg (1 mark)}$$

- 13) a) (i)** An ammeter is connected in series with a device to measure the electric current flowing through it. **(1 mark)**
- (ii)** A voltmeter is connected in parallel with a device to measure the voltage across it **(1 mark)**
- b) (i)** The purpose of a switch in a series circuit is to make it easy to open or close the electrical circuit, turning the flow of electricity on or off **(1 mark)**
- (ii)** Dry cell is the source of electrical energy that allows electrons to move **(1 mark)**
- 14) a)** The charges of the same sign (positive or negative) and the same amount of charges. **(1 mark)** because the balls repel each other **(1 mark)**
- b)** If somebody touches one of the balls, it becomes discharged **(1 mark)** and the force of repulsion between the balls disappears and we observe the attraction between the balls charged and non-charged ball **(1 mark)**.
- NB. An object positively or negatively charged attracts a neutral object because the latter becomes negatively charged by induction (if the object is positively charged) or positively charged (if the object is negatively charged).
- 15) a) (i)** Diverging / divergent beam **(1 mark)**
- b) (i)** The height $P'/P = i/o$ **(1 mark)**
- $$i = 12 \text{ cm} \times 70/60 = 14 \text{ cm (1 mark)}$$
- (ii)** Inverted image **(1 mark)** Smaller than the object and real

SECTION B

16) a)(i) Electrical hazards can cause burns **(1mark)**, shocks **(1mark)**, and electrocutions.

(ii) Always be aware of where the breakers and fuse boxes are located**(1mark)**

Never use faulty equipment **(1mark)**

Never play with damaged electrical wires

Never operate electrical equipment while standing in water

When working with or close to electricity, be sure to wear the required PPE (personal protective equipment)and use wooden ladders or ones made from non-conductive material.

Check your cords often for fraying or damage and replace them if necessary.

(b) The charge is given by $Q=It$ **(1mark)**

$$=5 \times 4 \times 20 \text{ C } \textbf{(1mark)}$$

c) The electrical energy $E=Pt$ **(1mark)**

$$=3 \times 10^3 \times 40 \times 60 \text{ J} = 7.2 \times 10^6 \text{ J } \textbf{(1mark)}$$

d) Voltage drop $V=RI$ **(1mark)**

$$=11 \times 10^3 \times 75 \times 10^{-6} \text{ V} = 0.825 \text{ V } \textbf{(1mark)}$$

17) Determination of volume of an irregularly shaped stone

Materials required:

Light thread, irregular stone, water, measuring cylinder **(2marks)**

Procedure:

-Fill a measuring cylinder with water and record the initial volume of the water V_1 . **(1mark)**

Carefully lower the stone into the water in the measuring cylinder. **(1mark)**

-Record the new volume of the water V_2 . (1mark)

-Find the volume of the water displaced,

$(V_2 - V_1)$. (1mark)

-The volume of the displaced water = volume of the stone. (1mark)

18)

a)Mercury is toxic (1mark)therefore it is a danger for human beings and environment (1mark)

The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal

b) Alcohol thermometer (1mark)

Digital thermometers (1mark) Spirit thermometers, traceable Printing thermometers -Channel Thermometers etc.

19) a) The distance time relation $X = 2t + 4$

(i)The motion is uniform rectilinear motion (1mark) because the

$X = 2t + 4$ is an equation of straight line $X = v_0 t + X_0$

(ii)Initial position $X_0 = 4$ m (1mark)

(iii)Its speed $v_0 = 2$ m/s (1mark)

(iv)The position at $t = 10$ s

$$X = (2 \times 10 + 4) \text{ m} = 24 \text{ m (1 mark)}$$

b)(i)Acceleration $a = 3$ m/s (1mark)

(ii) $v_0 = 5$ m/s (1mark)

(iii)Travelled distance $x = (a/2) t^2 + v_0 t$ (1mark)

$$= (3/2) \times 10^2 + 5 \times 10 = 250 \text{ m (1mark)}$$

c)(i)The acceleration $a = \frac{\Delta v}{\Delta t}$ (1mark)

$$a = \frac{46.1 - 18.5}{2.47} \text{ m/s}^2 = 11.2 \text{ m/s}^2 \text{ (1mark)}$$

(ii) Travelled distance $X = (a/2) t^2 + v_0 t$ **(1 mark)**

$$= (11.2 / 2) \times (2.47)^2 + 18.5 \times 2.47$$

$$= 79.855 \text{ m} \text{ **(1 mark)**}$$

20) a) (i) The electrostatic force between

$$F = k \frac{QQ'}{d^2} \text{ **(1 mark)**}$$

$$F = 9 \times 10^9 \times \frac{8 \times 10^{-6} \times 5 \times 10^{-6}}{(10 \times 10^{-2})^2} = 3.60 \times 10^{-8} \text{ N} \text{ **(1 mark)**}$$

(ii) Repulsive **(1 mark)** because the two charges are positive **(1 mark)**

b) The magnitude of the electric field $E = \frac{F}{|Q|}$ **(1 mark)**

$$E = \frac{4.80 \times 10^{-17}}{|-1.6 \times 10^{-19}|} \text{ N/C} = 300 \text{ N/C} \text{ **(1 mark)**}$$

Direction: Eastwards **(1 mark)** because the electric charge is negative

End