

535/2

**PHYSICS**

**Paper 2**

June / July 2023

**2 ¼ hours**

**ENTEBBE JOINT EXAMINATION BUREAU**

**Uganda Certificate of Education**

**PHYSICS**

**PAPER 2**

**2 hours 15 minutes**

**INSTRUCTIONS TO CANDIDATES**

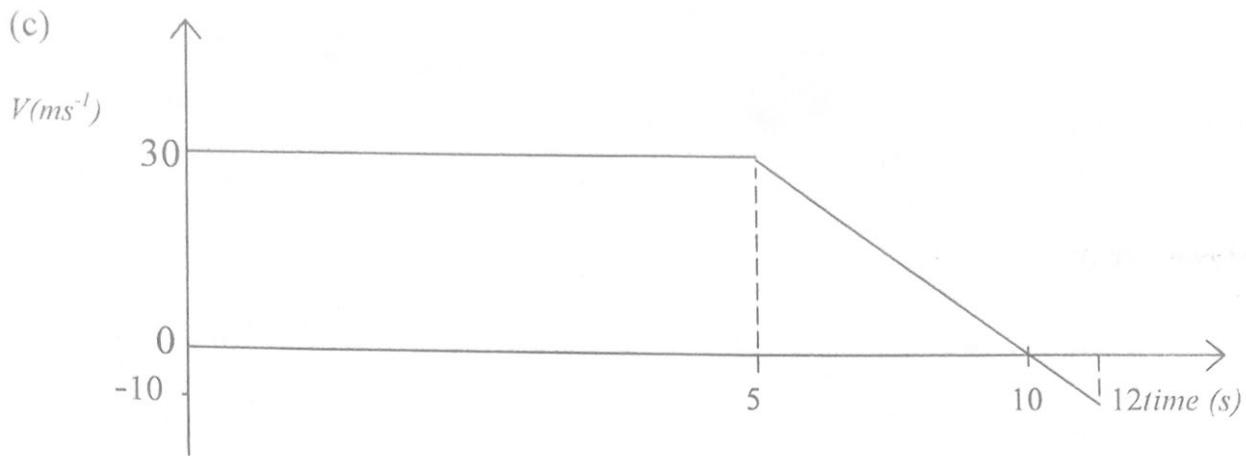
*Attempt any five questions.*

*Any extra question shall not be assessed*

**Where necessary assume the following:**

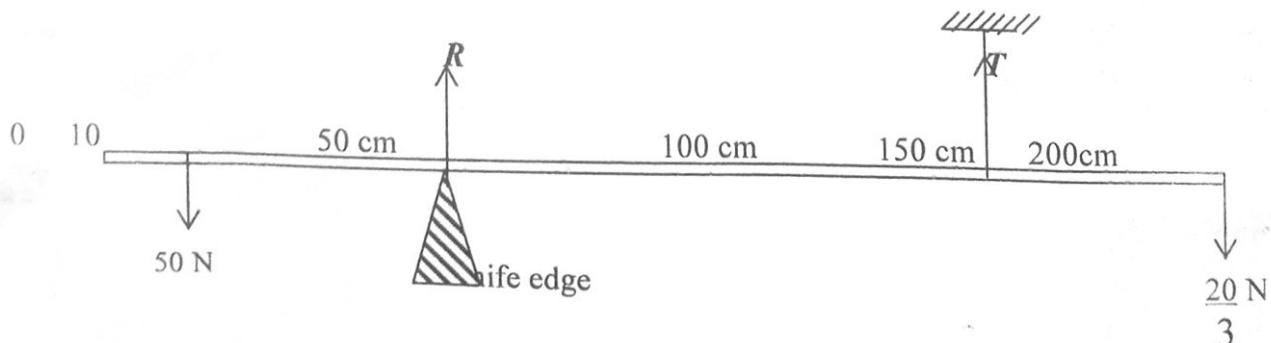
<i>Acceleration due to gravity</i>	=	$10ms^{-2}$
<i>Speed of sound in air</i>	=	$320ms^{-2}$
<i>Specific heat capacity of water</i>	=	$4200 Jkg^{-1} k^{-1}$
<i>Specific heat capacity of copper</i>	=	$400 Jkg^{-1} k^{-1}$
<i>Specific latent heat of fusion of water</i>	=	$340000JKg^{-1}$
<i>Speed of light in vacuum</i>	=	$3.0 \times 10^8 ms^{-1}$
<i>Density of water</i>	=	$1000kgm^{-3}$

1. (a) State the principle of linear conservation of momentum. (01 mark)
- (b) A trolley  $P$  of mass 150 g moving with a velocity of  $20 \text{ ms}^{-1}$  collides with another stationary trolley  $Q$  of mass 100 g. If  $P$  and  $Q$  move together after collision, calculate:
- (i) momentum of  $P$  before collision (03 marks)
- (ii) common velocity of  $P$  and  $Q$  after collision (03 marks)



The figure above represents a velocity – time graph for the motion of a car of mass 500kg. Find the

- (i) total distance it travelled (04 marks)
- (ii) time it takes to get back to the starting point if its velocity is kept constant (02 marks)
- (iii) momentum of the car just before deceleration (03 marks)
2. (a) State the principle of moments. (01 mark)
- (b) Describe an experiment to verify the principle of moments. (05 marks)
- (c) A uniform wooden beam of length 200 cm is supported on a knife edge by action of forces and a string as shown in the figure below.



If the beam has a mass of 2kg, find the reaction  $R$  at the knife edge and the tension,  $T$  in the string. (05 marks)

- (d) A man of 70 kg stands in a lift which goes up at a uniform acceleration of  $2 \text{ ms}^{-2}$ .
- (i) Show on a sketch the vertical forces acting on the man. (03 marks)
- (ii) Calculate the apparent weight of the man. (02 marks)
3. (a) Describe a simple model of the atom. (04 marks)
- (b) Define the following:
- (i) **Atomic number** (01 mark)
- (ii) **Isotopes of an element** (01 mark)
- (c) State **two** differences between an  $\alpha$ - and  $\beta$ - particle. (02 marks)
- (d) (i) What is meant by the terms **nuclear fission** and **nuclear fusion**? (02 marks)
- (ii) State **one** example of where each one occurs. (02 marks)
- (e) (i) What is **radioactivity**? (01 mark)
- (ii) A radioactive sample of mass 60 g has half-life of 8 minutes. Determine the mass that will disintegrate in 40 minutes. (03 marks)
4. (a) (i) Distinguish between **echoes** and **reverberations**. (02 marks)
- (ii) State **two** practical applications of echo - sounding under water. (01 mark)
- (b) Describe an experiment to show that sound cannot travel in a vacuum. (06 marks)
- (c) Explain why the moon is sometimes referred to as "a silent satellite." (02 marks)
- (d) A student stands between two cliffs which are 825 metres apart. He makes a sharp sound once and hears the first echo after 2 seconds. After how long will he hear the second echo? (04 marks)
5. (a) Define the following terms.
- (i) **A volt** (01 mark)
- (ii) **An ohm** (01 mark)

- (b) (i) State **Ohm's law**. (01 mark)
- (ii) With the aid of a diagram, describe how to determine internal resistance of a cell. (05 marks)
- (c) What is meant by **kilowatt hour**? (01 mark)
- (d) A water heater is labeled 3kW, 240V.
- (i) What is meant by the label? (02 marks)
- (ii) Calculate the cost of using the heater for 2 hours each day for a week if each unit costs Shs 500. (04 marks)
6. (a) With the aid of a diagram, explain briefly how a pure spectrum may be produced. (06 marks)
- (b) (i) What are **primary colours**? Name them. (02 marks)
- (ii) Explain briefly what happens when white light falls on a green body. (02 marks)
- (c) With the aid of a well labeled diagram, describe how a lens camera works. (06 marks)
7. (a) (i) Distinguish between **heat capacity** and **specific heat capacity** of a substance and state units of each. (03 marks)
- (ii) Describe an experiment to determine specific heat capacity of a liquid by the method of mixtures. (05 marks)
- (b) (i) What is meant by **specific latent heat of fusion of ice**? (01 mark)
- (ii) In an experiment to determine specific latent heat of fusion of ice, 500 g of water was put into a lagged calorimeter of heat capacity  $40\text{JKg}^{-1}$ . 80g of ice at  $0^{\circ}\text{C}$  was added to the water at  $40^{\circ}\text{C}$ . Find the final temperature of the mixture after all the ice had melted. (06 marks)
- (c) Why is salt used as an anti-freezer? (01 mark)
8. (a) Explain why electric power is transmitted at high voltage? (02 marks)
- (b) Explain why a transformer cannot work with d.c. (02 marks)
- (c) With the aid of a diagram, describe the action of a simple d.c. motor. (06marks)
- (d) (i) State **the law of electrostatics**. (01 mark)
- (ii) Explain how a lightning conductor works. (05 marks)

**PHYSICS**

Paper 2

July /Aug. 2023

2½ hours

**UGANDA TEACHERS' EDUCATION CONSULT (UTEC)****Uganda Certificate of Education****PHYSICS****Paper 2**

2 hours 15 minutes

**INSTRUCTIONS TO CANDIDATES:***Answer FIVE questions.**Any additional question(s) answered will not be marked**Mathematical tables, and silent non-programmable calculators may be used**Where necessary use the following constants;*

<i>Acceleration due to gravity, g</i>	=	$10ms^{-2}$
<i>Specific heat capacity of copper</i>	=	$400 Jkg^{-1}K^{-1}$
<i>Specific heat capacity of water</i>	=	$4200Jkg^{-1}K^{-1}$
<i>Specific latent heat of fusion of water</i>	=	$340,000 Jkg^{-1}$
<i>Speed of sound in air</i>	=	$330ms^{-1}$
<i>Density of water</i>	=	$1000 kgm^{-3}/ 1 gcm^{-3}$
<i>Speed of light in vacuum</i>	=	$3.0 \times 10^8 ms^{-1}$

**Turn Over**

1. (a) What is meant by the following terms:
- (i) Plumbline (01 mark)
  - (ii) Moment of a force (01 mark)
- (b) (i) State two conditions for a body to be in mechanical equilibrium. (02 marks)
- (ii) A uniform metre rule of mass 95g is balanced on a knife edge when a 5 g mass is hung at 10cm mark from one end. How far is the knife edge from the centre of the metre rule? (04 marks)
- (c) (i) Explain what happens to a metre rule balanced on finger tip when the centre of gravity is not exactly above the tip. (03 marks)
- (ii) With the aid of a labeled diagram, explain how the principle of moments is applied to the beam balance with two scale pans when measuring unknown mass. (5 marks)
2. (a) (i) Why do a thick glass crack when hot liquid is poured in it? (04 marks)
- (ii) A glass flask is fitted with a rubber bung and a length of glass tubing. The set up is placed in a vertical position with the end of the tube below the surfaces of water in a vessel as shown in figure 1 below. Explain what is observed when the flask is warmed. (04 marks)

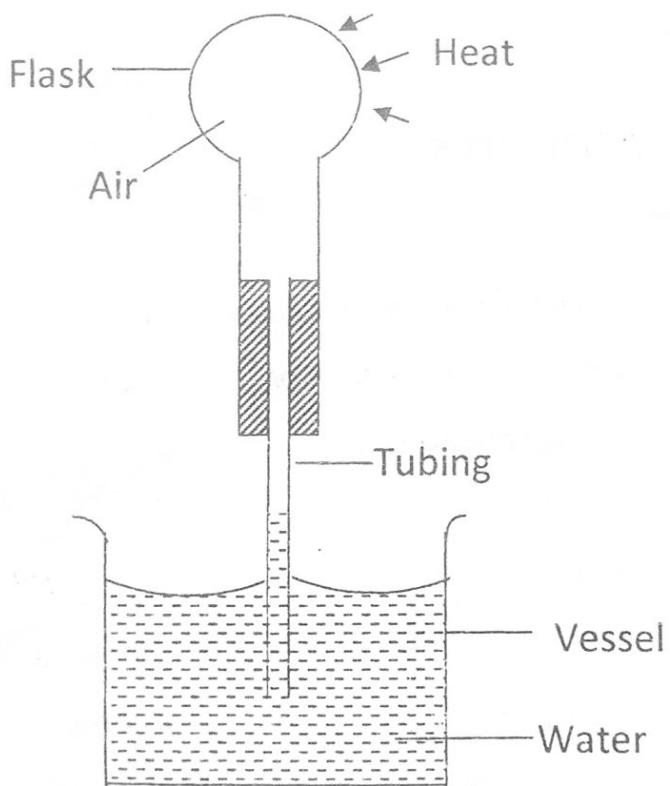


Fig. 1

- (b) (i) Explain what happens when a bimetallic strip is heated. (03 marks)
- (ii) Give two uses of bimetallic strips. (02 marks)
- (c) Air is trapped by a light frictionless piston in a cylinder of a uniform cross-sectional area. Air column of length 30.0cm at a pressure of 110 Pa is compressed by moving down a piston through a distance of 8.0cm. What is the new pressure in the cylinder if the temperature of air is kept constant? (03 marks)

3. (a) (i) Distinguish between energy and power. (02 marks)  
(ii) Describe the action of a four stroke engine. (06 marks)
- (b) A truck of total mass 15 tonnes moving at  $1\text{ms}^{-1}$  collides with a stationary truck of mass 10 tonnes. If the trucks are automatically connected so that they move off together. Find;  
(i) Their common velocity after collision. (03 marks)  
(ii) The kinetic energy lost during collision. (03 marks)
- (c) Give two sources of renewable energy. (02 marks)
4. (a) (i) Define the term power of a lens. (01 mark)  
(ii) Describe an experiment to determine the focal length of a converging lens using an illuminated object and plane mirror. (04 marks)
- (b) A small object is placed 6cm away from a diverging lens of focal length 10cm. By means of a drawn scale diagram, find:  
(i) the nature of the image.  
(ii) the position of the image. (05 marks)
- (c) Give three similarities between a lens camera and a human eye. (03 marks)
- (d) During the production of a pure spectrum:  
(i) Why is an illuminated slit placed at the principal focus of the converging lens? (01 mark)  
(ii) What is the significance of the prism? (02 marks)
5. (a) (i) Give four properties of electromagnetic waves. (02 marks)  
(ii) Explain why ultra sonics are used in echo sounders. (03 marks)
- (b) Briefly explain how surgical instruments can be cleaned using ultra sound. (03 marks)
- (c) (i) By including the term frequency, distinguish between music and noise. (02 marks)  
(ii) Describe an experiment to show that sound waves require a material medium for their transmission. (04 marks)
- (d) Figure 2. Shows a stationary wave formed in a closed tube of length 30cm. Find the wave length of this wave. (02 marks)

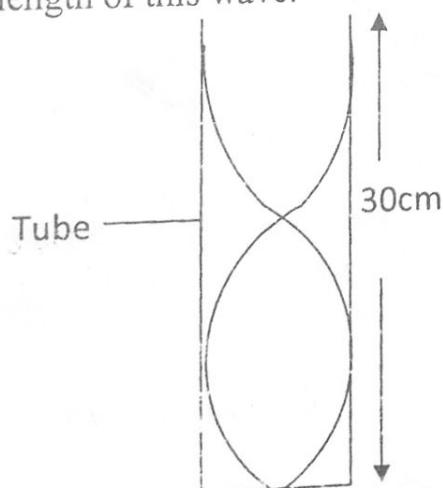


Fig.2

6. (a) (i) State two defects of a simple cell. (02 marks)  
(ii) Describe the action of a simple cell. (05 marks)
- (b) Briefly explain the production of geothermal electricity. (03 marks)

- (c) Why is it dangerous to connect a piece of copper wire across the terminals of a 2V lead acid cell which has an internal resistance of  $0.01\ \Omega$ ? (03 marks)
- (d) Draw the electric circuit symbols for;  
 (i) standard resistor  
 (ii) switch  
 (iii) cell (03 marks)
7. (a) (i) State two uses of tracers. (02 marks)  
 (ii) A radioactive source is brought near the cap of a positively charged electroscope as shown in figure 3 below. The leaf divergence reduces. Explain the cause for this observation. (04 marks)

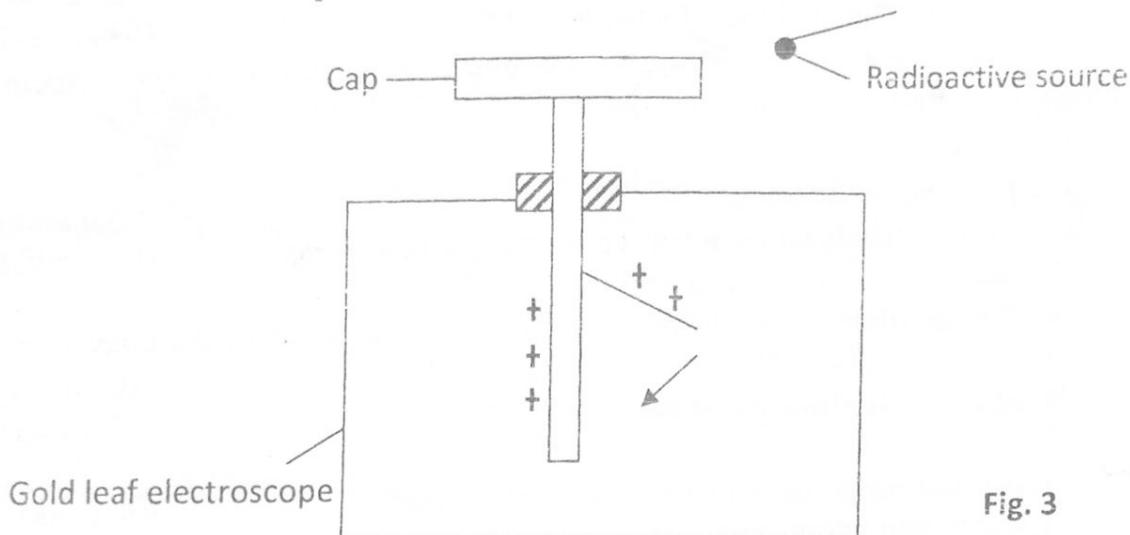


Fig. 3

- (b) Carbon,  $^{14}_6C$  undergoes a beta decay and turns into element N. Write a balanced nuclear equation for the decay. (02 marks)
- (c) What changes occur in atomic number and mass number of a radioactive atom if the nucleus emits.  
 (i) alpha particle (02 marks)  
 (ii) gamma rays (02 marks)
- (d) Briefly explain the production of cathode rays in a cathode ray tube. (04 marks)
8. (a) (i) Define the term neutral point. (01 mark)  
 (ii) Explain the term demagnetization using the domain theory. (03 marks)
- (b) (i) Draw the magnetic flux due to a solenoid. (02 marks)  
 (ii) A step up transformer is designed to operate from a 20 V supply and delivers energy at 250 V. If the transformer is 90% efficient, determine the current in its primary winding when the output terminals are connected to a 250 V, 100 W lamp. (04 marks)
- (c) (i) With the aid of a well labeled diagram, describe the operation of a bicycle dynamo. (04 marks)  
 (ii) State two factors that increase the power of the dynamo. (02 marks)

END

Name: .....Centre/Index No:...../.....

Signature: .....School .....

**535/1**

**PHYSICS**

Paper 1

July / Aug. 2023

2 hours 15 minutes



**UGANDA TEACHERS' EDUCATION CONSULT (UTEC)**

Uganda Certificate of Education

**PHYSICS**

Paper 1

**2 hours 15 minutes**

**INSTRUCTIONS TO CANDIDATES:**

Attempt **all** questions in this paper.

*Where necessary assume:*

$$\text{Acceleration due to gravity} = 10\text{ms}^{-2}$$

$$\text{Specific heat capacity of water} = 4200\text{Jkg}^{-1}\text{K}^{-1}$$

$$\text{Specific latent heat of fusion of water} = 340,000\text{Jkg}^{-1}$$

$$\text{Velocity of electromagnetic waves} = 3.0 \times 10^8 \text{ms}^{-1}$$

$$\text{Velocity of sound waves} = 330\text{ms}^{-1}$$

$$\text{Density of water} = 1000 \text{ kgm}^{-3}$$

$$\text{Density of mercury} = 13600 \text{ kgm}^{-3}$$

$$\text{Specific heat capacity of ice} = 2100 \text{ Jkg}^{-1}\text{K}^{-1}$$

## SECTION A (40 Marks)

1. Which of the following is true about specific gravity?  
A. It is measured in kilograms per cubic meter  
B. It has no units  
C. It compares densities of liquids to that of water only.  
D. It relates densities of solids to water only.
  
2. The major difference between soft and hard X-rays is?  
A. Velocity  
B. Intensity  
C. Frequency  
D. Polarization
  
3. Why is iron considered a suitable material for the construction of the core of a transformer?  
A. It is a metal.  
B. It does not readily get hot.  
C. It is easily magnetized.  
D. It is an electrical conductor.
  
4. For a given sound system, the minimum frequency of a standing wave is in a  
A. Fundamental mode  
B. Lowest mode  
C. Highest mode  
D. Peak mode
  
5. The p.d of a battery is  $2.2\text{ V}$ . When connected across a  $5\Omega$  resistor, suddenly this p.d falls to  $1.8\text{ V}$ , calculate its internal resistance.  
A.  $1.0\Omega$   
B.  $1.1\Omega$   
C.  $2.0\Omega$   
D.  $2.1\Omega$
  
6. Which one of the following sources of energy are renewable energy?  
A. Solar, Biogas and Tidal.  
B. Fossil, Nuclear and Tidal.  
C. Solar, Nuclear and Biogas.  
D. Solar, Tidal and Fossil.

7. Bimetallic strips are applied in
- A. Vapor-pressure thermometers
  - B. Liquid expansion thermometers
  - C. Metal expansion thermometers
  - D. Resistance thermometers
8. The following affect the magnitude of surface tension except?
- A. Temperature
  - B. Dirt
  - C. Soap
  - D. Surface area
9. A radioactive source has a half-life of 80s. How long will it take for  $\frac{7}{8}$  of the source to decay?
- A. 10s
  - B. 70s
  - C. 240s
  - D. 640s
10. The working of bow and the arrow applies all the following except?
- A. Hooke's law
  - B. gravitational law
  - C. Newton's first law
  - D. Conservation of energy law
11. When a vibrating object moves backwards, it creates a region of low pressure called?
- A. Refraction
  - B. Reflection
  - C. Rarefaction
  - D. Retardation
12. A positively charged rod was moved near the cap of a negatively charged gold leaf electroscope, the effect observed in the divergence of the gold leaf is?
- A. Decrease
  - B. Increase
  - C. no effect
  - D. increase then collapse

13. The seven coloured lights of the spectrum can be recombined when the two prisms are placed in
- A. Horizontal position with respect to each other
  - B. Adjacent position with respect to each other.
  - C. Inverted position with respect to each other.
  - D. Vertical position with respect to each other.
14. Why are petrol tanks painted silvery bright?
- A. To absorb heat.
  - B. To reflect away heat
  - C. To prevent heat loss
  - D. To prevent evaporation of oil since its volatile
15. The dynamo on a bicycle converts
- A. Mechanical energy to light.
  - B. Electrical energy to light.
  - C. Mechanical energy to electrical.
  - D. Heat from friction to light
16. The length of an open pipe which produces a third harmonic of frequency 600Hz is?
- A. 0.23m
  - B. 0.83m
  - C. 1.10m
  - D. 1.50m
17. A lead acid cell must be charged regularly to;
- A. prevent charge leakage
  - B. avoiding topping up
  - C. avoid drying up
  - D. avoid sulphation
18. The half-life of radon gas is 4 days. If some radon gas is accidentally released into a closed laboratory, how long would it take for the concentration of the gas to fall below 1% (one percent) of its original value?
- A. 4 days
  - B. 12 days
  - C. 28 days
  - D. 56 days

19. The flow of the fluid is said to be streamline if

- A. there is an obstacle in the fluid.
- B. the shape of the tube changes abruptly in diameter or direction.
- C. The speed of the fluid becomes too great.
- D. The pattern of the fluid flow does not change over

20. The effect of excessive frost collection inside a deep freezer is?

- A. Lowers the freezer temperature
- B. Acts as an insulator and slows cooling.
- C. Keeps the food content fresh
- D. Liquidates the refrigerant

21. At one end of a ripple tank 180cm across, a 12Hz vibrator produces waves whose wavelength is 60mm. The time needed to cross the wave is?

- A. 0.25 s
- B. 2.5s
- C. 7.2s
- D. 720s

22. Lenz's law is applied in the iron ring experiment in order to predict the direction of

- A. Force in the secondary coil
- B. Force in the primary coil
- C. Induced current in the secondary coil
- D. Induced e.m.f in the primary coil

23. Which of the following is NOT true about Ultraviolet radiations?

- A. Emitted from fairly high energy changes in electron structure of atoms
- B. Originates from hot radioactive bodies
- C. Originates from electric discharge through gases, particularly mercury vapor in quartz envelopes.
- D. Emitted from high frequency oscillatory electric currents.

24. Objects viewed through a blue-tinted glass appear blue because the;

- A. glass reflects only blue.
- B. objects reflect the blue colour.
- C. glass transmits only blue
- D. glass is transparent

25. In an experiment to determine the focal length of a converging lens while using an illuminated object and a plane mirror, the illuminated object is put at the

- A. Focal point of the lens
- B. Centre of curvature of the lens
- C. Principle axis of the lens
- D. Centre of the plane mirror and the lens

26. Shoulder bags and bag packs have wide padded straps so that the weight of the bag fall over

- A. a large area to maximize pressure
- B. a small area to maximize pressure
- C. a large area to minimize the pressure
- D. a small area to minimize the pressure

27. Which of the following applications of Hooke's law illustrates deformation as a depression of the free end?

- A. Loading a wire
- B. Loading a spiral spring
- C. Loading a horizontal beam fixed at one end
- D. Tightening a watch spring

28. During an atomic explosion, the energy released is due to conversion of

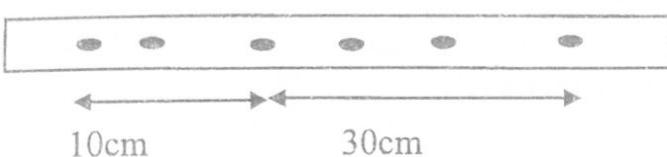
- A. protons to neutrons
- B. chemical energy into heat energy
- C. mechanical energy into nuclear energy
- D. mass into energy

29. Which one of the following devices uses flow of current through a conductor in a magnetic field to produce motion?

- A. Microphone.
- B. Loud speaker.
- C. D.C generator.
- D. Alternator.

30. Whenever the surfaces in contact tend to move or move with respect to each other , the force of friction comes into play

- A. Only if the objects are solid
- B. Only if one of the two objects is liquid
- C. Only if one of the two objects is gaseous
- D. Irrespective of whether the objects are solid, liquid or gaseous.

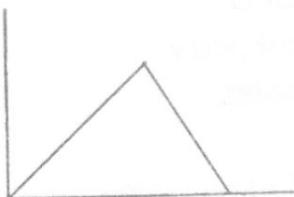
31. The lightning conductor operates on the principle of  
A. the law of electrostatics  
B. local action  
C. action at a point  
D. neutral point
32. Which of the following are properties of images formed in a plane mirror  
i. Same size as the object  
ii. Laterally inverted  
iii. Virtual  
iv. Real  
A. i , ii and iv only  
B. i , ii, and iii only  
C. i , iii , and iv only  
D. i , ii ,iii and iv
33. Figure 1.
- 
- The diagram in figure 1 above shows dots printed by a ticker timer of frequency 100Hz. calculate the acceleration of the locomotive
- A.  $50 \text{ ms}^{-2}$   
B.  $100 \text{ ms}^{-2}$   
C.  $150 \text{ ms}^{-2}$   
D.  $200 \text{ ms}^{-2}$
34. Which of the following occurs during 'induction' in a four -stroke cycle in a diesel engine?  
A. The piston admits air only into the cylinder  
B. The air is compressed to its minimum volume  
C. Fuel is pumped into the higher  
D. Both valves close and the piston moves up.
35. Notches and cracks spread more rapidly when brittle materials are under  
A. Strain  
B. Tension  
C. Compression  
D. Extension

36. Which of the following velocity-time graphs represents the motion of a body thrown vertically upwards?

A.



C.



B.



D.



37. A uniform meter rule is provided at the 20cm mark and balanced by a mass of 300g put at the 10cm mark, the mass of the meter rule is?

- A. 1g
- B. 50g
- C. 100g
- D. 600g



38. Which of the following are the effects of force on a body?

- (i) Stops motion
  - (ii) Changes mass
  - (iii) Changes shape
  - (iv) Changes direction
- A. (i), (ii) (iii) and (iv) only
  - B. (ii), (iii) and (iv) only
  - C. (i), (iii) and (iv) only
  - D. (i), and (ii) only



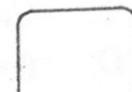
39. In a hydraulic car brake, the area of the piston on which the effort is applied is made smaller in order to

- A. Facilitate the movement of the piston downwards.
- B. Overcome a force as large as possible of the load.
- C. Transmit pressure equally through
- D. Obtain a pressure as large as possible



40. The device which melts to break the circuit when too much current flow is called

- A. a socket
- B. a socket breaker
- C. a fuse
- D. earth wire



## **SECTION B (40 marks)**

41. a) A gas jar full of air is inverted over another jar full of brown nitrogen dioxide gas (*nitrogen dioxide gas is denser than air*)  
i) State what is observed if the setup is left to stand for some time? (01 mark)

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- ii) What conclusion can be drawn from the observation in a(i)? (01 mark)

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- b) A small amount of water placed on wax forms small droplets but spreads out when placed on glass. Explain. (02 marks)

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42. a) Define the term '**lateral inversion**' as used in reflection of light. (01 mark)

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- b) Explain, with the aid of a ray diagram how the eye sees the image of a bright point formed by a plane mirror. (02 marks)

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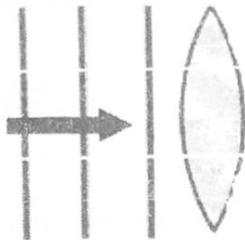
- c) State the effect of doubling the distance between pinhole and screen on the image formed in a pin-hole camera. (01 mark)

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43. a) Define **diffraction** as applied to wave properties. (01 mark)

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- b) Fig.2 below shows plane waves approaching a convex lens.



- i) Sketch the pattern to show how the wave is refracted. (1 $\frac{1}{2}$  mark)  
ii) How can refraction of such waves be illustrated in a ripple tank? (1 $\frac{1}{2}$  mark)

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44. a) i) Give any **two** properties of electric field line. (1mark)

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- (ii) Fig 3.



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The diagram in figure 3 above shows a positively charged spherical conductor near an earthed metal plate. Sketch the electric field between them. (01 mark)

b) Draw a well labeled diagram of a gold leaf electroscope. (02 marks)

45. a) What is meant by the **electromotive force** of a cell? (01 mark)

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b) Two cells each of e.m.f 1.5V and internal resistance of 2ohms are connected in parallel across a 1ohm resistor.

i) Sketch the circuit showing the arrangement. (01 mark)

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ii) Calculate the current through the circuit (02 marks)

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46. a) State **Archimedes' principle**. (01 marks)

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- b) A ship of mass  $1.3 \times 10^6 \text{ kg}$  floats in sea water. If the ship enters fresh water, what mass of cargo must be unloaded so that the same volume of water is displaced as before? (Take: Density of fresh water =  $1000 \text{ kg m}^{-3}$ , Relative density of sea water 1.03). (02 marks)
- .....
- .....
- .....
- .....
- .....

- c) Explain why a cork released below the surface of water rises. (01 mark)
- .....
- .....
- .....
- .....
- .....

47. a) Define the term 'couple' as used in forces. (01 mark)
- .....
- .....
- .....
- .....
- .....

- b) A uniform rod of mass  $5 \text{ kg}$  and length  $1.6 \text{ m}$  is placed horizontally across smooth supports X and Y. If X is  $10 \text{ cm}$  from one end and Y is  $50 \text{ cm}$  from the other end. Find the reactions at X and Y. (02 marks)
- .....
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- c) State the two conditions for a mechanical system to be in equilibrium. (01 mark)
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48. a) Define the term 'neutral point' as used in magnetism. (01 mark)

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- b) Using the domain theory, explain demagnetization. (02marks)

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- c) Draw the resultant field lines of a bar magnet placed in the earth's magnetic field with north pointing in the earth's magnetic field. (01 mark)



49. a) State the law of conservation of linear momentum. (01 mark)

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- b) Explain why the recoil velocity is much less than the forward velocity of the bullet. (01 mark)

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- c) An inflated balloon contains 2.0g of air which is allowed to escape from a nozzle at a speed of  $4.0\text{ms}^{-1}$ . Assuming that the balloon deflates at a steady rate in 2.5s, what is the force exerted on the balloon? (02 marks)

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50. a) Briefly explain the differences between mass and weight. (02 marks)

- b) (i) Find the weight of an object whose mass is 20g. (01 marks)

- (ii) Why is an astronaut often weightless when in an Earth-orbiting spacecraft? (01 mark)

*END*