

Candidate's Name:

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(Do not write your School / Centre Name or Number anywhere on this booklet.)

535/1

PHYSICS THEORY

Paper 1

July. / Aug. 2023

2 1/4 hours



JINJA JOINT EXAMINATIONS BOARD

Uganda Certificate of Education

MOCK EXAMINATIONS 2023

PHYSICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Section A contains 40 objective type questions. You are required to write the correct answer A, B, C or D against each question in the box on the right hand side.

Section B contains 10 structured questions. Answers are to be written in the spaces provided on the question paper.

Mathematical tables and silent non-programmable calculators maybe used.

Acceleration due gravity, g = 10 m s^{-2}

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

Velocity of light in air, c = $3.0 \times 10^8 \text{ m s}^{-1}$

Density of water = 1000 kg m^{-3}

For Examiner's Use Only

Q.41	Q.42	Q.43	Q.44	Q.45	Q.46	Q.47	Q.48	Q.49	Q.50	MCQs	Total

SECTION A (40 MARKS)

Answer all questions in this section.

SECTION A (40 MARKS)

Answer all questions in this section.

1. That, that makes a body to change its state of motion and or shape is known to be;

A. ☒ Rate of change of momentum. B. Magnetism.
C. Momentum. D. Inertia.

A

2. Which of the following represents a primary colour and a complementary colour respectively?

A. yellow and peacock blue.
B. cyan and (green + red).
C. ☒ magenta and (blue + green).
D. ☒ red and peacock blue.

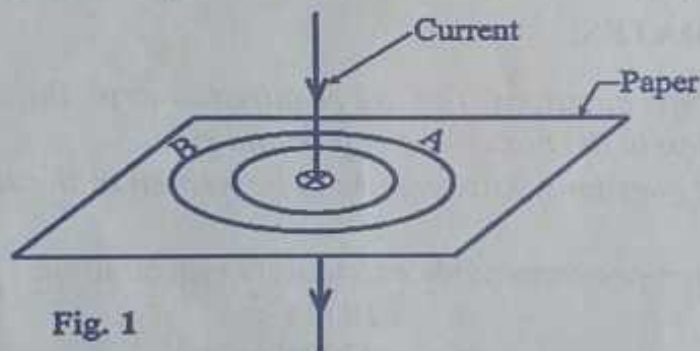
D

3. The discovered archeological artifacts are taken to scientific laboratories and put under experimental works to know their actual age. This process is known to be;

A. Back-dating. B. ☒ Nuclear fission.
C. Radioactivity. D. ☒ Carbon-dating.

D

4. The diagram in figure 1 shows a metal wire carrying current into a paper as viewed from above.



What will be the direction of the magnetic field due to the current carrying wire?

A. From the center towards A B ☒ from A towards B.
C. From the center Towards B. D from B towards A.

B

5. Which of the following is the "study of forces between electric charges at rest"?

A. ☒ Corona discharge B. Lightning.
C. ☒ Electrostatics. D. Electrophorus.

C

6. Which of the following is **not** a property of cathode rays?

- A. They move in straight lines. B. ☒ They are electrically neutral.
C. They are negatively charged. D. They ionize gas molecules.

B

7. A metallic can filled with ether is placed on a film of water which is on a wooden block. An air current is then blown through the glass tube in order to speed up the evaporation process as in figure 2.

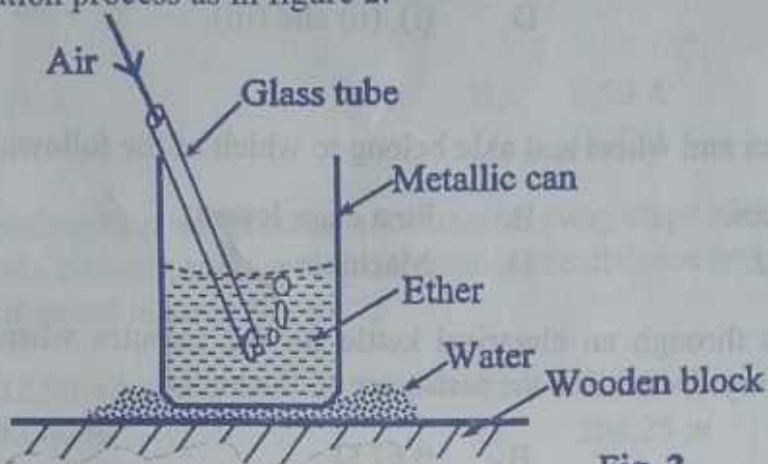


Fig. 2

Which of the following is true about the experiment?

- (i) Ether evaporates by getting the latent heat from water under the can.
(ii) Ether evaporates by getting the latent heat from the air current.
(iii) The experimental setup is to show, making ice by evaporation of a volatile liquid.

- A. (ii) only. B. ☒ (i) and (iii) only.
C. (ii) and (iii) only. D. (iii) only.

B

7. Two microscopic plates with a thin film of water are pressed together as in figure 3 but after, they could not be separated.



Fig. 3

This is because;

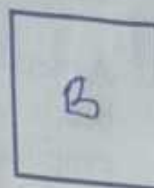
- A. ☒ No pressure exists on both the inside and outside surfaces of the slides.
B. ☒ Pressure existing on the outside surfaces presses the slides together.
C. Pressure existing on the inside surfaces presses the slides together.
D. Water sticks on glass.

B

9. The main reason (s) why the moon is called a silent planet is that:

- (i) It has no atmosphere for transmission of sound waves.
- (ii) Waves on the moon travel at a speed greater than $3.0 \times 10^8 \text{ ms}^{-1}$.
- (iii) No person lives on the moon.

- A. (i) only. B. (iii) only ✓
C. (ii) and (iii) only. D. (i), (ii) and (iii).



10. Screw jack, inclined planes and wheel and axle belong to which of the following groups?

- A. Electrical appliances. B. First class levers.
C. Magnetic materials. D. Machines ✓



11. A charge of 72 C flows through an electrical kettle for 0.2 minutes when connected to a 240 V battery. Determine the resistance of the kettle.

- A. 40.00 Ω . ✓
C. 3.33 Ω . B. 0.67 Ω
D. 20.00 Ω



12. Convert a temperature of 67 K to centigrade scale.

- A. 206 $^{\circ}\text{C}$ B. 340 $^{\circ}\text{C}$
C. 4.07 $^{\circ}\text{C}$ D. 2.06 $^{\circ}\text{C}$



13. Figure 4 shows wheel A, driving wheel B. The diagram is drawn to scale. If a force of 300 N is used to drive a load of 280 N

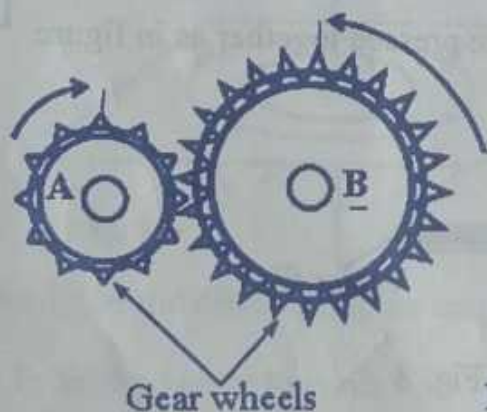
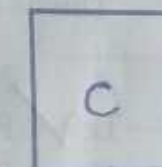


Fig. 4

Calculate the efficiency of the machine system.

- A. 53.6% B. 50.0%
C. 46.7%. ✓ D. 60.0%



14. An object of mass m kg is acted on by a force of 24 N, making it to change its velocity from 10 m s^{-1} to 32 m s^{-1} in 11 seconds. Find the value of m .

A. 12 ✓ B. 1.09
C. 48 D. 2.40

A

15. Two cells each of e.m.f 3 V and internal resistance 2Ω are arranged in series, and across which a resistor of resistance 11Ω is connected. Find the current through the 11Ω resistor.

A. 0.25 A B. 0.50 A
C. 0.40 A ✓ D. 0.20 A

C

16. A boy standing by a tall building a few metres away claps his hands once. After 2.5 seconds, he hears another clap. Determine the distance between the boy and the building. (Speed of sound in air is 330 ms^{-1})

A. 412.50 m ✓ B. 825.00 m
C. 132.00 m D. 206.25 m

A

17. The table below shows a neutral atom X with M as a product of an isotope of X after a radioactive decay.

Atom	Atomic mass	Neutron number	Electron number
X	p	55	f
M	89	V	43

If M results after the isotope of X losing two alpha particles, find the values of p , f and V .

Value of p Value of f Value of V

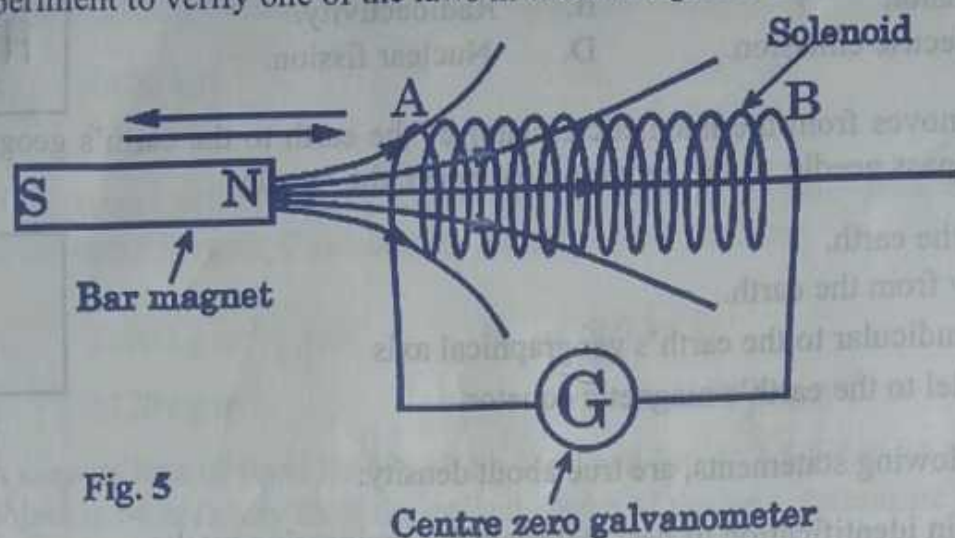
A. 89 43 55
B. 102 ✓ 47 46
C. 102 43 55
D. 89 47 46

B

18. A ball of mass 300g is dropped from the top of a tower, 50 m high. What is its kinetic energy half-way down the tower?
- A. 75 J ✓
B. 75 kJ
C. 150 J
D. 60 J
19. An object of mass 2kg at a temperature of 90°C is placed in a liquid of mass 3.6 kg at a temperature of 25°C . If the temperature of both the liquid and object settles to a uniform value of 55°C and the specific heat capacity of the liquid is $3600\text{J kg}^{-1}\text{K}^{-1}$, calculate the heat capacity of the object.
- A. $11108.57\text{J kg}^{-1}\text{K}^{-1}$
B. $5554.29\text{J kg}^{-1}\text{K}^{-1}$
C. 5554.29J K^{-1}
D. 11108.57J K^{-1} ✓
20. An A.C transformer has 80 turns in the primary coil connected to an A.C voltage equal to 20 V. The current through resistance R connected across the secondary coil is 10 A. Calculate the value of R if the number of turns in the secondary coil is 150.
- A. $0.27\ \Omega$
B. $60.00\ \Omega$
C. $30.00\ \Omega$
D. $3.57\ \Omega$ ✓
21. Two plane mirrors are inclined at an acute angle to each other. When a chair is placed in between the mirrors, 8 images are seen in the mirrors. Determine the angle of inclination between the mirrors.
- A. 40° ✓
B. 45°
C. 51°
D. 36°
22. The strength of an electromagnet can be increased by:
- (i) making it a U-shaped magnet.
(ii) decreasing the current flowing through the solenoid.
(iii) increasing the number of turns of the solenoid.
- A. (i) only.
B. (i) and (ii) only.
C. (i) and (iii) only. ✓
D. (i), (ii) and (iii).
23. Which of the following is true about kinetic theory of matter?
- (i) ✓ Molecules in gases possess the strongest intermolecular force of attraction.
(ii) ✓ Molecules in solids are constantly and randomly vibrating in all directions about their equilibrium positions.
(iii) Molecules in gases are at rest and only vibrate about their equilibrium positions when the liquid is subjected to heating.

C

24. Figure 5 shows a bar magnet moved towards and away from the solenoid in an experiment to verify one of the laws in electromagnetic induction.



What is the polarity of the solenoid when the bar magnet is moved towards and away from it respectively?

Towards the solenoid

Away from the solenoid

- A. A is north, B is south ✓
 B. A is south, B is north
 C. A is north, B is south
 D. A is south, B is north

- A is south, B is north
 A is south, B is north
 A is north, B is south
 A is north, B is south

A

25. A huge, electric spark discharge between two charged clouds or between a charged cloud and the ground best describes:

- A. Work function.
 C. Lightning

- B. ✓ Corona discharge
 D. Electrostatic induction.

C

26. Which of the following is (are) true about closed pipes as applied to stationary waves?

- (i) The fundamental note occurs with one node and one antinode.
 (ii) ✗ The pipes form transverse stationary waves.
 (iii) The frequency of the second resonance in the pipes is three times the fundamental frequency.

- A. (i) and (ii) only
 C. (iii) only.

- B. (i), (ii) and (iii).
 D. (i) and (iii) only. ✓

D

27. In the sun, it is known that a hydrogen atom combines with a hydrogen atom or with a helium atom to form other atoms with a release Mega-watts of thermal energy. What is the best description of this process?
- A. Nuclear fusion ✓ B. Radioactivity.
C. Thermoelectric emission. D. Nuclear fission.
28. When a person moves from the magnetic equator of the earth to the earth's geographical north with a compass needle, at the geographical north, the needle
- A. dips into the earth.
B. dips away from the earth.
C. lies perpendicular to the earth's geographical axis
D. lies parallel to the earth's magnetic equator.
29. Which of the following statements, are true about density:
- (i) It is used in identification of best materials for engineering works.
(ii) It is a scalar quantity.
(iii) It is a fundamental quantity of measurement in physics.
(iv) For an irregular shaped object, it can be determined using a graduated cylinder.
- A. (i), (ii), (iii) and (iv). B. (i), (ii) and (iii).
C. (iii) and (iv). D. ✓ (i), (ii) and (iv).
30. Mercury is preferred to alcohol as a thermometric liquid. Because:
- (i) alcohol does not stick on the walls of the capillary tube.
(ii) mercury is a better conductor of heat than alcohol.
(iii) alcohol is transparent and makes it easier to take temperature readings.
- A. (i) and (iii) only. B. (iii) only.
C. (i) and (ii) only. D. (ii) only. ✓
31. A point beyond which a material is permanently stretched and there is a permanent change in length when the stretching force is removed, best describes
- A. Yield point. B. Proportional limit.
C. Elastic limit. D. Breaking point. ✓

32. The temperature of a substance in a laboratory is found to be 52°C on a thermometer. The ice point and boiling point of the thermometer are found to be at a distance of 6.5 cm and 22.5 cm from the lower part of the bulb of the thermometer. What is the length of the mercury column for the measured temperature?

A. 14.82 cm ✓
 B. 8.32 cm
 C. 8.58 cm
 D. 21.58 cm

A

33. Methylated spirit of density 1.12 g cm^{-3} and volume 35 ml is mixed with water of the same volume. Calculate the density of the mixture.

A. 2120 kg m^{-3} Free
 B. 560 kg m^{-3}
 C. 1120 kg m^{-3}
 D. 1000 kg m^{-3}

Free

34. A convex lens of focal length 12 cm forms an image 2.5 times its object. If the object is 14 cm away from the optical center of the lens, determine the image distance.

A. 30.0 cm
 B. 25.0 cm
 C. 35.0 cm ✓
 D. 67.2 cm

C

35. Figure 6 shows a car passing by pothole A at 90 km h^{-1} and observed to possess a kinetic energy of 1500 kJ at pothole B.

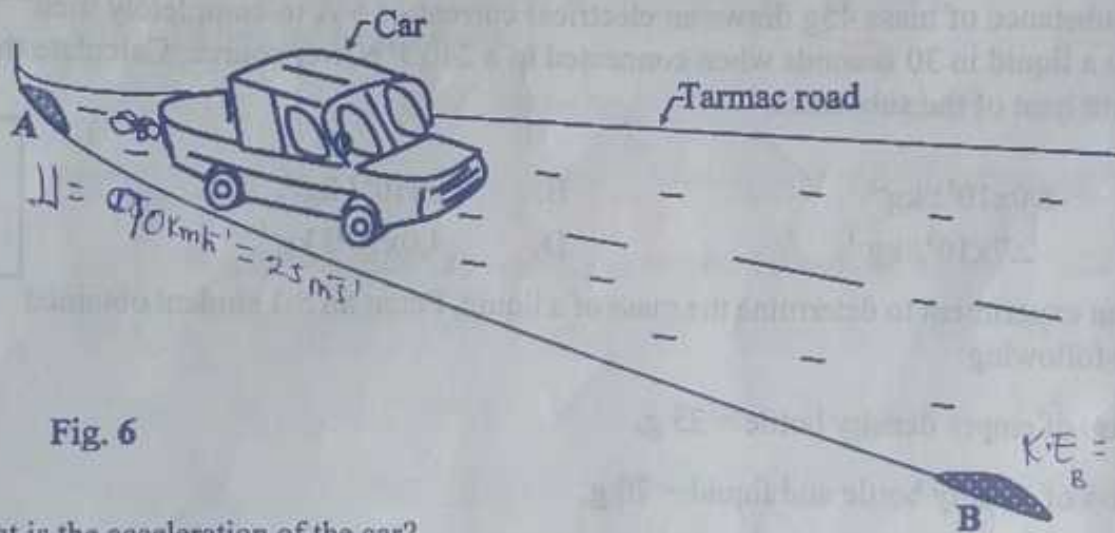


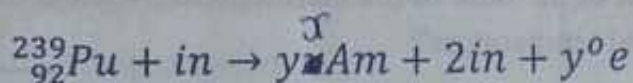
Fig. 6

What is the acceleration of the car?

A. 0.47 ms^{-2} B. 1.25 ms^{-2} C. 2.5 ms^{-2} D. 0.75 ms^{-2} Free

Free

36. A plutonium bomb released a huge amount of thermal energy on Hiroshima in accordance to the equation below.:



Find the values represented by x and y on Am.

- A. $x = 238, y = 93$
 C. $x = 239, y = 93$ ✓
 B. $x = 240, y = 92$
 D. $x = 242, y = 91$

C

37. The distance between the first and the third crest on a transverse wave is 17.5 m. Determine the frequency of vibration of the wave medium.

- A. 19.4 Hz
 C. 37.7 Hz
 B. 18.9 Hz
 D. 38.9 Hz

Free

38. Which part of a human eye has the same function as the diaphragm of a lens camera?

- A. Iris. ✓
 C. Ciliary muscles.
 B. Retina.
 D. Pupil.

A

39. A substance of mass 45g draws an electrical current of 5 A to completely melt into a liquid in 30 seconds when connected to a 240 V power source. Calculate the specific latent heat of the substance.

- A. $8.0 \times 10^5 \text{ J kg}^{-1}$. ✓
 C. $2.7 \times 10^4 \text{ J kg}^{-1}$.
 B. $8.0 \times 10^4 \text{ J kg}^{-1}$.
 D. $4.0 \times 10^6 \text{ J kg}^{-1}$.

A

40. In an experiment to determine the mass of a liquid, Peter, an S.1 student obtained the following:

Mass of empty density bottle = 25 g,

Mass of density bottle and liquid = 70 g,

Volume of the liquid = 0.02 l.

Calculate the relative density of the liquid

- A. 2.25 ✓
 C. 1.56
 B. 1.25
 D. 1.08

A

SECTION B (40 MARKS)

Answer all questions in this section. All the working must be shown clearly in the spaces provided.

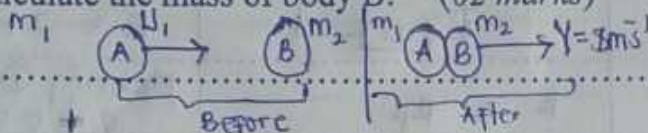
41. (a) State Newton's first law of motion. (01 mark)

Every body continues in its state of rest or uniform motion in a straight line unless acted upon by an external force.

- (b) State one instance where Newton's first law is applied practically. (01 mark)

Passengers lurch forward when a moving vehicle suddenly stops.
A cyclist riding on level ground does not come to rest immediately after stopping.

- (b) Body A of mass 2 kg moving at 20ms^{-1} collides head-on with a stationary body B and the bodies stick together after collision. If both move at 8ms^{-1} after collision, calculate the mass of body B. (02 marks)



$$m_1 u_1 + m_2 u_2 = (m_1 + m_2) v$$

Therefore, the mass of body B is 3 kg.

$$\begin{aligned} (2 \times 20) + (m_2 \times 0) &= (2 + m_2) \times 8 \\ 40 &= 16 + 8m_2 \\ 40 - 16 &= 8m_2 \\ \frac{24}{8} &= \frac{8m_2}{8} \\ m_2 &= 3\text{kg} \end{aligned}$$

42. (a) (i) Define the term a wave. (01 mark)

A wave is any disturbance which transfers energy from one point to another without any net movement of the medium itself.

- (ii) Briefly, explain why sound can be heard clearly at night? (02 marks)

During night, air around the ground is cold and more dense than the air above the ground. This means that sound waves move from a more denser medium to a less dense medium and hence are totally internally reflected back towards the ground.

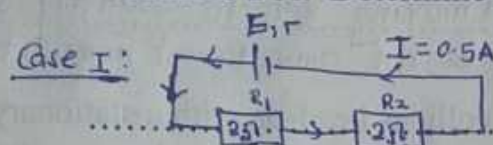
- (b) State two properties of sound waves. (01 mark)

- Sound waves are longitudinal in nature.
- Sound waves are mechanical waves i.e. require a material medium for their transmission.

43. (a) What is meant by a volt? (01 mark)

A Volt the Voltage between any ² points of a conductor when the work done in moving ⁺1 Coloumb of charge between the points is One Joule... (01)

- (b) A cell produces 0.5 A when connected to two 2Ω resistors arranged in series. When the resistors are arranged in parallel in the same circuit, the current flowing becomes 2 A. Determine the e.m.f and internal resistance of the cell. (03 marks)



$$R = R_1 + R_2$$

$$= 2 + 2$$

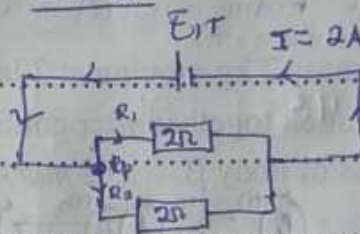
$$R = 4\Omega$$

$$E = I(R + r)$$

$$E = 0.5(4 + r)$$

$$E = 2 + 0.5r \quad \text{--- (1)}$$

Case II:



$$R = R_p$$

$$= \frac{R_1 R_2}{R_1 + R_2}$$

$$= \frac{2 \times 2}{2 + 2}$$

$$= \frac{4}{4}$$

$$R = 1\Omega$$

$$E = I(R + r)$$

$$E = 2(1 + r)$$

$$E = 2 + 2r \quad \text{--- (2)}$$

Equating (1) and (2)

$$2 + 0.5r = 2 + 2r$$

$$2 - 2 = 2r - 0.5r$$

$$0 = 1.5r$$

$$\frac{0}{1.5} = \frac{1.5r}{1.5}$$

$$r = 0\Omega$$

From (1) $E = 2 + 0.5r$

$$E = 2 + 0.5(0)$$

$$E = 2V$$

44. (a) (i) Briefly explain why a cathode ray tube is evacuated. (01 mark)

To prevent collision between air molecules and the emitted electrons which would reduce the number of electrons striking the florescent screen. (01)

- (ii) What is the function of the cooling fins in an X-ray tube. (01 mark)

To cool the Metal target after being hit by the fast moving electrons. (01)

- (b) Figure 7 shows the screen of C.R.O. The time base is set to 0.005 s cm^{-1} .

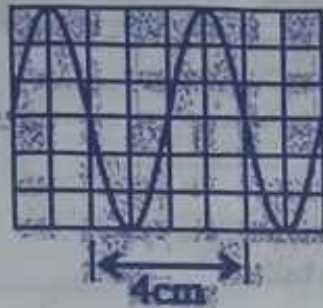


Fig. 7

Determine the frequency of the input A.C signal.

(02 marks)

$$T = \text{time base setting} \times \text{wave length}$$

$$= 0.005 \times 4$$

$$T = 0.02 \text{ seconds} \quad \checkmark \quad (01)$$

$$f = \frac{1}{T}$$

$$= \frac{1}{0.02}$$

$$\text{Frequency} = 50 \text{ Hz} \quad \checkmark$$

- (a) (i) What is radioactivity?

(01 mark)

This is the random and spontaneous decay of certain unstable atomic nuclei to form stable nuclides with the emission of radiation and energy... \checkmark (01)

- (ii) Briefly explain why radioactivity is said to be random and spontaneous.

(02 marks)

Radioactivity is said to be random and spontaneous because it occurs on its own (naturally) and no one can predict when and which atom is to decay. \checkmark (02)

- (b) State the main similarity between X-rays and Gamma radiations. (01 mark)

They are both electromagnetic waves. \checkmark (01)

45. Figure 8 shows a ball of mass 3.6 kg released from the top of a cliff and left to fall to the ground under the influence of its own weight.

(a) What is meant by the term **weight**?

(01 mark)

8

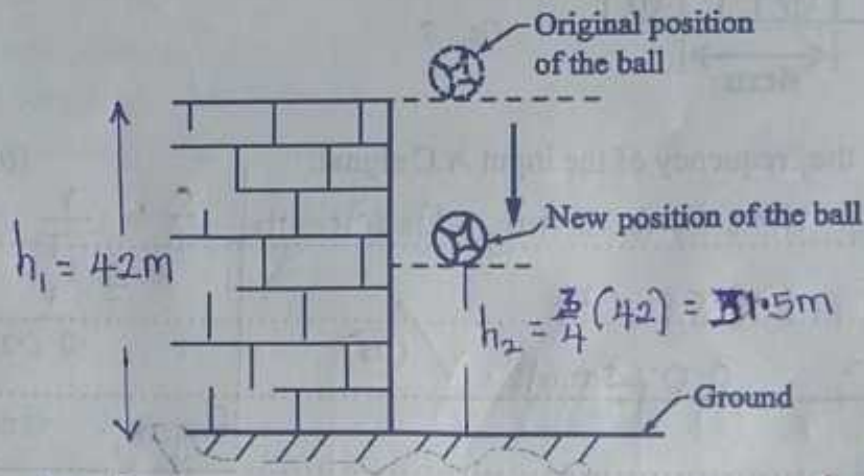


Fig. 8

Weight is a force of gravity acting on a body.

- (b) If the top of the cliff is 42 m from the ground and the new position of the ball is quarter way down the cliff, calculate the gain in kinetic energy at the new position.

(03 marks)

K.E at the new position = Lost P.E

$$= Mg(h_1 - h_2)$$

$$= 3.6 \times 10 (42 - 31.5)$$

$$= 36 (10.5)$$

$$= 378 \text{ J}$$

Therefore, the gain in kinetic energy at the new position is 378 J.

46. (a) Define magnetic field.

(01 mark)

This is a region around a magnet where the magnetic force is experienced.

- (b) Figure 9 shows a thick copper wire XY placed between two pole pieces of a strong U-shape permanent magnet

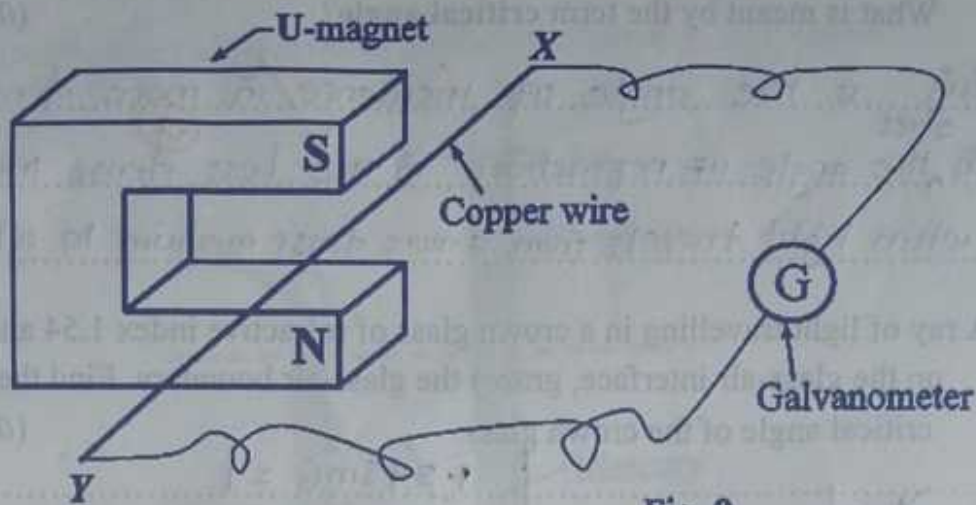


Fig. 9

- (i) What is observed on the galvanometer when the wire XY is moved vertically and horizontally between the poles? (01 mark)

When wire XY is moved vertically, the galvanometer shows no deflection ✓ and when moved horizontally, the galvanometer shows a deflection ✓ (01)

- (ii) Briefly explain the observation in (b) (i) above. (02 marks)

When wire XY is moved vertically between the poles, the magnetic field is not cut ✓ and no emf is induced ✓ which would induce a current to deflect the galvanometer. ✓ (01)

When wire XY is moved horizontally between the poles, the magnetic field is cut ✓ and an emf is induced ✓ which induces a current ✓ and hence the galvanometer showing a deflection ✓ (01)

47. (a) State the two types of reflection of light. (01 mark)

Regular reflection ✓ (01)

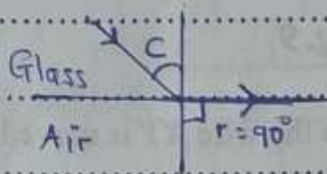
Diffuse / Irregular reflection ✓

(01 mark)

- (b) (i) What is meant by the term
- critical angle**
- ?

This is the angle of incidence in more dense medium which gives the angle of refraction in the less dense medium equal to 90° when light travels from a more dense medium to a less dense medium.

- (ii) A ray of light travelling in a crown glass of refractive index 1.54 and incident on the glass-air interface, grazes the glass-air boundary. Find the critical angle of the crown glass. (02 marks)



$$\frac{1.54 \sin C}{1.54} = \frac{1}{1.54}$$

$$\sin C = 0.6494$$

$$n \sin C = n_a \sin 90^\circ$$

$$C = \sin^{-1}(0.6494)$$

$$1.54 \sin C = 1 \times 1$$

$$C = 40.4964^\circ$$

Therefore, Critical angle of crown glass is 40.4964°

48. (a) What do you understand by the statement "the specific latent heat of fusion of substance W is $2260000 \text{ J kg}^{-1}$ "? (01 mark)

It requires 2260000 J of heat to change state of 1 kg mass of substance, W from solid to liquid at a constant temperature.

- (ii) Explain why the specific latent heat of vaporization of a substance is always greater than its specific latent heat of fusion. (03 marks)

During Vaporization, heat supplied is used to overcome the intermolecular forces of attraction between liquid molecules and also for the vapour to expand against the atmospheric pressure. During fusion, heat supplied is only used to overcome the intermolecular forces of attraction between the solid molecules.

49. (a) State Pascal's principle of transmission. (01 mark)

Pressure exerted at any point of an enclosed fluid is transmitted equally through out the whole fluid and in all directions.

$$P = h \rho g$$

- (b) Figure 10 shows air trapped by a column of mercury in a J-tube.

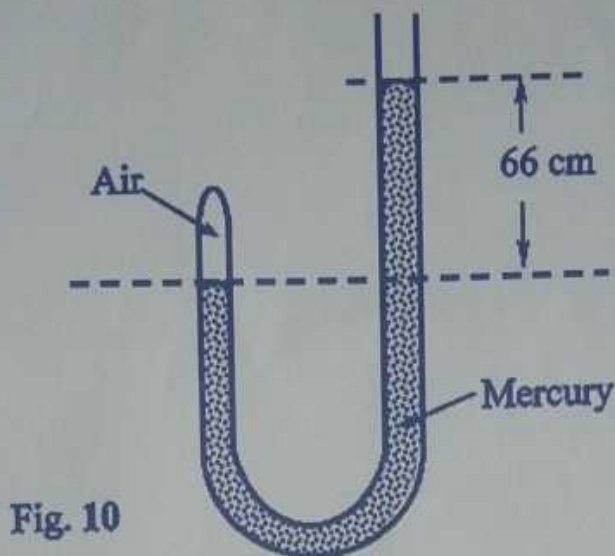


Fig. 10

Taking atmospheric pressure to be 76 cm Hg and density of mercury as 13600 kg m^{-3} , Calculate the pressure of the enclosed air.

(03 marks)

$$\text{Pressure due to air} = \text{Atmospheric pressure} + \text{Excess pressure due to air}$$

$$= H \rho g + h \rho g$$

$$= \left(\frac{76}{100} \times 13600 \times 10 \right) + \left(\frac{66}{100} \times 13600 \times 10 \right) \quad (03)$$

$$= (0.76 \times 136000) + (0.66 \times 136000)$$

$$= 103360 + 89760$$

$$\text{Pressure due to air} = 193120 \text{ Nm}^{-2}$$