NJ

535/1
Physics
Paper 1
July -August 2023
2 ¼ Hours

UGANDA MUSLIM TEACHERS' ASSOCIATION

UMTA JOINT MOCK EXAMINATIONS - 2023

NAME.....

INDEX NO. ..... SIGNATURE .....

UGANDA CERTIFICATE OF EDUCATION

PHYSICS

Paper 1

2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- *Write your name, signature, centre and index number clearly in the spaces provided above.*
- *Section A contains 40 objectives type questions.*
- *You are required to write the correct answers A, B, C and D against each question in the box on the right hand side of each page.*
- *Section B contains 10 structured questions. Answers are to be written in the spaces provided on the question paper.*
- *Mathematical tables, slide rules and silent non- programmable calculators may be used.*

Assume where necessary:

- *Acceleration due to gravity g = 10ms^{-2}*
- *Specific heat capacity of water = 4200JKg^{-1}K^{-1}*
- *Specific latent heat of fusion of ice = 336,000JKg^{-1}*
- *Speed of sound in air = 330ms^{-1}*
- *Speed of light = 3.0×10^{8}ms^{-1}*
- *Specific latent heat of vaporization of water = 2.26×10^{6} JKg^{-1}*

FOR EXAMINER'S USE ONLY

Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	MCQ	TOTAL

SECTION A: (40 MARKS)

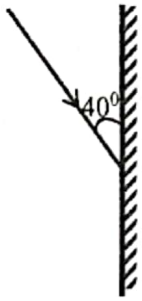
1. The property of a body which resists a change in its state of rest or of uniform motion is
   A. acceleration
   B. density
   C. inertia
   D. velocity

C

2. The motion of the molecules of two gases causes them to mix. What is this mixing called?
   A. Conduction
   B. Convection
   C. diffusion
   D. evaporation

C

3. The diagram shows a single ray of light being directed at a plane mirror. What are the angles of incidence ***i***, and reflection, **r** ?



	i	r
A.	40^0	40^0
B.	40^0	50^0
C.	50^0	40^0
D.	50^0	50^0

D

4. Which pair of emissions travel with same speed in air?
   A. α-particles and γ-rays
   B. γ-rays and infra-red waves
   C. infra-red waves and sound waves
   D. Sound waves and α- particles

B

5. Why are γ-rays (gamma rays) not deflected by a magnetic field?
   A. They are strongly penetrating
   B. They are weakly ionizing
   C. They have no charge
   D. They have no mass.

C

$\frac{l_{\theta_1} - l_0}{l_{100} - l_0} \times 100$

6. The length of a mercury column of a thermometer at the ice point and steam point are 4cm and 44cm respectively. The reading of the thermometer when the mercury column is 18cm long is

   A. 35.0°C
   B. 40.9°C
   C. 45.0°C
   D. 100.0°C

   A

7. Electrical equipment should not be used in damp conditions. What is the main hazard?
   A. The equipment becomes too hot
   B. The fuse keeps "blowing"
   C. The insulation becomes damaged
   D. The risk of electric shock.

   D

8. In which device is a permanent magnet used?
   A. an electric bell
   B. an electromagnet
   C. a plotting compass
   D. a relay

   C

9. When a plastic rod is charged positively by friction, it
   A. gains electrons
   B. gains neutrons
   C. gains protons
   D. loses electrons

   D

10. The splitting of white light into its component colours is called
    A. deflection
    B. dispersion of light
    C. reflection of light
    D. refraction of light

    B

11. A charge of mass 7.1×10^{-29} kg. experiences a force of 7.1×10^{-26} N in an electric field. What is the acceleration of the charge?
    A. $5.0 \times 10^{-5}\ ms^{-2}$
    B. $1.0 \times 10^{-3}\ ms^{-2}$
    C. $5.0 \times 10^{-3}\ ms^{-2}$
    D. $1.0 \times 10^{3}\ ms^{-2}$

    D

12. When a force of $60N$ is applied to a stationary trolley, it takes 40 seconds to move through a distance of 20m in the direction of force. The average power developed by the trolley is

A. 13.3W

B. 15.0W

C. 30.0W

D. 120.0W

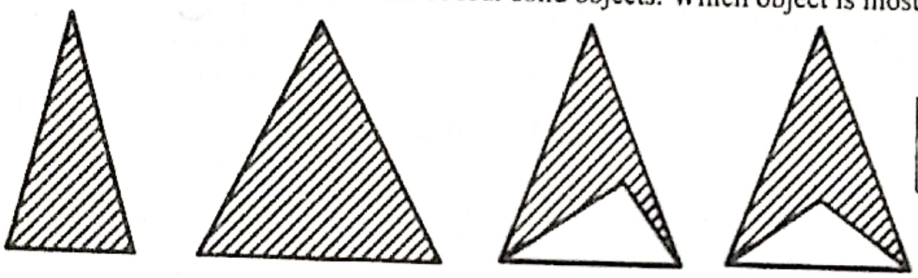
C

13. A student was asked to calculate the volume of a piece of wire which is about 85cm long and 0.6cm in diameter. Which measuring instruments did the students use?

	Length	**Diameter**
A.	metre rule	micrometer
B.	metre rule	vernier callipers
C.	micrometer	vernier callipers
D.	Vernier callipers	micrometer

A

14. The diagrams show cross sections of four solid objects. Which object is most stable?



A B C D

B

15. The rate at which heat energy is conducted through a substance depends on its state. What is the order of conduction?

	Best ⟶		Worst
A.	gas	liquid	solid
B.	liquid	gas	solid
C.	Solid	gas	liquid
D.	Solid	liquid	gas

D

$e = IVt$

$E = Pxt$

16. A dry-battery can deliver 3000J of energy to a small 2W electric motor before the battery is exhausted. How long, in minutes, does the motor run?

$\frac{3000}{2} = t$

$\frac{1500}{60} = t$

A. 25 minutes

B. 50 minutes

C. 100 minutes

D. 1500 minutes

A

17. Which range of audible frequencies is a healthy teenager likely to be able to hear?

A. 2Hz to 20Hz

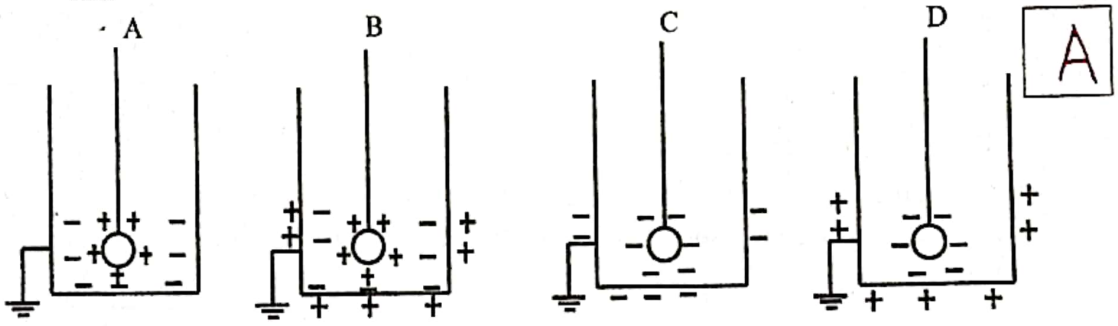
B. 2Hz to 200Hz

C. 20Hz to 20KHz

D. 20Hz to 200KHz

C

18. A charged sphere is suspended by an insulating thread inside a metal can. The outside of the can is earthed. Which diagram shows the resulting charges on the sphere and on the can?



A

19. The equation represents actinium decaying to thorium

$$^{227}_{89}Ac \rightarrow {}^{227}_{90}Th + Y$$

Which particle does **Y** represent?

A. a helium nucleus

B. an atom

C. an electron

D. a neutron

C

20. The difference of pitch between two musical sounds is due to the difference in
    A. amplitude
    B. frequency
    C. loudness
    D. timbre

B

21. A body X of mass 100kg moving with a velocity of $2ms^{-1}$ collides with a stationary body Y of mass 60kg. If both bodies X and Y move together after impact,

    What is their common velocity?

    A. $0.33ms^{-1}$
    B. $1.25ms^{-1}$
    C. $2.00ms^{-1}$
    D. $3.33ms^{-1}$

B

22. An object is placed between the pole and the principal focus of a concave mirror. The image formed is
    A. real, erect, diminished
    B. real, inverted, magnified
    C. real, erect, magnified
    D. virtual, erect, magnified

D

23. A radioactive material gives a count rate of 8000 counts per minute. After 20 days, it gives a count rate of 500 counts per minute. What is the half-life of the material?

    A. 4 days
    B. 5 days
    C. 20 days
    D. 80 days

B

24. A dipper moving up and down makes waves in a ripple tank, What will happen when the dipper frequency is increased?
    A. The waves will be closer together.
    B. The wave peaks will be higher and the troughs lower
    C. The waves will move more quickly across the tank
    D. The waves will move more slowly across the tank

A

8000 → t½ → 4000 → t½ → 2000 → t½ → 1000 → t½ → 500

4 t½ = 20

25. At what temperature and where in a liquid, does evaporation occur?

Temperature	where in a liquid.
A. any	points of heating only
B. any	surface only.
C. boiling point only	points of heating only
D. boiling point only	surface only

B

26. The total electric energy used to drive unit charge round the complete circuit is the
A. emf
B. joule
C. ohm
D. watt

A

27. Short sightedness can be corrected by a
A. concave lens
B. convex lens
C. concave mirror
D. convex mirror

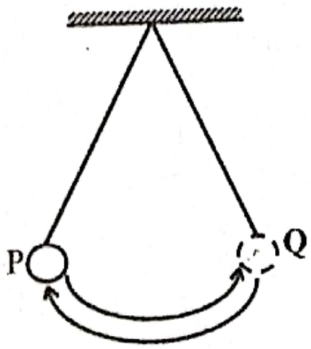
A

28. A transformer is needed to convert a mains 240V supply into a 12V supply .If there are 2000 turns on the primary coil, how many turns should there be on the secondary coil?
A. 100
B. 120
C. 200
D. 40000

A

$\frac{240}{12} = \frac{2000}{N_s}$

29. It takes 13.8s for a pendulum to swing from **P** to **Q** and back again twenty times. What is the period of the pendulum?



A. 0.35s
B. 0.69s
C. 1.38s
D. 4.60s

B

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	Temperature	where in a liquid.
A.	any	points of heating only
B.	any	surface only.
C.	boiling point only	points of heating only
D.	boiling point only	surface only

B

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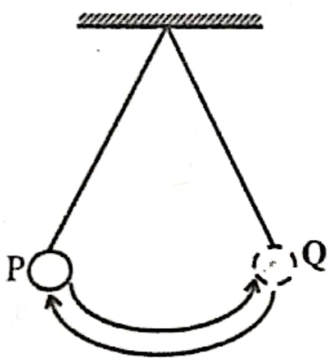


A. 0.35s
B. 0.69s
C. 1.38s
D. 4.60s

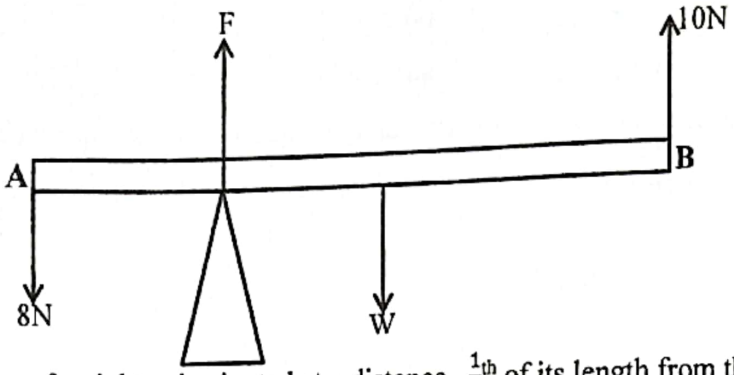
B

30. Which of the following list of physical quantities consist only of vectors?

A. acceleration, force, volume
B. mass, velocity, acceleration
C. time, mass, force
D. velocity, acceleration, force

D

31.



A uniform beam of weight w is pivoted at a distance $\frac{1}{5}^{th}$ of its length from the end A and kept in equilibrium by applying forces of 8N and 10N as shown in the diagram. The force exerted by the pivot on the beam is

A. 16N
B. 20N
C. 30N
D. 32N

C

32. The efficiency of a machine which raises a load of 400N through a distance 3m when an effort of 200N moves a distance of 12m is

A. 5%
B. 12.5%
C. 50%
D. 60%

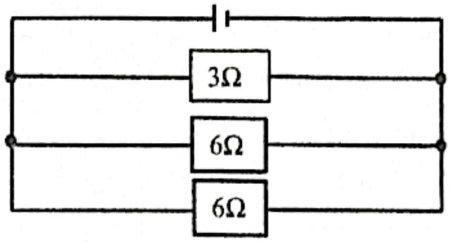
C

33. A 150W heating coil is used for 6 minutes to heat a metal block of mass 1.5kg and specific heat capacity of 3000 $Jkg^{-1}K^{-1}$. The temperature of the metal block is

A. 6°C
B. 12°C
C. 15°C
D. 24°C

B

34. The diagram shows a circuit.



What is the effective resistance of the three resistors.

A. 0.6Ω
B. 1.5Ω
C. 6.7Ω
D. 15Ω

B

35. During a thunder storm, an observer sees a lightning flash. 6 seconds later the observer hears the thunder.

How far away is the observer from the lightning?

A. 50m
B. 333M
C. 500m
D. 1980m

D

36. The law of electrostatic induction states that
A. Like charges attract and unlike charges repel
B. Like charges repel and unlike charges attract
C. Like poles attract and unlike poles repel.
D. Like poles repel and unlike poles attract.

B

37. A gas occupies volume of $2m^3$ in a cylinder at a pressure of 240 mm Hg. A piston compresses the gas until the volume is $0.5m^3$ at constant temperature.

What is the new pressure of the gas?

A. 60mmHg
B. 240mmHg
C. 480 mmHg
D. 960 mmHg

D

$P_1V_1 = P_2V_2$

$240 \times 2 = P_2 \times 0.5$

38. Why is electrical energy usually transmitted at high voltage.

A. The resistance of the transmission cables is as small as possible

B. The transmission cables are safer to handle

C. As little energy as possible is wasted in the transmission cables.

D. The transmission system does not require transformers.

C

39. Which of the following is correct for domestic lighting circuits?

	Circuit connection	Fuse position	Switch position
A	Parallel	Live lead	Live lead
B	Parallel	Neutral lead	Neutral lead
C	Series	Live lead	Live lead
D	Series	Neutral lead	Neutral lead

A

40. When a particular body or system is set in oscillation at its own natural frequency due to impulses received from some other nearby body or system which is vibrating with same frequency,

A. music is produced

B. nodes occur

C. resonance occur

D. sound is produced

C

SECTION B: (40 MARKS)

41. (a) State the four factors which affect terminal velocity (2 marks)

Density of the body ✓
Density of the fluid ✓
Volume, surface roughness or area / size of the body ✓
weight, full of gravity ✓ and Temperature.

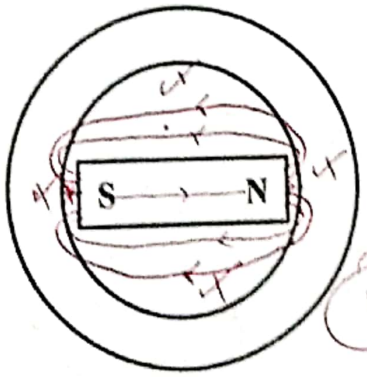
(b) Explain briefly how a person is able to drink using a straw. (2 marks)

When sucking, the lungs expands and air inside the straw flows to the lungs. The atmospheric pressure at the surface of the liquid becomes greater than the air pressure in the straw and pushes the liquid into the straw

42. (a) What is a magnetic pole? (1 mark)

A magnetic pole is a place on a magnet where the resultant attractive force appears to be concentrate of.

(b)(i) The magnet is placed at the centre of a soft iron ring of internal diameter 5cm and external diameter 7cm as shown in the diagram.



b2

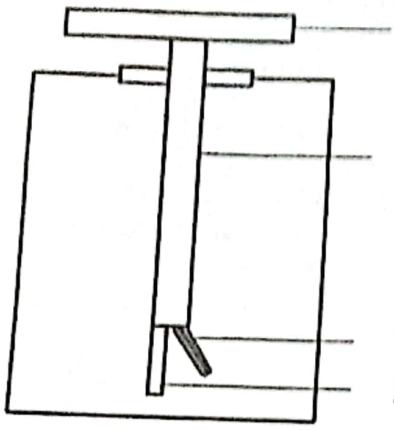
1 mk field lines
1 mk direction.
cross if it goes outside the ring (fieldline)

Draw the magnetic field pattern on the diagram. (2 marks)

(ii) State an application of the effect shown in your answer to (b)(i) (1 mark)

magnetic screening

43. (a) The diagram below shows the main parts of the gold-leaf electroscope. Name them. (2 marks)



P Brass cap

Q metal Brass rod

R Gold leaf

S Brass plate / metal plate

(b) State two uses of the gold leaf electroscope. (2 marks)

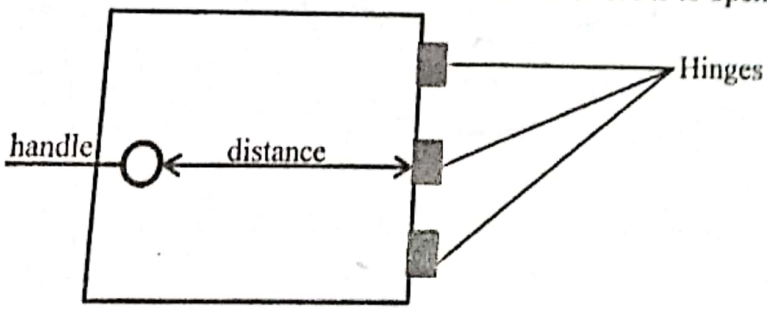
Testing the nature of charge, determine magnitude of charge

Distinguish conductors and insulators (test the insulation property of a body, Detect the presence of charge

44. (a) (i) State the principle of moments. (1 mark)

When a body is in equilibrium the sum of clockwise moment about any point is equal to the sum of anticlockwise moment about the same point

(ii) A door requires a minimum moment of force of 32.5Nm in order to open it.



Summation of the resultant force on a body is zero.

What is the minimum distance of the handle from the hinges, if the door is to be pulled open with a force at the handle not greater than 50N? (2 marks)

Moment = force × distance

325 = 50 × d

d = 0.65 m

(b) State two conditions necessary for the body to be in equilibrium. (1 mark)

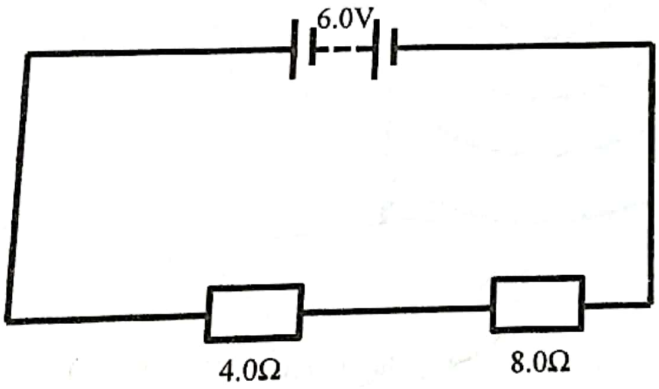
The sum of forces in one direction is equal to the sum of forces in the opposite direction.

The sum of clockwise moment about any point is equal to the sum of clockwise moment about the same point.

45. (a) What is a coulomb? (1 mark)

A coulomb is the quantity of electricity which passes any point in a circuit when a steady current of one ampere is flowing.

(b) The diagram shows a battery of emf 6.0V in series with resistors of resistances 4.0Ω and 8.0Ω



Determine

(i) the current through the battery. (1½ mark).

R = 4.0 + 8.0 = 12.0Ω.

from V = IR

6 = 12I

I = 0.5 A

1½

(ii) the power developed in the battery. (1½ mark).

$P = IV$ ✓

$= 0.5 \times 6.$ ✓

$= 3.0\ W$ ✓ (With or without but wrong units.)

46. (a). Define the term wavelength. (1 mark)

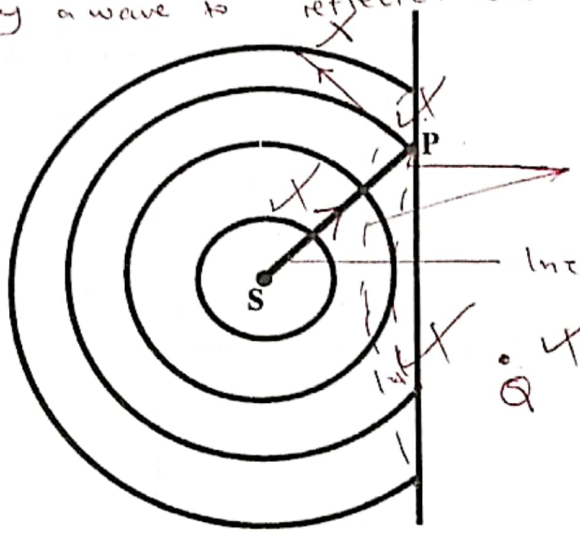
Wavelength is the distance between two successive particles points which are in phase. (same point on their paths and moving in the same direction)

(b) The diagram shows a circular wave incident on a plane surface.

distance between two succe crests or troughs.

- distance covered by a wave to complete a cycle.

reflected wave.



reflected circular waves.

Incident wave path.

Q ✓

On the diagram,

(i) mark with a dot the position of the image of the source S and label it Q (1 marks).

(ii) show as accurately as possible, the reflected circular wave. (2 marks)

47. (a) What is meant by specific latent heat of fusion of a solid? (1 mark)

is the quantity of heat required to change one kilogram mass of a solid into a liquid at constant temperature

(b) Heat energy is supplied to a melting solid at a constant rate of 2000W. Calculate the mass of the solid changed to liquid in 2 minutes given that the specific latent heat of fusion of the solid is $95000 Jkg^{-1}$. (3 marks)

$H = mL_f$ ✓ $H = P \times t$

$2000 \times 2 \times 60$ ✓ $= m \times 95000$ ✓

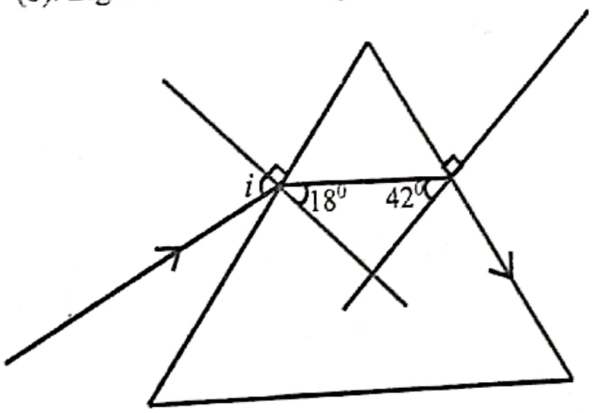
$m = 2.526\ kg$ ✓

$\rightarrow n = \frac{\sin i}{\sin r}$ where n = refr
i = angle of
r = angle of refr

48. (a) State Snell's law.

Snell's law state that the ratio of sine of angle of incidence to the sine of angle of refraction is equal to a constant for a given pair of media.

(b). Light is incident on a glass prism at an angle i as shown in the diagram.



Calculate; (1 ½ marks

(i) the refractive index of the glass prism.

$n_g \sin 42 = \sin 90$ ✓

$n_g = \frac{1}{\sin 42}$ ✓ $= 1.49 \simeq 1.5$ ✓ 2sf →

(ii) the angle of incidence, ***i*** (1 ½ marks)

$n_{asmi} = n_{gsm}\ 18^\circ$ ✓

$\sin i = 1.5 \sin 18^\circ$ ✓

$i = 27.6^\circ$ ✓

49. (a) What is an echo? (1 mark)

An echo is a reflected sound. ✓

(b) (i) An echo sounder of a ship transmits a pulse of sound through water and receives the reflected sound after 0.5 seconds. The speed of sound in sea water is $1200ms^{-1}$. Calculate the depth of the sea. (2 marks).

$v = \frac{2d}{t}$ ✓

$1200 = \frac{2d}{0.5}$ ✓

$d = 300\,m$ ✓

(ii) State any two factors which affect the frequency of a note produced by a vibrating string. (1 mark)

Tension in the string ✓

Length ✓

mass per unit length ✓

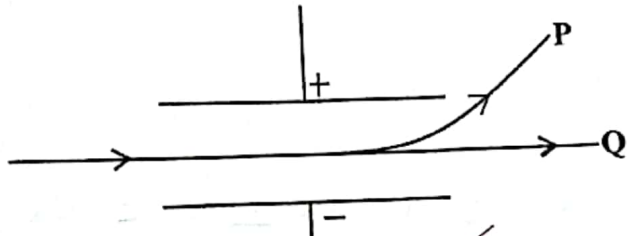
Thickness ✓ / size of the string.

first 2

50. (a) What are isotopes? (1 mark)

Isotopes are atoms of the same element with the same atomic number but different mass numbers.

(b) The diagram shows two types of radiations passing through an electric field. Name the radiations **P** and **Q**.



P..... Beta particles. ✓

Q..... Gamma rays / radiation. ✓

(1 mark)

(c)(i) How many neutrons does the nucleus of one of $^{234}_{90}Th$ atoms contain? (1 mark)

234 − 90 ✓

= 144

(ii) What is meant by the statement "the half-life of $^{234}_{90}Th$ is 24 days? (1 mark)

END