Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic :7_ Electric Field

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Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Q1.

Over one hundred years ago, Rutherford supervised a series of experiments using a source of alpha particles and thin gold foil.

The initial kinetic energy of an alpha $\left({}^{4}_{2}\alpha\right)$ particle is 7.3×10^{-13} J.

(i) In a textbook, it states that an alpha particle with this energy would be brought to rest when it reached a distance of 5.0×10^{-14} m from the centre of the gold nucleus $\left({}^{197}_{79}\mathrm{Au}\right)$.

Deduce whether this statement is correct.

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(ii) Determine the initial momentum of the alpha particle.

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Initial momentum = ...

(Total for question = 4 marks)

Q2.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

An object was thrown so that it followed the path shown. Assume drag forces were negligible.

The object was thrown with an initial vertical component of velocity u. The time taken to reach maximum height is t.

Which of the following could **not** be used to determine the maximum vertical height s reached by the object?

☒ **A** $s = ut - \frac{1}{2}gt^2$

☒ **B** $s = ut$

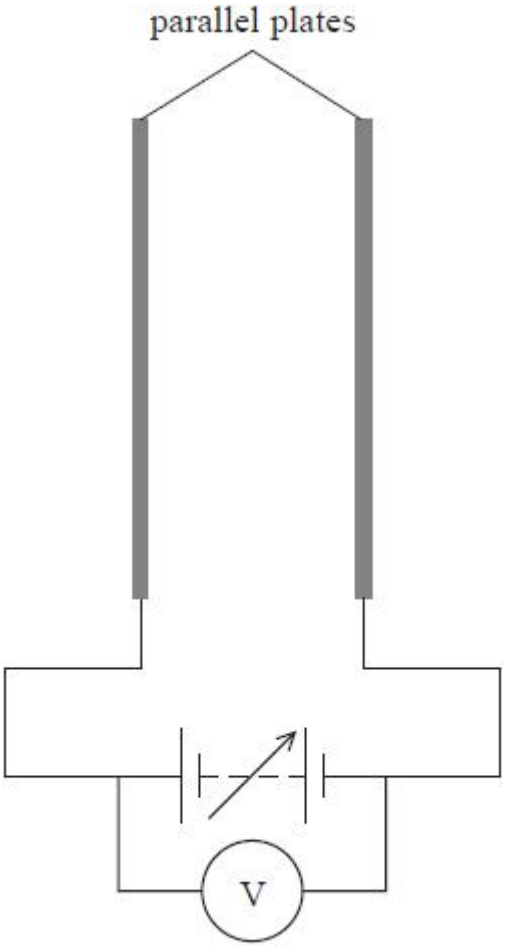
☒ **C** $s = \frac{1}{2}ut$

☒ **D** $s = \frac{u^2}{2g}$

(Total for question = 1 mark)

Q3.

A teacher demonstrates the electric field produced between two parallel metal plates. The plates are connected to a variable power supply, as shown. The power supply has a very large internal resistance and includes a voltmeter that indicates its output.



The power supply output is increased until sparks are heard and are seen in the gap between the plates. Sparks form in air when the electric field strength exceeds 3.0×10^6 V m^{-1} and the air becomes conducting for a short time.

(i) Calculate the minimum potential difference across the plates for sparks to be created.

distance between parallel plates = 2.0 mm

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Minimum potential difference = ...

(ii) Explain why the voltmeter reading decreases significantly whenever sparks are produced.

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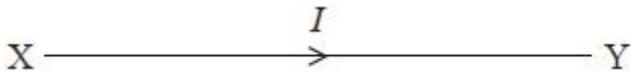
(Total for question = 5 marks)

Q4.

An electrical conductor XY carries a current *I* as shown.



The current density *j* is defined as $j = \frac{I}{A}$ where *A* is the cross-sectional area of the conductor.

The resistivity ρ of the conducting material is given by $\rho = \frac{E}{j}$

where *E* is the electric field strength.

Show that the units are the same on both sides of this equation.

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(Total for question = 4 marks)

Q5.

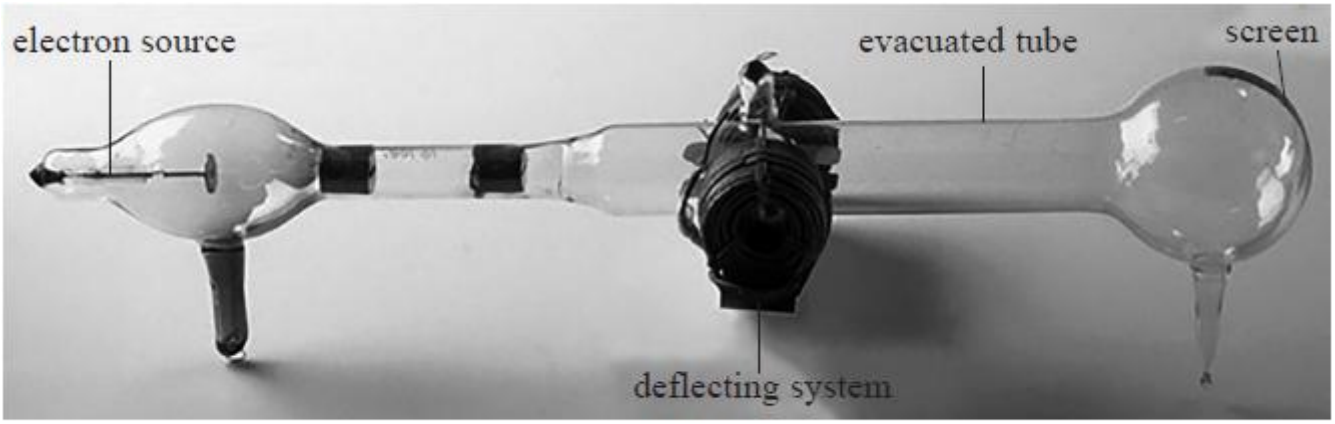
Electric field strength can have the unit of

- **A** V m
- **B** V C^{-1}
- **C** N m^{-1}
- **D** N C^{-1}

(Total for question = 1 mark)

Q6.

At the end of the 19th century, J.J. Thompson used electric and magnetic fields to deflect beams of charged particles. A photograph of his apparatus is shown.



Electrons were accelerated through a potential difference to produce a beam of high-energy electrons. The beam was then deflected in perpendicular directions by the magnetic and electric fields. The final position of the beam on the screen was determined by the charge and mass of the electrons.

Explain how electrons from the source become a beam of high-energy electrons.

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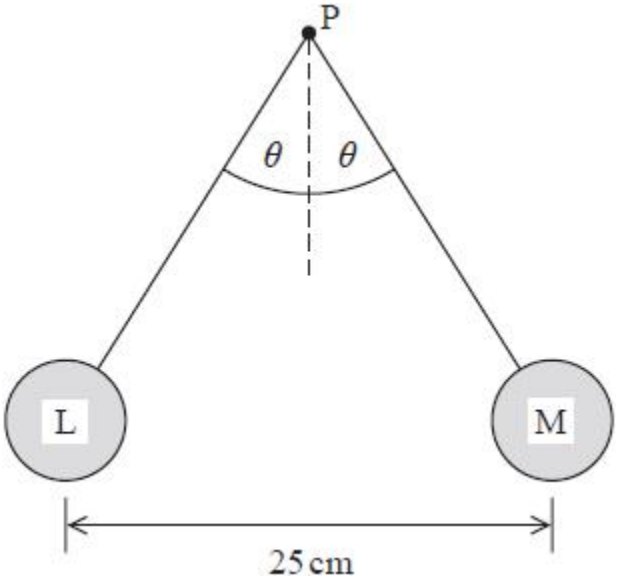
(Total for question = 2 marks)

Q7.

Two small spheres L and M are attached to non-conducting threads and suspended from a point P. Each sphere is given an equal positive charge of 4.0×10^{-7} C. The spheres hang in equilibrium as shown in the diagram.

The mass of each sphere is 2.7 g.



By considering the forces acting on one of the spheres, calculate the tension in the thread and the angle θ.

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Tension = ...

θ = ...

Q8.

A lamp consists of a filament in a vacuum. Under normal working conditions the filament has a temperature of 1600 K. A similar filament lamp that is gas-filled has a filament temperature of 3200 K.

The ratio of the wavelength at which maximum intensity of radiation is emitted by the vacuum lamp to that for the gas-filled lamp is

- **A** 1:2
- **B** 1:1
- **C** 2:1
- **D** 16:1

(Total for Question = 1 mark)