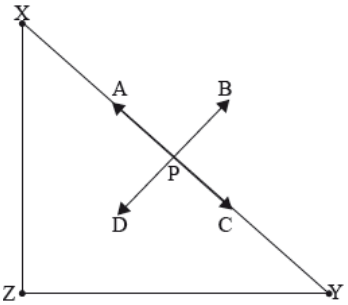
5.1 Practice Questions *[14 marks]*

1. Three positive point charges of equal magnitude are held at the corners X, Y and Z of a right-angled triangle. The point P is at the midpoint of XY. Which of the arrows shows the direction of the electric field at point P? *[1 mark]*



Markscheme

B

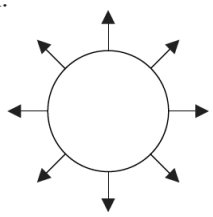
2. Which of the following is the SI unit of gravitational field strength? *[1 mark]*

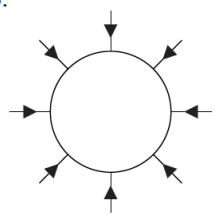
A. N
B. N m
C. Nkg^{-1}
D. Nm^2kg^{-2}

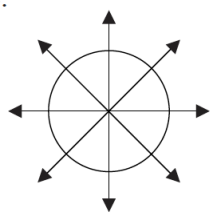
Markscheme

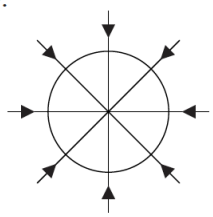
C

3. Which of the following is the best representation of the electric field lines around a negatively charged metal sphere? *[1 mark]*

A.


B.


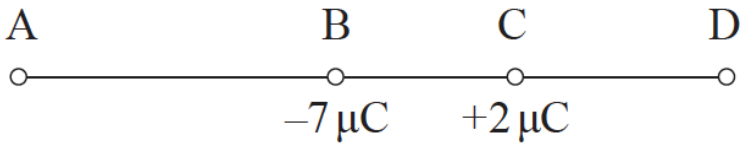
C.


D.


Markscheme

B

4. Two isolated point charges, -7 μC and +2 μC, are at a fixed distance apart. At which point is it possible for the electric field strength to be zero? *[1 mark]*



(not to scale)

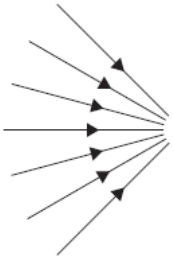
Markscheme

D

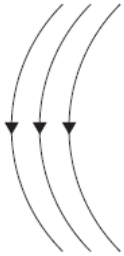
5. A positively charged particle follows a circular path as shown below. *[1 mark]*

Which of the following electric fields could have caused the charged particle to follow the above path?

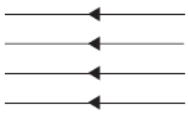
A.



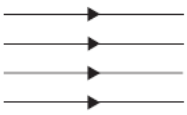
B.



C.



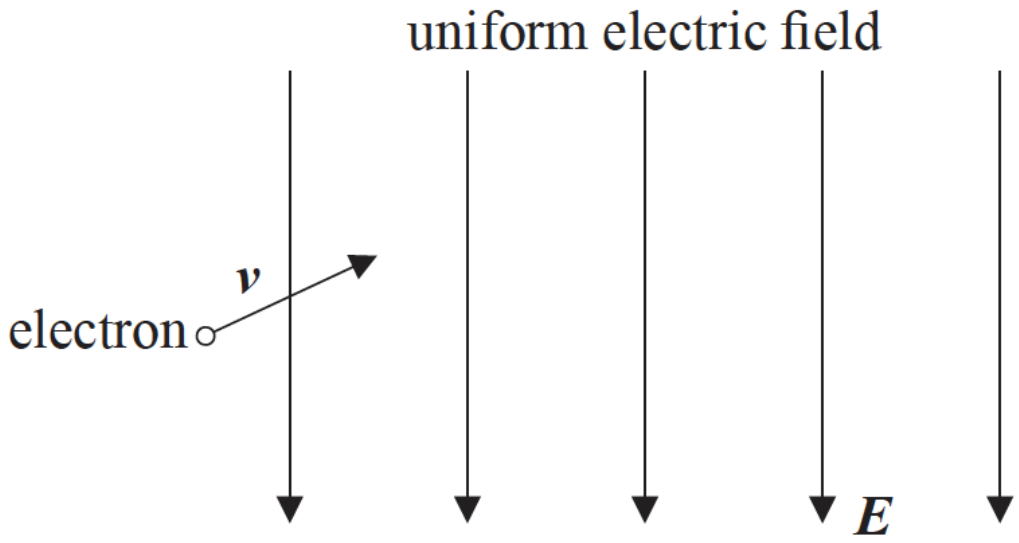
D.



Markscheme

A

6. The diagram below shows a uniform electric field of strength ***E***. The field is in a vacuum. *[1 mark]*



An electron enters the field with a velocity ***v*** in the direction shown. The electron is moving in the plane of the paper. The path followed by the electron will be

1. parabolic.
2. in the direction of ***E***.
3. in the direction of ***v***.
4. circular.

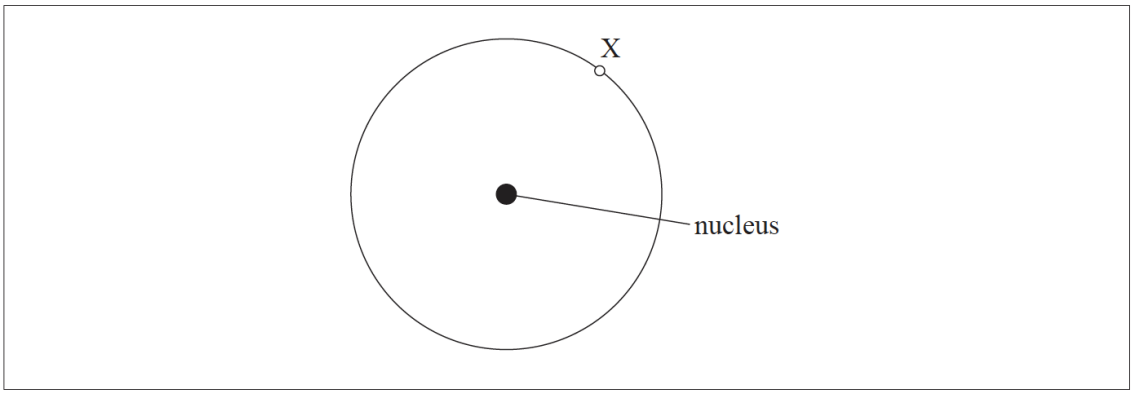
Markscheme

A

This question is in **two** parts. **Part 1** is about the properties of tungsten. **Part 2** is about the properties of a gas.

Part 1 Properties of tungsten

An isolated nucleus of an atom of the metal tungsten contains 74 protons.



Point X is 140 pm from the nucleus.

7. (i) On the diagram above, draw an arrow to show the direction of the electric field at point X. *[3 marks]*

(ii) Assuming the nucleus acts as a point charge, determine the magnitude of the electric field strength at point X.

Markscheme

(i) arrow pointing away from nucleus;

(ii) $E = \frac{74 \times 1.6 \times 10^{-19}}{4\pi \times 8.85 \times 10^{-12} \times \left[1.4 \times 10^{-10}\right]^2}$;

$5.4 \times 10^{12}\,\text{Vm}^{-1}$ or NC^{-1};

*Award **[2]** for a bald correct answer.*

This question is in **two** parts. **Part 1** is about a lightning discharge. **Part 2** is about fuel for heating.

Part 1 Lightning discharge

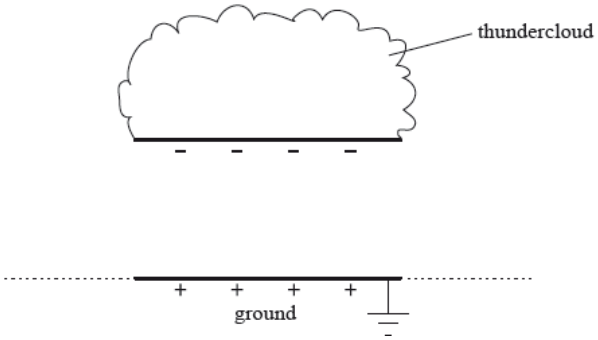
8a. Define *electric field strength*. *[2 marks]*

Markscheme

force acting per unit charge;

on positive test / point charge;

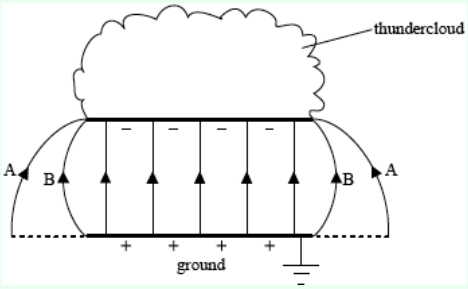
8b. A thundercloud can be modelled as a negatively charged plate that is parallel to the ground. *[3 marks]*



The magnitude of the charge on the plate increases due to processes in the atmosphere. Eventually a current discharges from the thundercloud to the ground.

On the diagram, draw the electric field pattern between the thundercloud base and the ground.

Markscheme



lines connecting plate and ground equally spaced in the central region of thundercloud and touching both plates; *(judge by eye)*

edge effects shown; *(accept either edge effect A or B shown on diagram)*

field direction correct;