7 The force between two identical point charges, X and Y, is F.

Charge X is doubled; charge Y remains the same.

Which row of the table gives the force on each charge?

	X	Y
☒ A	F	F
☒ B	F	$2F$
☒ C	$2F$	F
☒ D	$2F$	$2F$

(Total for Question 7 = 1 mark)

0·

☒ —

☒ $\overline{2}$
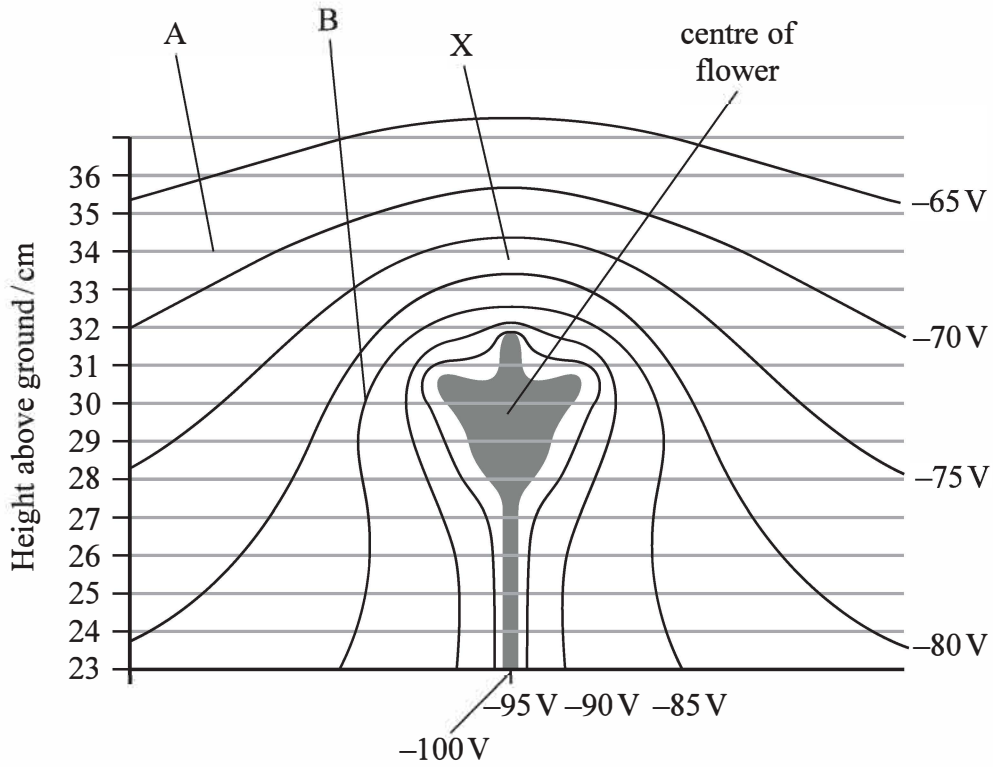
☒ 0

☒ 0

(Total for Question 8 = 1 mark)

13 Some flowers are negatively charged and surrounded by an electric field. This helps to attract bees.

(a) State what is meant by an electric field.

(1)

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(b) The diagram shows lines of equipotential surrounding a flower.

(i) Determine the electric field strength at X.

(3)

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Electric field strength at X = ...

(ii) Draw the electric field line between point A and point B on the diagram.

(2)

(iii) An equation for electric potential V is

$$V = \frac{Q}{4\pi\varepsilon_0 r}$$

This applies to a radial field.

Deduce whether the electric field in the region directly above the flower is radial. You should take values from the diagram. A graphical method is not required.

(3)

(c) A bee has short hairs which are thought to carry charge.

State how the bee might use this to detect the electric field of a flower.

(1)

(d) When the bee is collecting nectar from the plant, the electric field strength decreases. It is thought that this warns other bees that the nectar supply is low.

State the effect of a decreased electric field strength on the equipotential lines.

(1)

(Total for Question 13 = 11 marks)

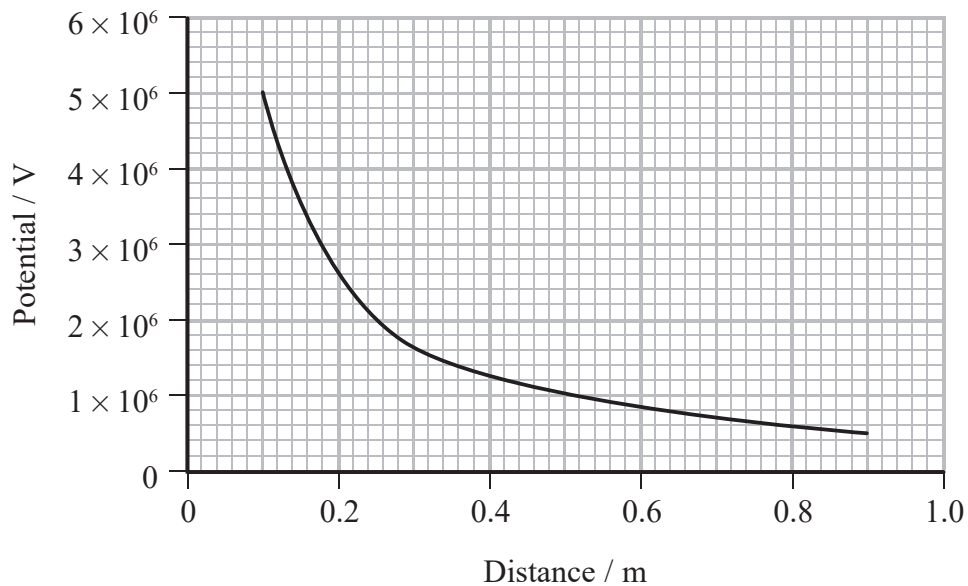*Turn over* ▶

16 (a) Sketch the electric field around a positive point charge.

(3)

●

(b) The graph shows how potential varies with distance from the centre of a charged sphere.

Distance / m

Air molecules will be ionised if the electric field strength exceeds $3 \times 10^6 \, \text{V} \, \text{m}^{-1}$.

Deduce whether air molecules will be ionised at a distance of 30 cm from the centre of this sphere.

(4)

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(c) A magician did a trick which he claimed was the most dangerous ever. He positioned himself midway between two charged spheres which were separated by a distance of about two metres. Each sphere was charged to a potential that would cause ionisation at a distance of one metre. He wore a protective suit of chain mail and a helmet consisting of a metal cage. The protective suit and helmet were earthed to a potential of 0 V.

A scientist said "there is no danger in this and I would happily do it tomorrow".

Explain whether this statement is justified.

(3)

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(Total for Question 16 = 10 marks)

7 A potential difference V is applied across two parallel plates. An electron midway between the two plates at point X experiences an electric force F.

$$0\,V \qquad +V$$

Y X
• •
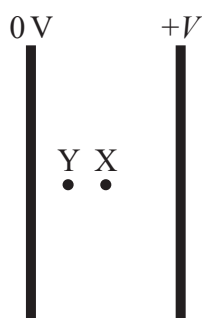
The electron moves to point Y which is halfway between point X and the left-hand plate.

Which of the following is the electric force experienced by the electron at Y?

☒ **A** $2F$

☒ **B** F

☒ **C** $\dfrac{F}{2}$

☒ **D** $\dfrac{F}{4}$

(Total for Question 7 = 1 mark)

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