

Electric Fields Past Paper Questions

1. The force between two point charges is F when they are separated by a distance r . If the separation is increased to $3r$ what is the force between the charges?

A $\frac{F}{3r}$

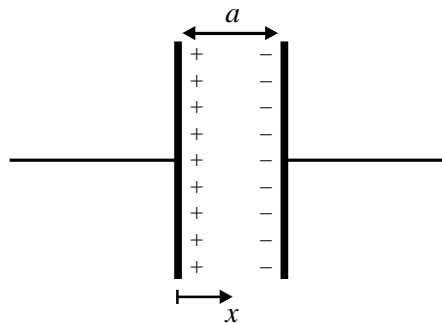
B $\frac{F}{9r}$

C $\frac{F}{3}$

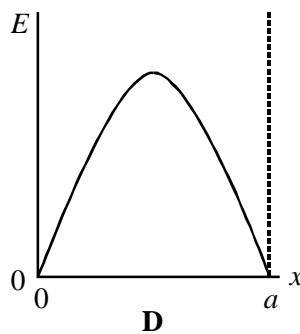
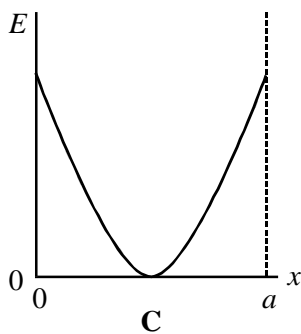
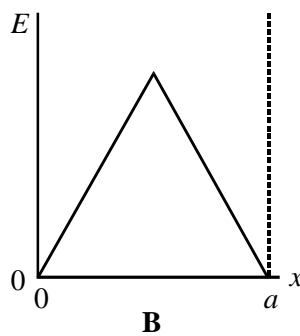
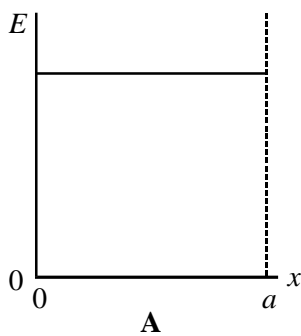
D $\frac{F}{9}$

(Total 2 marks)

2.



Two parallel metal plates of separation a carry equal and opposite charges. Which one of the following graphs, **A** to **D**, best represents how the electric field strength E varies with the distance x in the space between the plates?



(Total 2 marks)

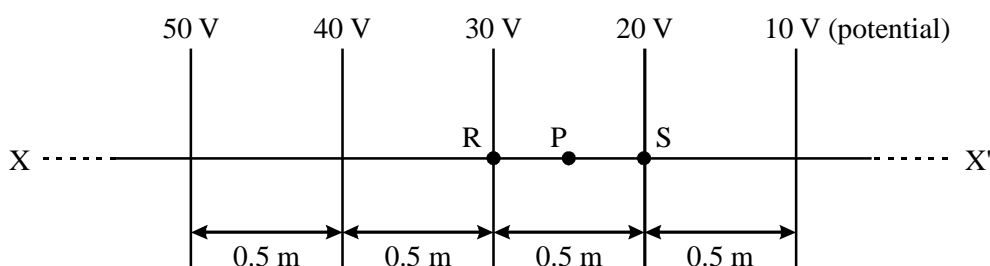
3. Two horizontal parallel plate conductors are separated by a distance of 5.0 mm in air. The lower plate is earthed and the potential of the upper plate is + 50 V.

Which line, **A** to **D**, gives correctly the electric field strength, E , and the potential, V , at a point midway between the plates?

	<i>electric field strength $E/V\ m^{-1}$</i>	<i>potential V/V</i>
A	1×10^4 upwards	25
B	1×10^4 downwards	25
C	1×10^4 upwards	50
D	1×10^4 downwards	50

(Total 2 marks)

4.



The diagram shows how the electric potential varies along a line XX' in an electric field. What will be the electric field strength at a point P on XX' which is mid-way between R and S ?

- A** $5.0\ V\ m^{-1}$
- B** $10\ V\ m^{-1}$
- C** $20\ V\ m^{-1}$
- D** $30\ V\ m^{-1}$

(Total 2 marks)

5. (a) Complete the table of quantities related to fields. In the second column, write an SI unit for each quantity. In the third column indicate whether the quantity is a scalar or a vector.

quantity	SI unit	scalar or vector
gravitational potential		
electric field strength		
magnetic flux density		

(3)

- (b) (i) A charged particle is held in equilibrium by the force resulting from a vertical electric field. The mass of the particle is 4.3×10^{-9} kg and it carries a charge of magnitude 3.2×10^{-12} C. Calculate the strength of the electric field.

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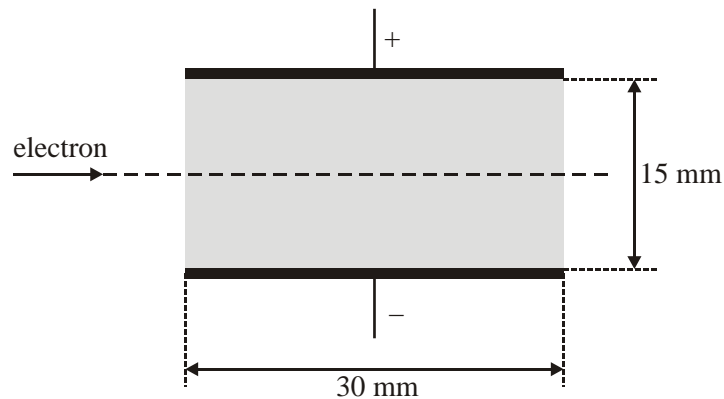
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- (ii) If the electric field acts upwards, state the sign of the charge carried by the particle

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(3)
(Total 6 marks)

6. (a) An electron travels at a speed of 3.2×10^7 ms⁻¹ in a horizontal path through a vacuum. The electron enters the uniform electric field between two parallel plates, 30 mm long and 15 mm apart, as shown in the figure below. A potential difference of 1400 V is maintained across the plates, with the top plate having positive polarity. Assume that there is no electric field outside the shaded area.



- (i) Show that the electric field strength between the plates is 9.3×10^4 Vm⁻¹.

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- (ii) Calculate the time taken by the electron to pass through the electric field.

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- (iii) Show that the acceleration of the electron whilst in the field is $1.6 \times 10^{16} \text{ m s}^{-2}$ and state the direction of this acceleration.

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(5)

- (b) Determine the magnitude and direction of the velocity of the electron at the point where it leaves the field.

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(3)

(Total 8 marks)