Electric Field - 2018

1. 9702/11/M/J/18/No.28

   A particle has a charge of +2.0 mC and is in a vertical uniform electric field. An electric force of 1.0×10^{-2} N acts upwards on the particle.
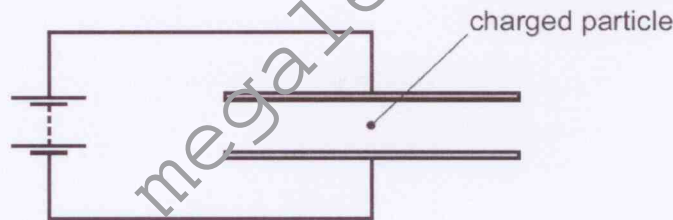
   What is the electric field strength?

   $E = \dfrac{F}{Q} = \dfrac{1.0 \times 10^{-2}}{2 \times 10^{-3}}$

   A   0.20 V m^{-1} downwards

   B   0.20 V m^{-1} upwards

   $= 5 V m^{-1}$ upwards

   C   5.0 V m^{-1} downwards

   D   5.0 V m^{-1} upwards ✓

2. 9702/11/M/J/18/No.29

   A charged particle is in the electric field between two horizontal metal plates connected to a battery, as shown. There is a force F on the particle due to the electric field.

   charged particle

   The separation of the plates is doubled.

   What is the new force on the particle?

   A $\dfrac{F}{4}$ B $\dfrac{F}{2}$ ✓   C F D $2F$

   $\dfrac{f}{\varepsilon} = \dfrac{v}{d}$
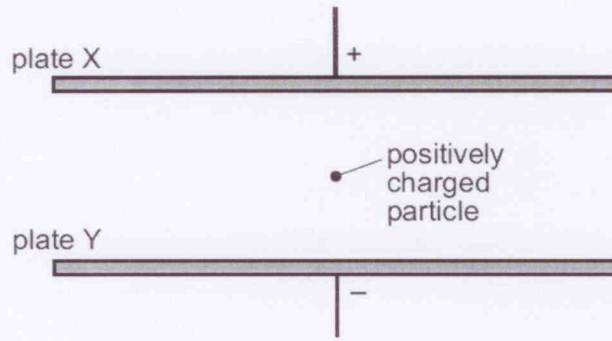
   $f = \dfrac{Vq}{d}$

   $f_2 = \dfrac{Vq}{2d}$

   i-Substitute f in f_2.

   $f_2 = \dfrac{f}{2}$

3. 9702/12/M/J/18/No.30
    Two large parallel metal plates X and Y are situated in a vacuum as shown.

    plate X $+$

    positively charged particle

    plate Y $-$

    (handwritten) — +ve particle is repelled by plate x and attracted by plate y.
    — The two forces are equal
    — The force is constant.

   Plates X and Y carry equal and opposite charges.

    What happens to the force on a positively charged particle as it moves from plate X to plate Y?

    A   It decreases because the positively charged particle is moving away from the positively charged plate.

    B   It decreases because the positively charged particle is moving in the direction of the electric field between the plates.

    C   It increases because the positively charged particle is moving closer to a negatively charged plate.

    D   It remains constant because the positively charged particle is in the uniform electric field between the plates.

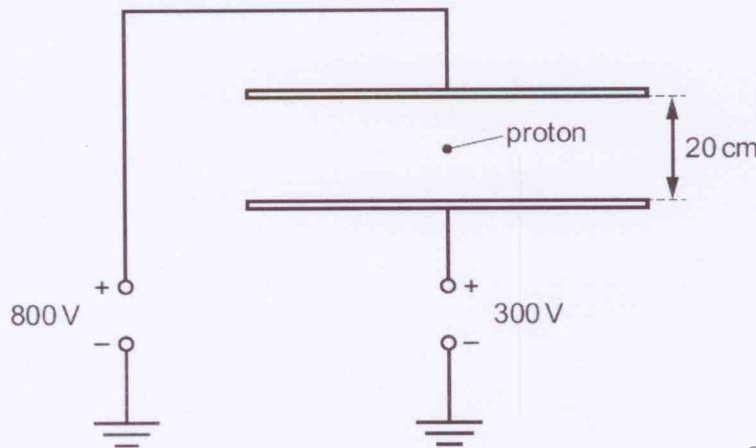4. 9702/12/M/J/18/No.31
    Four diagrams representing the electric field between two oppositely-charged point charges are shown.

    Which diagram correctly shows the electric field lines?

    A

    B

    C

    D

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www.youtube.com/megalecture
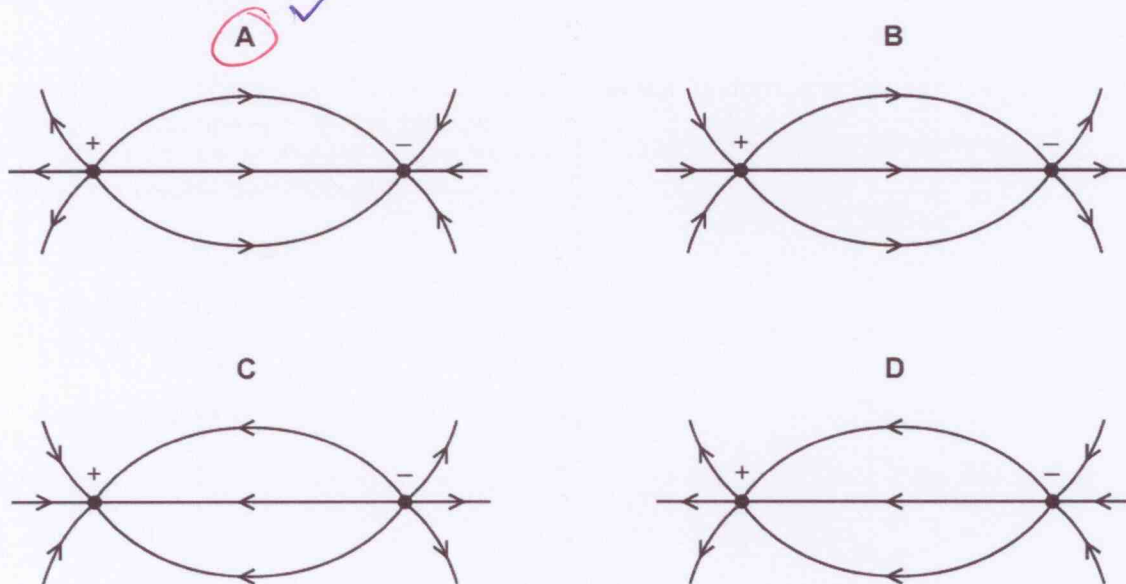
5. 9702/13/M/J/18/No.27

Two parallel metal plates are situated 20 cm apart in a vacuum. They are connected to two sources of potential difference as shown.

A proton is released in the space between the plates.

What is the magnitude and direction of the acceleration of the proton?

A $2.4 \times 10^{11} \, \text{m s}^{-2}$ downwards

B $2.4 \times 10^{11} \, \text{m s}^{-2}$ upwards

C $5.3 \times 10^{11} \, \text{m s}^{-2}$ downwards

D $5.3 \times 10^{11} \, \text{m s}^{-2}$ upwards

(Handwritten working:)

$f = \dfrac{Vq}{d}$

$= \dfrac{500 \times 1.6 \times 10^{-19}}{0.2}$

$= 4 \times 10^{-16} \, \text{N}$

$f = ma$

$a = \dfrac{f}{m_p}$

$= \dfrac{4 \times 10^{-16} \, \text{N}}{1.67 \times 10^{-27} \, \text{kg}}$

$= 2.395 \times 10^{11} \, \text{m s}^{-2}$

$\approx 2.4 \times 10^{11} \, \text{m s}^{-2}$

downwards since proton is +ve upper plate is +vely charged.

P.d across plate = 800 - 300 = 500 V.

Charge on proton = +1.6 × 10⁻¹⁹ C

d = 0.2 m.

mass of proton = 1.67 × 10⁻²⁷ g.

6. 9702/13/M/J/18/No.28

A particle having mass m and charge +q enters a uniform electric field with speed v.

Initially, the particle is travelling at right-angles to the electric field.

During its movement through the field, the particle is deflected through distance d, as shown.

path of particle

region of uniform electric field
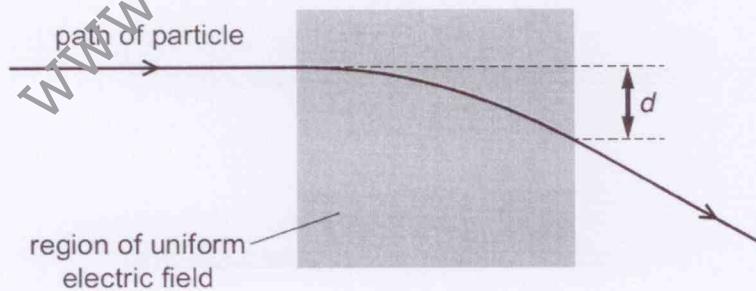
A second particle of mass 2m, charge +q and speed v enters the electric field along the same path.

What is the distance through which this particle is deflected in the electric field?

A $\dfrac{d}{4}$

B $\dfrac{d}{2}$

C $2d$

D $4d$

**7.** 9702/13/M/J/18/No.29

What is a possible charge on a particle? — charge should be multiple of 1.6×10^{-19} C.

A 6.40×10^{-20} C

B 4.00×10^{-19} C

C 1.12×10^{-18} C ✓

D 9.11×10^{-18} C

$2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19}$

$3 \times 1.6 \times 10^{-19} = 4.8 \times 10^{-19}$

$4 \times 1.6 \times 10^{-19} = 6.4 \times 10^{-19}$

$5 \times 1.6 \times 10^{-19} = 8.0 \times 10^{-19}$

$6 \times 1.6 \times 10^{-19} = 9.6 \times 10^{-19}$

$7 \times 1.6 \times 10^{-19} = 1.12 \times 10^{-18}$

8. 9702/12/F/M/18/No.12

A charged oil drop is held stationary between two charged parallel plates.

top plate

charged oil drop

bottom plate
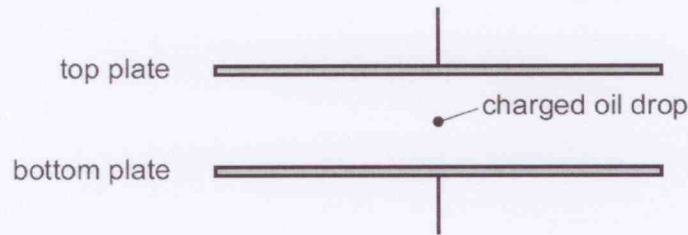
Which forces act on the oil drop?

A both electric and gravitational ✓

B electric only

C gravitational only

D neither electric nor gravitational

— oil drop is matter

— It is attracted by gravity.

— oil drop is charged

— It will feel force due to electric field.

9. 9702/12/F/M/18/No.30

An electron passes into the space between two parallel plates that are 5.0 cm apart and which are maintained at electric potentials of +2000 V and −500 V, respectively.

+2000 V

electron

5.0 cm
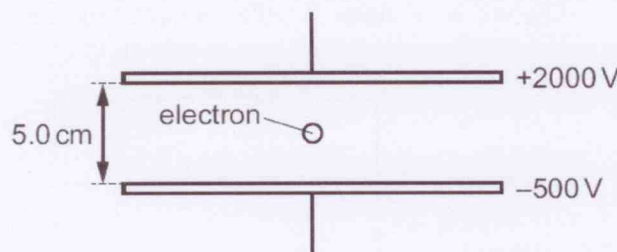
−500 V

What is the electric force on the electron?

A 1.6×10^{-15} N

B 4.8×10^{-15} N

C 6.4×10^{-15} N

D 8.0×10^{-15} N ✓

$p.d = 2000 - (-500)$

$= 2000 + 500$

$= 2500 V.$

$F = e\dfrac{V}{d}$

$= \dfrac{1.6 \times 10^{-19} C \times 2500 V}{0.05 m}$

$= 8.0 \times 10^{-15} N$

10. 9702/12/F/M/18/No.31

Which statement about electric charges in a uniform electric field is **not** correct?

A Electric charges of the same magnitude, whether positive or negative, experience the same magnitude of force when placed in the same uniform electric field.

B The direction of the force on a positive charge placed in a uniform electric field is independent of the magnitude of the charge.

C The magnitude of the force on a positive charge placed in a uniform electric field is proportional to the magnitude of the electric field strength.

D The work done to move a positive charge a certain distance in a uniform electric field is independent of the direction of the movement.

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