

Electric Potential

TOPIC QUESTIONS

Level	A Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

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?

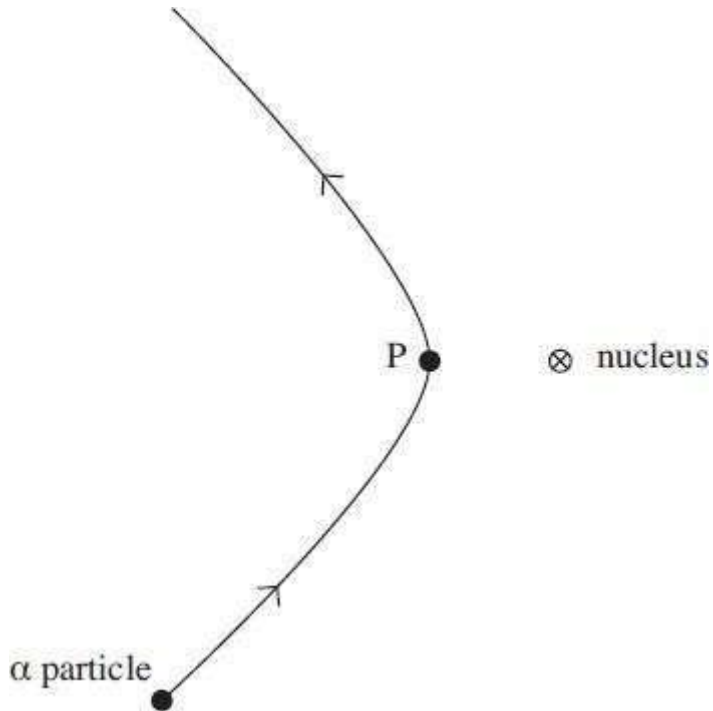
A $\frac{F}{3r}$

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

C $\frac{F}{3}$

D $\frac{F}{9}$

2. The diagram shows the path of an α particle deflected by the nucleus of an atom.
Point P on the path is the point of closest approach of the α particle to the nucleus.



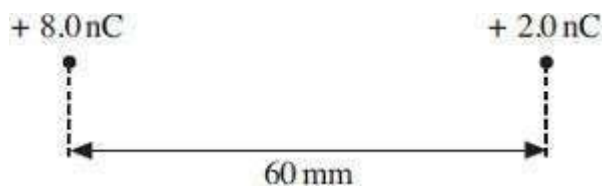
Which one of the following statements about the α particle on this path is correct?

- A Its acceleration is zero at P.
- B Its kinetic energy is greatest at P.
- C Its speed is least at P.
- D Its potential energy is least at P.

3. A repulsive force F acts between two positive point charges separated by a distance r . What will be the force between them if each charge is doubled and the distance between them is halved?

- A F
- B $2F$
- C $4F$
- D $16F$

4. The distance between two point charges of $+ 8.0 \text{ nC}$ and $+ 2.0 \text{ nC}$ is 60 mm .



At a point between the charges, on the line joining them, the resultant electric field strength is zero. How far is this point from the $+ 8.0 \text{ nC}$ charge?

- A 20 mm
- B 25 mm
- C 40 mm
- D 45 mm

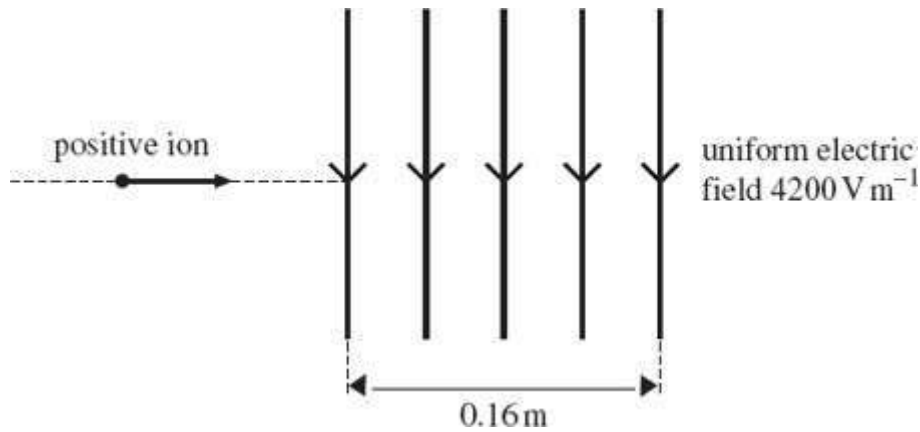
5. Which one of the following **cannot** be used as a unit for electric field strength?

- A $\text{J m}^{-1} \text{C}^{-1}$
- B $\text{J A}^{-1} \text{s}^{-1} \text{m}^{-1}$
- C $\text{N A}^{-1} \text{s}^{-1}$
- D J C m^{-1}

6. An electron and a proton are $1.0 \times 10^{-10} \text{ m}$ apart. In the absence of any other charges, what is the electric potential energy of the electron?

- A $+2.3 \times 10^{-18} \text{ J}$
- B $-2.3 \times 10^{-18} \text{ J}$
- C $+2.3 \times 10^{-8} \text{ J}$
- D $-2.3 \times 10^{-8} \text{ J}$

7.



An ion carrying a charge of $+4.8 \times 10^{-19} \text{C}$ travels horizontally at a speed of $8.0 \times 10^5 \text{ms}^{-1}$. It enters a uniform vertical electric field of strength 4200 V m^{-1} , which is directed downwards and acts over a horizontal distance of 0.16m . Which one of the following statements is **not** correct?

- A The ion passes through the field in $2.0 \times 10^{-7} \text{s}$.
 - B The force on the ion acts vertically downwards at all points in the field.
 - C The magnitude of the force exerted on the ion by the field is $1.6 \times 10^{-9} \text{N}$.
 - D The horizontal component of the velocity of the ion is unaffected by the electric field.
8. The electric potential at a distance r from a positive point charge is 45 V . The potential increases to 50 V when the distance from the charge decreases by 1.5 m . What is the value of r ?
- A 1.3 m
 - B 1.5 m
 - C 7.9 m
 - D 15 m

9. The repulsive force between two small negative charges separated by a distance r is F .

What is the force between the charges when the separation is reduced to $\frac{r}{3}$?

- A $\frac{F}{9}$
- B $\frac{F}{3}$
- C $3F$
- D $9F$

10. What is the acceleration of an electron at a point in an electric field where the field strength is $1.5 \times 10^5 \text{ V m}^{-1}$?

- A $1.2 \times 10^6 \text{ m s}^{-2}$
- B $1.4 \times 10^{13} \text{ m s}^{-2}$
- C $2.7 \times 10^{15} \text{ m s}^{-2}$
- D $2.6 \times 10^{16} \text{ m s}^{-2}$

11. At a distance L from a fixed point charge, the electric field strength is E and the electric potential is V .

What are the electric field strength and the electric potential at a distance $3L$ from the charge?

	Electric field strength	Electric potential
A	$\frac{E}{3}$	$\frac{V}{9}$
B	$\frac{E}{3}$	$\frac{V}{3}$
C	$\frac{E}{9}$	$\frac{V}{3}$
D	$\frac{E}{9}$	$\frac{V}{9}$

12. The diagram shows a particle with charge $+Q$ and a particle with charge $-Q$ separated by a distance d .

The particles exert a force F on each other.



An additional charge of $+2Q$ is then given to each particle and their separation is increased to $2d$.

What is the force that now acts between the particles?

- A an attractive force of $\frac{9}{2}F$
- B an attractive force of $\frac{9}{4}F$
- C a repulsive force of $\frac{3}{2}F$
- D a repulsive force of $\frac{3}{4}F$

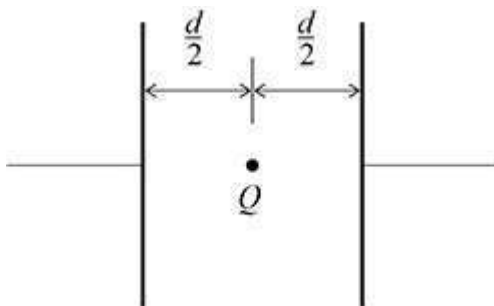
13. Two protons are separated by distance r .

The electrostatic force between the two protons is X times the gravitational force between them.

What is the best estimate for X ?

- A 10^{20}
- B 10^{28}
- C 10^{36}
- D 10^{42}

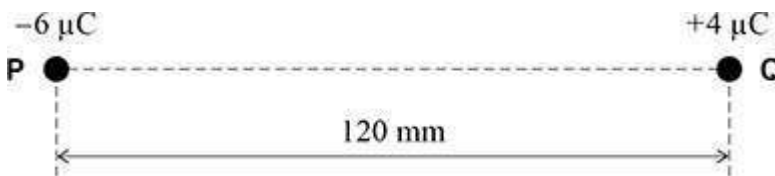
14. Two parallel metal plates separated by a distance d have a potential difference V across them. A particle with charge Q is placed midway between the plates.



What is the magnitude of the electrostatic force acting on the particle?

- A zero
- B $\frac{QV}{2d}$
- C $\frac{QV}{d}$
- D $\frac{2QV}{d}$

15. Two charged particles **P** and **Q** are separated by a distance of 120 mm.
X is a point on the line between **P** and **Q** where the electric potential is zero.

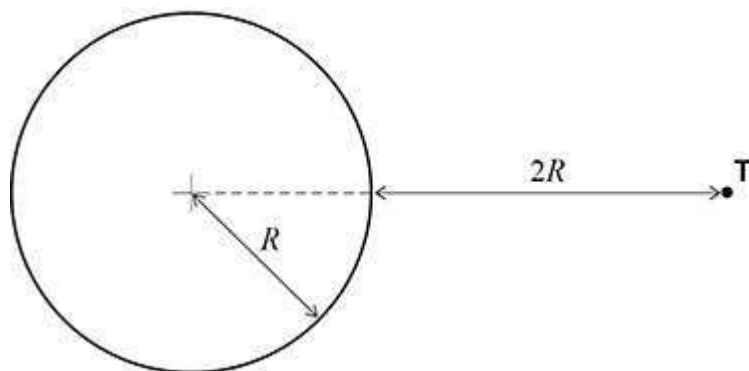


What is the distance from **P** to **X**?

- A 40 mm
- B 48 mm
- C 60 mm
- D 72 mm

16. An isolated spherical conductor is charged.

The conductor has a radius R and an electric potential V . The electric field strength at its surface is E .

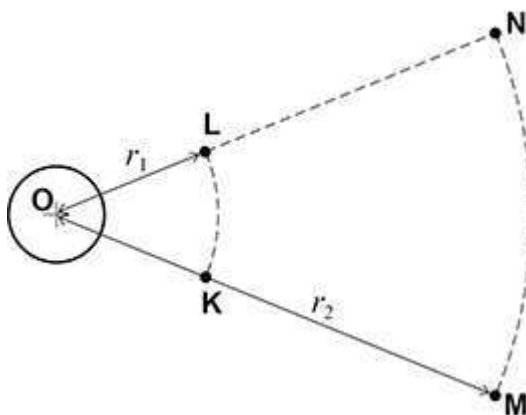


Point **T** is a distance $2R$ from the surface.

What are the electric field strength and electric potential at **T**?

	Electric field strength	Electric potential
A	$\frac{E}{2}$	$\frac{V}{4}$
B	$\frac{E}{3}$	$\frac{V}{9}$
C	$\frac{E}{4}$	$\frac{V}{2}$
D	$\frac{E}{9}$	$\frac{V}{3}$

17. **O** is the centre of a negatively charged sphere.

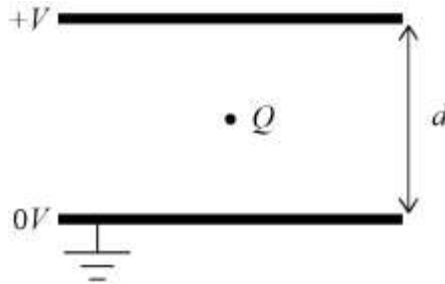


K and **L** are two points at a distance r_1 from **O.M**
and **N** are two points at a distance r_2 from **O**.

Which statement is true?

- A The work done moving an electron from **M** to **K** is the same as that done moving an electron from **K** to **L**.
- B The work done moving a positron from **K** to **M** is the same as that done moving an electron from **K** to **M**.
- C No work is done moving an electron from **M** to **N**.
- D No work is done moving a positron from **L** to **N**.

18. A small object of mass m has a charge Q . The object remains stationary in an evacuated space between two horizontal plates. The plates are separated by a distance d and the potential difference between the plates is V .



What is V ?

- A $\frac{mQg}{d}$
- B $\frac{mdg}{Q}$
- C $\frac{mQ}{d}$
- D $\frac{md}{Q}$

19. mJ of work is done when a charge of $30 \mu\text{C}$ is moved between two points, **M** and **N**, in an electric field.

What is the potential difference between **M** and **N**?

A 20 mV

B 20 V

C 45 V

D 50 V

20. A parallel-plate capacitor is fully charged and then disconnected from the power supply. A dielectric is then inserted between the plates.

Which row correctly identifies the charge on the plates and the electric field strength between the plates?

	Charge	Electric field strength
A	Stays the same	Increases
B	Increases	Decreases
C	Increases	Increases
D	Stays the same	Decreases