Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 7_ Electric Field

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Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A charged capacitor is discharged through a resistor. The potential difference across the capacitor halved in a time *t*. The time constant is *T*.

Which of the following is the equation for *t*?

☐ **A** $t = \frac{\ln 2}{T}$

☐ **B** $t = \ln \frac{1}{2T}$

☐ **C** $t = T \ln \frac{1}{2}$

☐ **D** $t = T \ln 2$

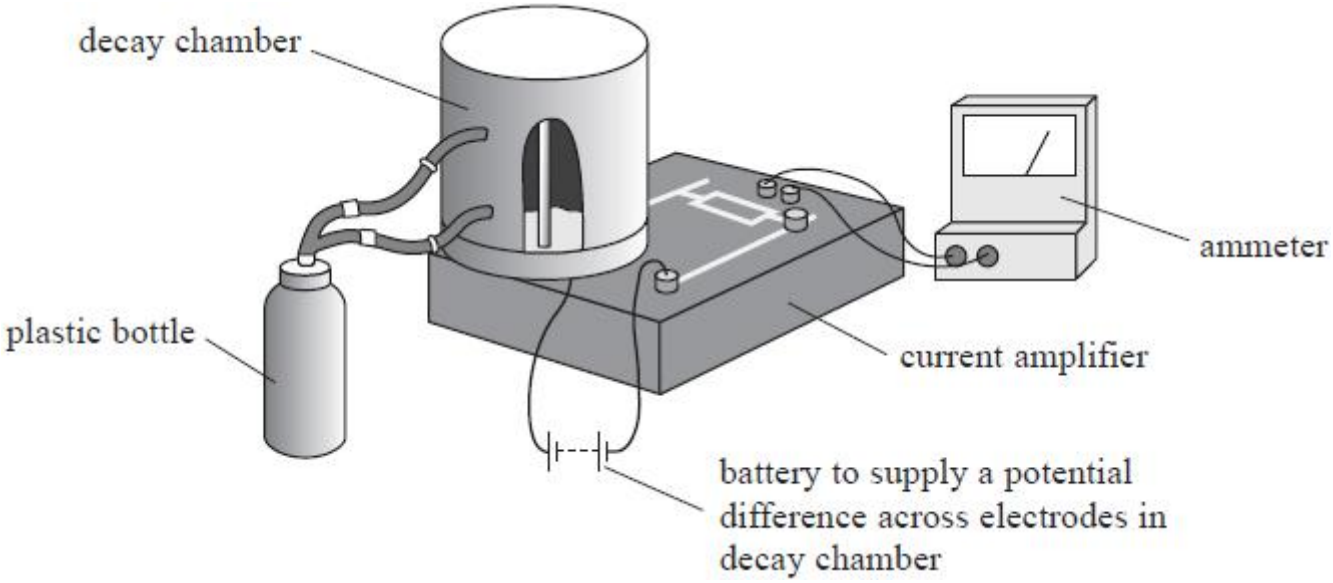
(Total for question = 1 mark)

Q2.

Radon is a radioactive gas. One isotope of radon, $^{220}_{86}Rn$, decays to polonium, Po, by emitting an alpha particle.

The diagram shows apparatus for monitoring the decay of radon in the laboratory.
Radon gas is produced in the plastic bottle from the decay of radium. A small amount of radon is then inserted into the decay chamber by squeezing the plastic bottle.
A current is produced between two electrodes inside the chamber. This current is amplified and recorded by the ammeter.

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(i) Explain why a current is produced in the decay chamber.

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(ii) A teacher is demonstrating the operation of the decay chamber to her class. She squeezes the bottle to introduce radon into the chamber.

She claims that within 450 s the activity of the radon in the chamber will be less than 1% of its initial value.
Assess whether her claim is correct.
half-life of radon = 55.6 s

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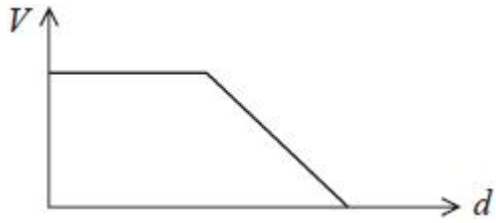
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Q3.

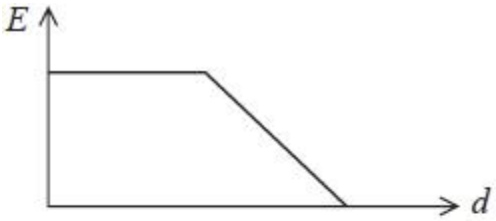
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The graph shows how the potential *V* varies with distance *d* in an electric field.

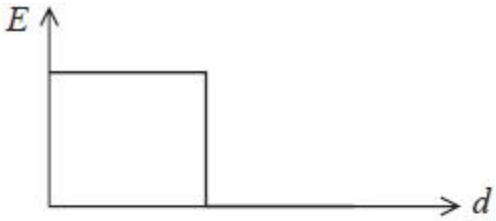
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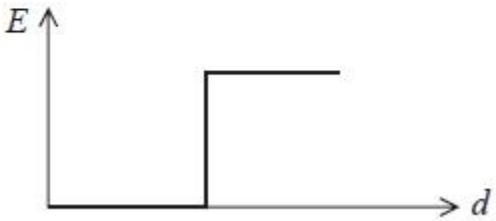
Which of the following shows the corresponding variation in electric field strength *E*?



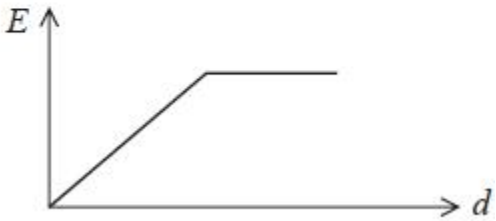
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(Total for question = 1 mark)

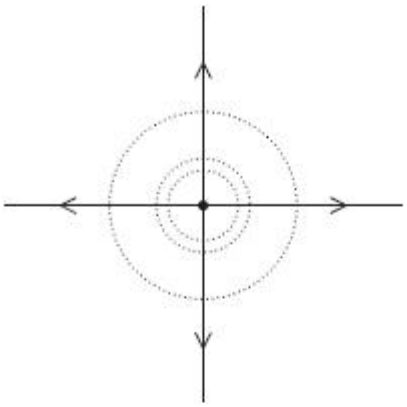
Q4.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

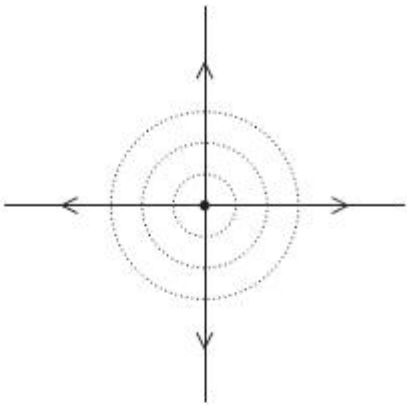
A point object has a charge +Q.

Which of the following diagrams shows equipotential lines differing by a constant potential difference, and electric field lines around the object?

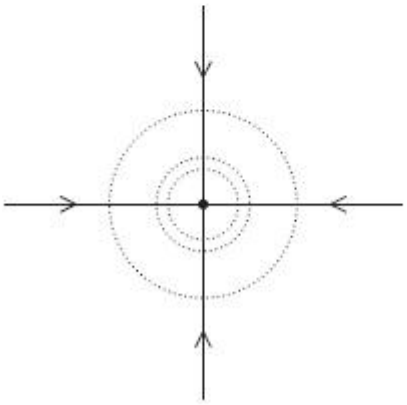
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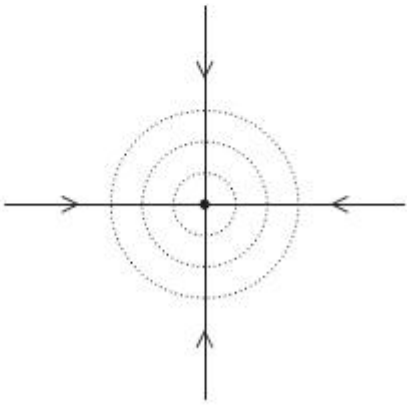
☐ **A**



☐ **B**



☐ **C**



☐ **D**

(Total for question = 1 mark)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Alpha particle scattering investigations were first carried out in the early part of the 20th century.

An alpha particle with initial kinetic energy 8.8×10^{-13}J approaches a nucleus of a gold $\left({}^{197}_{79}\mathrm{Au}\right)$ atom.

Which of the following is an equation for the closest distance *r*, in metres, between the alpha particle and the nucleus?

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☒ **A** $r = 8.99 \times 10^{9} \left(\dfrac{2 \times 1.6 \times 10^{-19} \times 79 \times 1.6 \times 10^{-19}}{8.8 \times 10^{-13}} \right)$

☒ **B** $r = \dfrac{2 \times 1.6 \times 10^{-19} \times 197 \times 1.6 \times 10^{-19}}{8.99 \times 10^{9} \times 8.8 \times 10^{-13}}$

☒ **C** $r = 8.99 \times 10^{9} \left(\dfrac{8.8 \times 10^{-13}}{4 \times 1.6 \times 10^{-19} \times 79 \times 1.6 \times 10^{-19}} \right)$

☒ **D** $r = 8.99 \times 10^{9} \left(\dfrac{2 \times 79}{8.8 \times 10^{-13}} \right)$

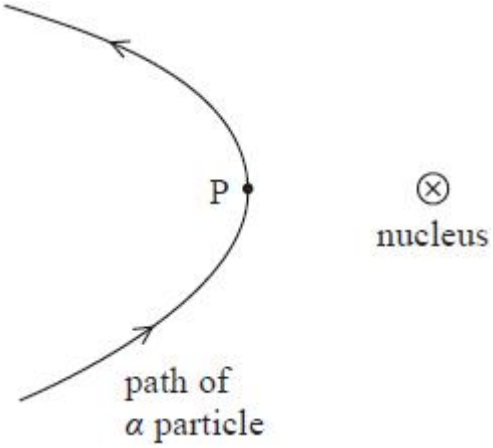
(Total for question = 1 mark)

Q6.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Alpha particle scattering investigations were first carried out in the early part of the 20th century.

The diagram shows the path of an *α* particle that is being deflected by the nucleus of a gold atom. The closest distance of approach of the *α* particle to the nucleus is at point P.



Which row in the table describes the speed and potential energy of the *α* particle at point P on this path?

	Speed at P	Potential energy at P
☒ **A**	greatest	greatest
☒ **B**	greatest	least
☒ **C**	least	greatest
☒ **D**	least	least

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(Total for question = 1 mark)

Q7.

Our understanding of the atom has developed over time, from early models in which atoms were considered to be hard incompressible spheres, through to the nuclear model of the atom and the ladder model in which electrons exist in a discrete number of allowed energy states.

The nuclear model of the atom was established following a series of experiments in which alpha particles were directed at thin gold foil.

(i) An alpha particle approaching a gold nucleus, $^{197}_{79}Au$, head-on will be brought to rest and returned along its original path.

Calculate the minimum distance between the alpha particle and the nucleus for alpha particles of energy of 5.5 MeV.

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Minimum distance = ...

(ii) It is observed that electrons, with energy of 5.5 keV, are diffracted as they pass through the thin gold foil.

Explain a conclusion about the electrons that can be made from this observation.

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(Total for question = 7 marks)

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