

# Electrostatics, Fields and Potential

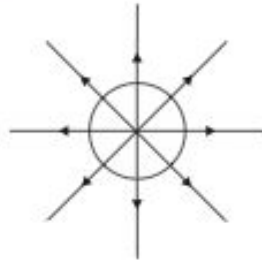
16. An alpha particle is accelerated through a potential difference of 10 kV. Its gain in kinetic energy is
- A. 10 eV.
  - B. 20 eV.
  - C. 10 keV.
  - D. 20 keV.

- 12 -

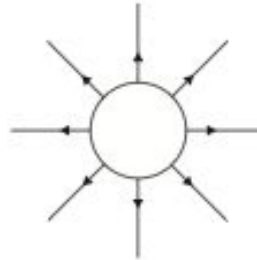
M09/4/PHYSI/SPM/ENG/TZ1/XX

20. Which diagram best represents the electric field due to a negatively charged conducting sphere?

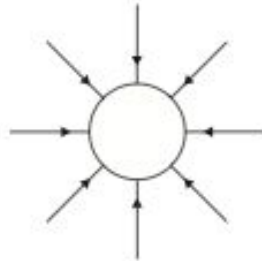
A.



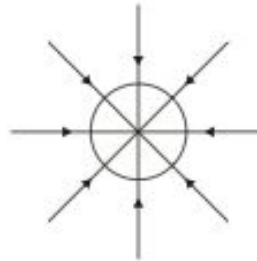
B.



C.

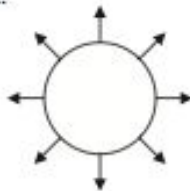


D.

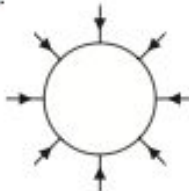


20. Which of the following is the best representation of the electric field lines around a negatively charged metal sphere?

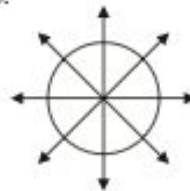
A.



B.



C.



D.



*(Question B3 continued)*

**Part 2** Electric and gravitational fields

- (a) State, in terms of electrons, the difference between a conductor and an insulator. [1]

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.....

- (b) Suggest why there must be an electric field inside a current-carrying conductor. [3]

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- (c) The magnitude of the electric field strength inside a conductor is  $55 \text{ NC}^{-1}$ . Calculate the force on a free electron in the conductor. [1]

.....  
.....

- (d) The electric force between two point charges is a fundamental force as is the gravitational force between two point masses. State **one** similarity between these two forces and **one** difference (other than the fact that one applies to charge and the other to mass). [2]

Similarity: .....  
.....

Difference: .....  
.....

*(Question B3, part 2 continued)*

- (e) The force on a mass of 1.0 kg falling freely near the surface of Jupiter is 25 N. The radius of Jupiter is  $7.0 \times 10^7$  m.
  - (i) State the value of the magnitude of the gravitational field strength at the surface of Jupiter. [1]  
.....
  - (ii) Calculate that the mass of Jupiter is about  $1.8 \times 10^{27}$  kg. [2]  
.....  
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.....

**A2.** This question is about the properties of tungsten.

- (a) Tungsten is a conductor used as the filament of an electric lamp. The filament of the lamp is surrounded by glass which is an insulator.  
  
Outline, in terms of their atomic structure, the difference between the electrical properties of tungsten and of glass. [2]

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**Part 2** Electric and gravitational fields

- (a) a conductor contains “free” electrons and insulators do not / *OWTTE*; [1]
- (b) to have a current electrons must be accelerated/move along the wire;  
and so a (electric) force must act on them;  
this is provided by the electric field; [3]
- (c)  $8.8 \times 10^{-18} \text{ N}$ ; [1]
- (d) *similarity*:  
both follow an inverse square law;  
*difference*:  
gravitational force is always attractive/is much weaker than electric force / electric  
force can be repulsion/is much stronger than gravitational force; [2]
- (e) (i)  $25 \text{ N kg}^{-1}$ ; [1]
- (ii)  $M = \frac{25R^2}{G}$ ;  
 $= \frac{25 \times 7.0^2 \times 10^{14}}{6.7 \times 10^{-11}}$ ;  
 $= 1.8 \times 10^{27} \text{ kg}$  [2]

- A2. (a) conduction is due to movement of the free electrons (transferring charge around  
circuit);  
tungsten is a good electrical conductor with large numbers of free electrons;  
glass is a poor electrical conductor with few/no free electrons; [2 max]