CAMBRIDGE INTERNATIONAL A LEVEL • PHYSICS 9702

Topical Questions

Unit 18: Electric Fields

Past Papers 2021 – 2025

QUESTION PAPER 3 Questions

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Question 1

(a) Define *electric potential*.

.....

.....

..... [2]

(b) An isolated conducting sphere in a vacuum has radius r and is initially uncharged. It is then charged by friction so that it carries a final charge Q. This charge can be considered to be acting at the centre of the sphere.

By considering the electric potential at its surface, show that the capacitance C of the sphere is given by

$$C = 4\pi\varepsilon_0 r$$

where ε_0 is the permittivity of free space.

[2]

(c) The dome of an electrostatic generator is a spherical conductor of radius 13 cm. It is initially charged so that the electric potential at the surface is 4.5 kV.

A smaller isolated sphere of radius 5.2 cm, initially uncharged, is brought near to the dome. Sparking causes a current between the two spheres until they reach the same potential. Assume that any charge on a sphere may be considered to act as a point charge at its centre.

Calculate the charge that is transferred between the two spheres.

charge = ... C [3]

[Total: 7]

Question 2

(a) An isolated metal sphere of radius r is charged so that the electric potential at its surface is V_0.

On Fig. 5.1, sketch the variation with distance x from the centre of the sphere of the electric potential. Your graph should extend from $x = 0$ to $x = 3r$.

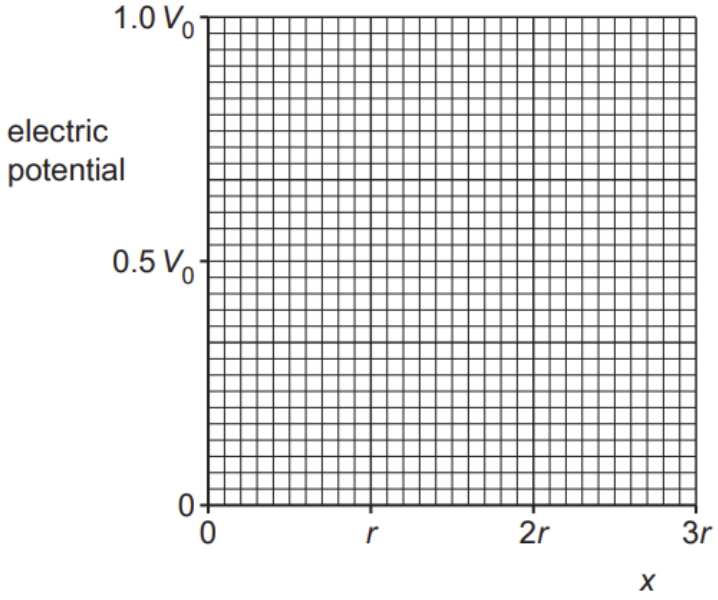


Fig. 5.1

[3]

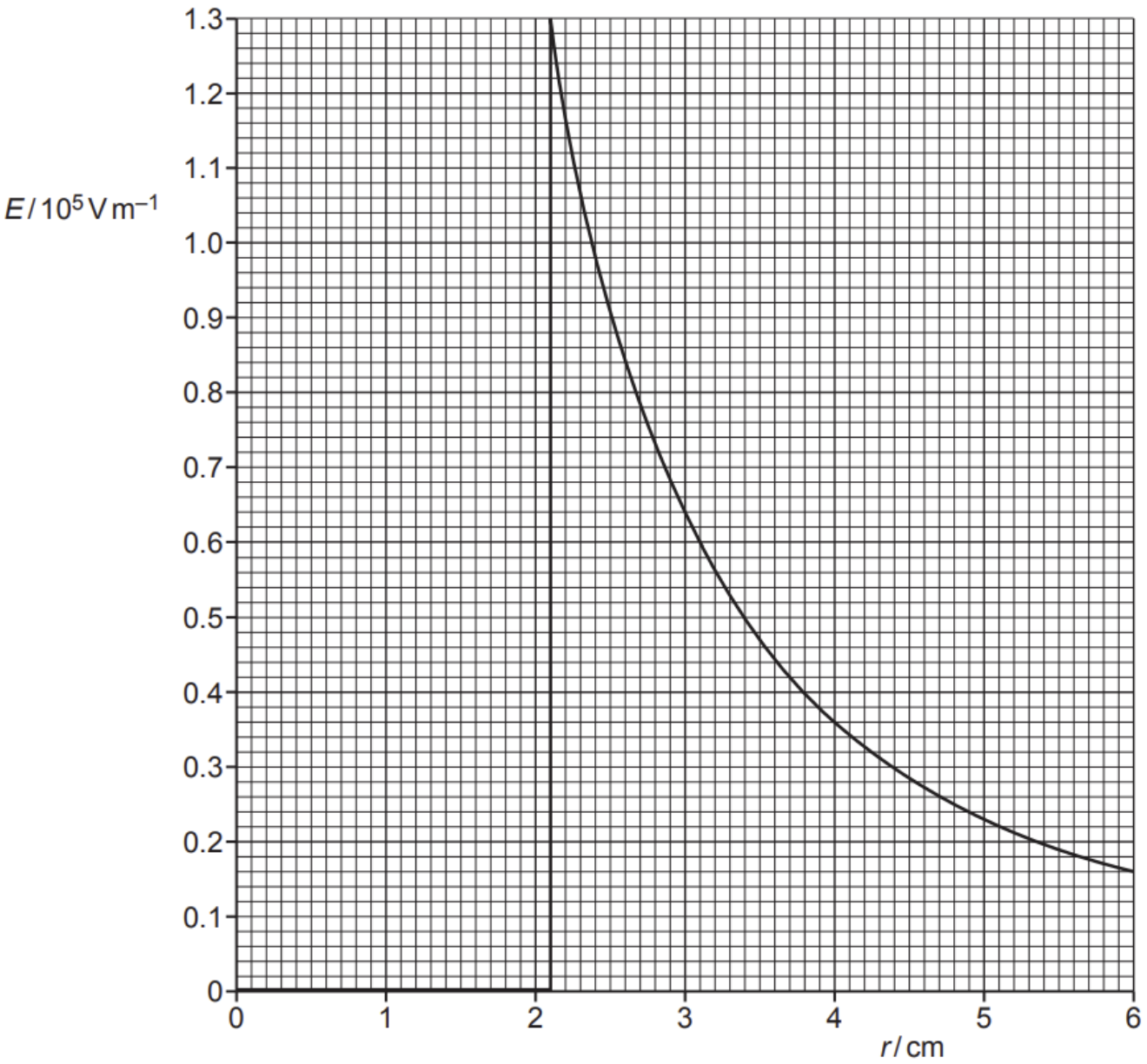
Question 3

(a) State a similarity between the gravitational field lines around a point mass and the electric field lines around a point charge.

.....

..... [1]

(b) The variation with radius r of the electric field strength E due to an isolated charged sphere in a vacuum is shown in Fig. 6.1.



Use data from Fig. 6.1 to:

(i) state the radius of the sphere

radius = ... cm [1]

(ii) calculate the charge on the sphere.

charge = ... C [2]

(c) Using the formula for the electric potential due to an isolated point charge, determine the capacitance of the sphere in **(b)**.

capacitance = ... F [3]

[Total: 7]