

1 (a) (i) Define gravitational field.

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..... [1]

(ii) Define electric field.

.....
..... [1]

(iii) State **one** similarity and **one** difference between the gravitational potential due to a point mass and the electric potential due to a point charge.

similarity:
.....
difference:
..... [2]

(b) An isolated uniform conducting sphere has mass M and charge Q .
The gravitational field strength at the surface of the sphere is g .
The electric field strength at the surface of the sphere is E .

(i) Show that

$$\frac{M}{Q} = \alpha \frac{g}{E}$$

where α is a constant.

[3]

(ii) Show that the numerical value of α is $1.35 \times 10^{20} \text{ kg}^2 \text{ C}^{-2}$.

[1]

- (c) Assume that the Earth is a uniform conducting sphere of mass 5.98×10^{24} kg. The surface of the Earth carries a charge of -4.80×10^5 C that is evenly distributed.
- (i) Use the information in (b) to determine the electric field strength at the surface of the Earth. Give a unit with your answer.

electric field strength = unit [2]

- (ii) State how the direction of the electric field at the surface of the Earth compares with the direction of the gravitational field.

..... [1]