

- 1 (a) (i) Define gravitational field.

..... [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  $\alpha$  is a constant.

[3]

- (ii) Show that the numerical value of  $\alpha$  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  $5.98 \times 10^{24}$  kg. The surface of the Earth carries a charge of  $-4.80 \times 10^5$  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]