

2 Communications satellites are usually placed in a *geo-synchronous orbit*.

(a) State **two** features of a geo-synchronous orbit.

.....

.....

.....

.....

(2 marks)

(b) Given that the mass of the Earth is  $6.00 \times 10^{24}$  kg and its mean radius is  $6.40 \times 10^6$  m,

(i) show that the radius of a geo-synchronous orbit must be  $4.23 \times 10^7$  m,

.....

.....

.....

.....

.....

.....

(ii) calculate the increase in potential energy of a satellite of mass 750 kg when it is raised from the Earth's surface into a geo-synchronous orbit.

.....

.....

.....

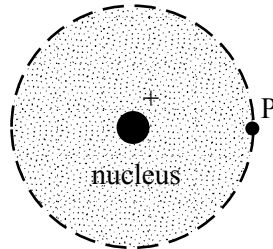
.....

(6 marks)

8

- 3 The mass of the nucleus of an isolated copper atom is  $63 \text{ u}$  and it carries a charge of  $+29 e$ . The diameter of the atom is  $2.3 \times 10^{-10} \text{ m}$ .

P is a point at the outer edge of the atom.



(a) Calculate

- (i) the electric field strength at P due to the nucleus,

.....

.....

.....

- (ii) the gravitational potential at P due to the nucleus.

.....

.....

.....

(5 marks)

(b) Draw an arrow on the above diagram to show the direction of the electric field at the point P.

(1 mark)

6

- 2 (a) Complete the table of quantities related to fields. In the second column, write an SI unit for each quantity. In the third column indicate whether the quantity is a scalar or a vector.

quantity	SI unit	scalar or vector
gravitational potential		
electric field strength		
magnetic flux density		

(3 marks)

- (b) (i) A charged particle is held in equilibrium by the force resulting from a vertical electric field. The mass of the particle is  $4.3 \times 10^{-9}$  kg and it carries a charge of magnitude  $3.2 \times 10^{-12}$  C. Calculate the strength of the electric field.

.....

.....

.....

.....

- (ii) If the electric field acts upwards, state the sign of the charge carried by the particle.

.....

(3 marks)

6

**TURN OVER FOR THE NEXT QUESTION**

**Turn over ▶**