2 **(a)** A satellite is orbiting the Earth in a circular orbit with a period of 24 hours.

(i) State two conditions under which the orbit of this satellite is geostationary.

1. ……..

……

2. ……..

……
[2]

(ii) Suggest one advantage of a geostationary satellite used for communiation.

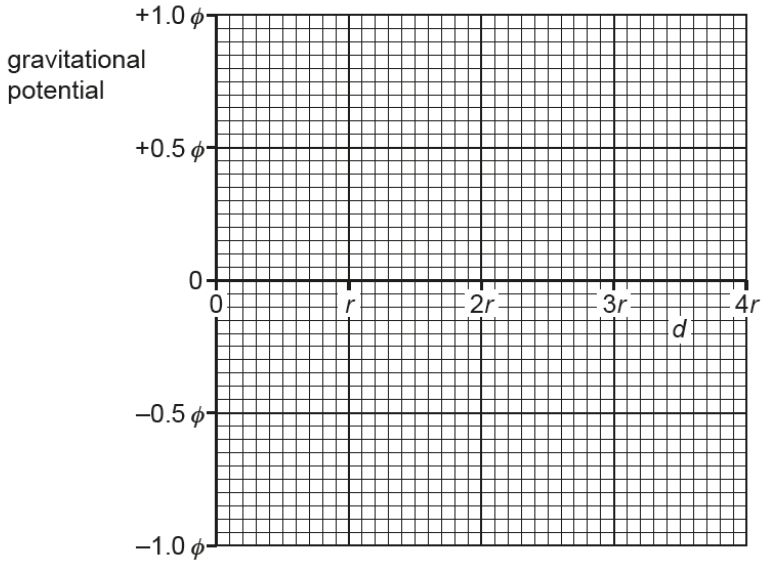
……

……

……

…… [1]

(b) **(i)** An isolated solid sphere of radius r may be assumed to have its mass M concentrated at its centre. The magnitude of the gravitational potential at the surface of the sphere is ϕ. On Fig. 2.1, show the variation of the gravitational potential with distance d from the centre of the sphere for values of d from $d = r$ to $d = 4r$.



[2]

Fig. 2.1

(ii) The sphere in **(b)(i)** is a planet with radius r of 6.4×10^6 m and mass M of 6.0×10^{24} kg. The planet has no atmosphere. A rock of mass 3.4×10^3 kg moves directly towards the planet. Its distance from the centre of the planet changes from $4r$ to $3r$.

Calculate the change in gravitational potential energy of the rock.

change = ... J [2]

(iii) Explain whether the rock's speed increases, decreases or stays the same as it moves towards the planet.

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.....

.....[2]