

3 (a) Explain why gravitational potential is a negative value for an isolated mass.

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(b) A satellite can orbit the Earth along an east-to-west direction (known as a retrograde orbit) as well as along the west-to-east direction (known as a prograde orbit).

(i) A satellite is launched in the west-to-east direction from a launch pad on the Equator to the geostationary orbit.

Explain why this launch direction is preferred.

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(ii) The Earth may be considered to be a uniform sphere of radius 6400 km with its mass of 6.0×10^{24} kg concentrated at its centre.

Show that the geostationary satellite is 3.59×10^7 m above the Earth's surface.

[2]

- (iii) A satellite of mass 1000 kg is in geostationary orbit. Find its total energy.

total energy = J [2]

- (iv) Atmospheric drag is very low but nonetheless present at the height where geostationary satellites orbit.

Explain, in terms of energy, the impact of atmospheric drag on the subsequent trajectory of geostationary satellites.

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