

- 1 (a) Define gravitational potential.

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..... [2]

- (b) Explain why values of gravitational potential near to an isolated mass are all negative.

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.....  
..... [3]

- (c) The Earth may be assumed to be an isolated sphere of radius  $6.4 \times 10^3$  km with its mass of  $6.0 \times 10^{24}$  kg concentrated at its centre. An object is projected vertically from the surface of the Earth so that it reaches an altitude of  $1.3 \times 10^4$  km.

Calculate, for this object,

- (i) the change in gravitational potential,

change in potential = .....  $\text{J kg}^{-1}$

- (ii) the speed of projection from the Earth's surface, assuming air resistance is negligible.

speed = .....  $\text{m s}^{-1}$   
[5]

(d) Suggest why the equation

$$v^2 = u^2 + 2as$$

is not appropriate for the calculation in (c)(ii).

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..... [1]