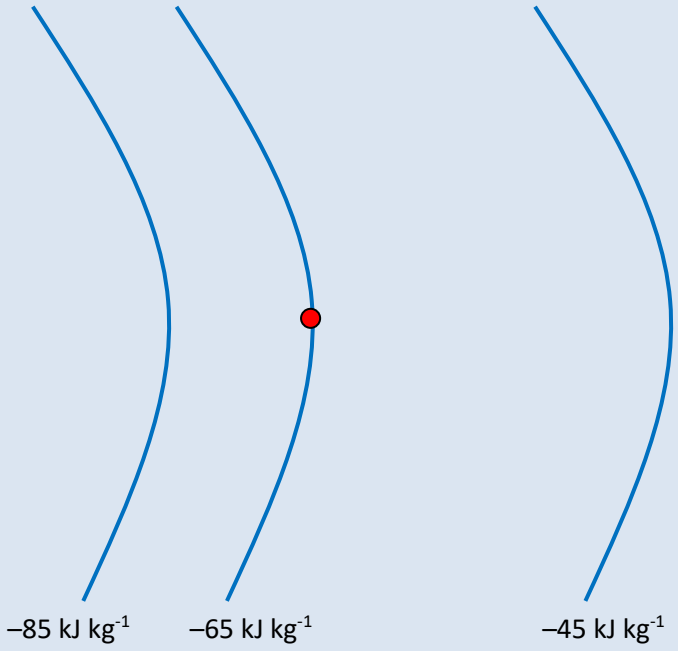
Quiz D17.2

Gravitation (HL)

1. A point mass *m* is on the surface of the Earth. The mass is raised to a height *R* above the surface where *R* is the radius of Earth. The gravitational field strength on the surface is *g*. What is the work done by the gravitational force?

A mgR **B** $-mgR$ **C** $\frac{mgR}{2}$ **D** $-\frac{mgR}{2}$

2. The diagram shows three gravitational equipotential lines.



A point mass of 2.0 kg is placed on the middle equipotential and released.

What is the direction of motion of the mass and what is the change in its potential energy when it reaches one of the other two equipotentials?

	Direction of motion	Change in potential energy
A	Left	40 kJ
B	Left	–40 kJ
C	Right	40 kJ
D	Right	–40 kJ

3. A mass is dropped from rest from a height R above the surface of a planet of radius R and mass M. With what speed does the mass impact the surface of the planet?

A $\sqrt{\frac{2GM}{R}}$ **B** $\sqrt{\frac{GM}{R}}$ **C** $\sqrt{\frac{GM}{2R}}$ **D** $\sqrt{\frac{GM}{4R}}$

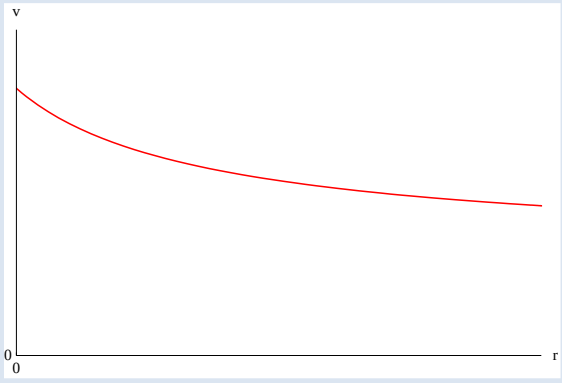
4. A projectile is launched vertically from the surface of a planet of radius R with speed $\frac{v_{esc}}{5}$ where v_{esc} is the escape speed from the surface. How far from the centre of the planet does the projectile reach?

A $25R$ **B** $\frac{25}{2}R$ **C** $\frac{25}{12}R$ **D** $\frac{25}{24}R$

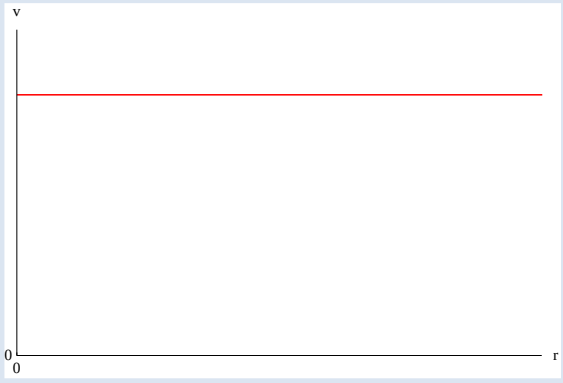
5. A satellite is in a circular orbit around a planet. The orbit radius is r and the total energy of the satellite is E. What work must be done on the satellite to increase the orbit radius to $3r$?

A $\frac{E}{3}$ **B** $\frac{2E}{3}$ **C** $-\frac{E}{3}$ **D** $-\frac{2E}{3}$

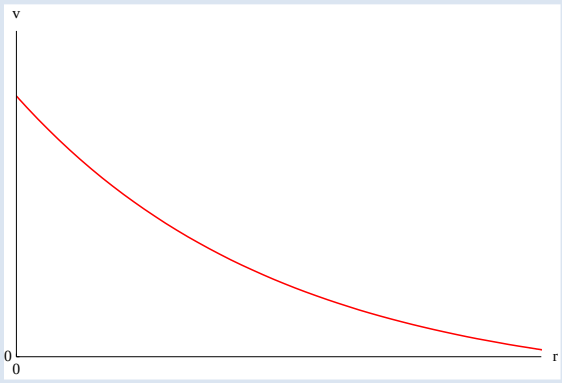
6. A mass is projected vertically upwards from the surface of a planet with a speed that is double the escape speed. What graph shows the variation with distance from the surface *r*, of the speed *v* of the projectile?



A



B



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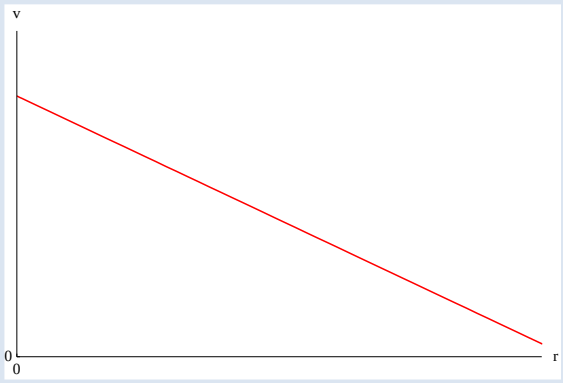
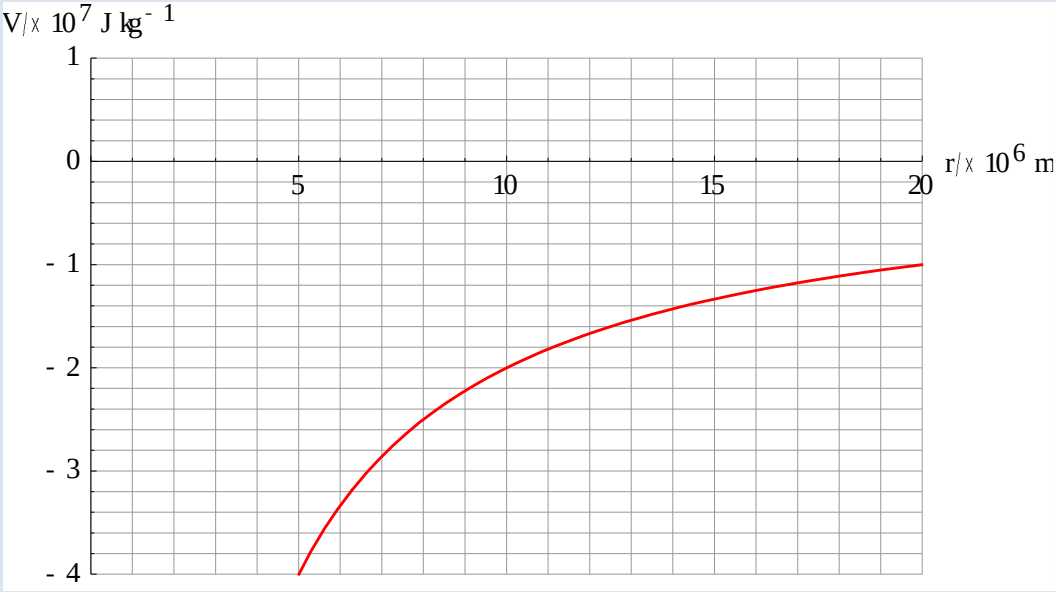


D

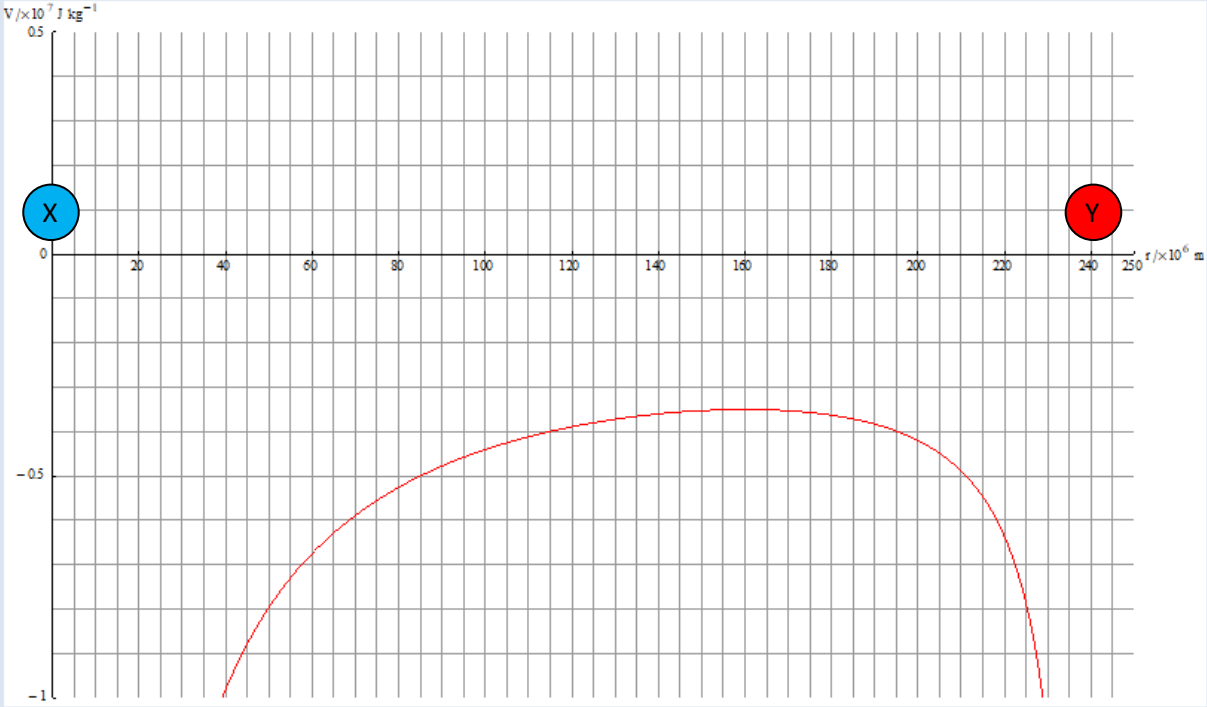
7. The graph shows the variation with distance *r* from the centre of a planet of the gravitational potential *V* in the exterior of the planet.



What is an estimate of the escape speed from a point a distance of 10^7 m from the centre of the planet?

A 2×10^3 m s^{-1} **B** 4×10^3 m s^{-1} **C** 6×10^3 m s^{-1} **D** 8×10^3 m s^{-1}

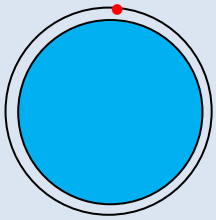
8. The graph shows the variation of the gravitational potential due to two spherical masses, X and Y, along the line joining their centres. The centres are separated by a distance 2.4×10^8 m. The variable *r* is the distance of a point on the line joining the two centres and the centre of X.



What is an estimate of the ratio of masses, $\frac{M_X}{M_Y}$?

A 4 **B** 2 **C** $\frac{1}{2}$ **D** $\frac{1}{4}$

9. A projectile of mass *m* is launched with kinetic energy *K* from the surface of a planet of mass *M* and radius *R*. ~~The~~ projectile ~~settles in~~ enters a circular orbit just grazing the surface of the planet.



What is *K*?

A $\frac{GMm}{4R}$ **B** $\frac{GMm}{2R}$ **C** $\frac{GMm}{R}$ **D** $\frac{2GMm}{R}$

10. A satellite orbits a planet of radius R with a speed that is one third of the escape speed from the surface of the planet. What is the radius of the orbit?

A R **B** $3R$ **C** $\frac{9R}{2}$ **D** $9R$

Quiz D17.2 Answers	
1	D
2	B
3	B
4	D
5	D
6	A
7	C
8	A
9	B
10	C