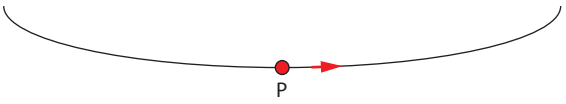
Self-test questions

Topic 10

1 The diagram shows a gravitational field line. A point mass is placed at point P.



Which arrow represents the gravitational force on the particle?

A
B
C
D

2 The escape speed form the surface of planet X is v. Planet Y has the same density as planet X and has double the radius. What is the escape speed from the surface of planet Y?

A $\frac{v}{\sqrt{2}}$

B $v\sqrt{2}$

C $2v$

D $4v$

3 A mass of 2.0 kg is moved at a very small constant speed from a point where the gravitational potential is -5.0×10^6 J kg^{-1} to a point where the potential is -2.0×10^6 J kg^{-1}. What is the work done by the gravitational force acting on the mass?

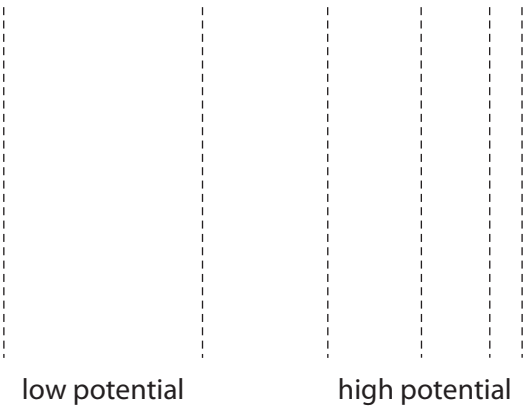
A -6.0×10^6 J

B 6.0×10^6 J

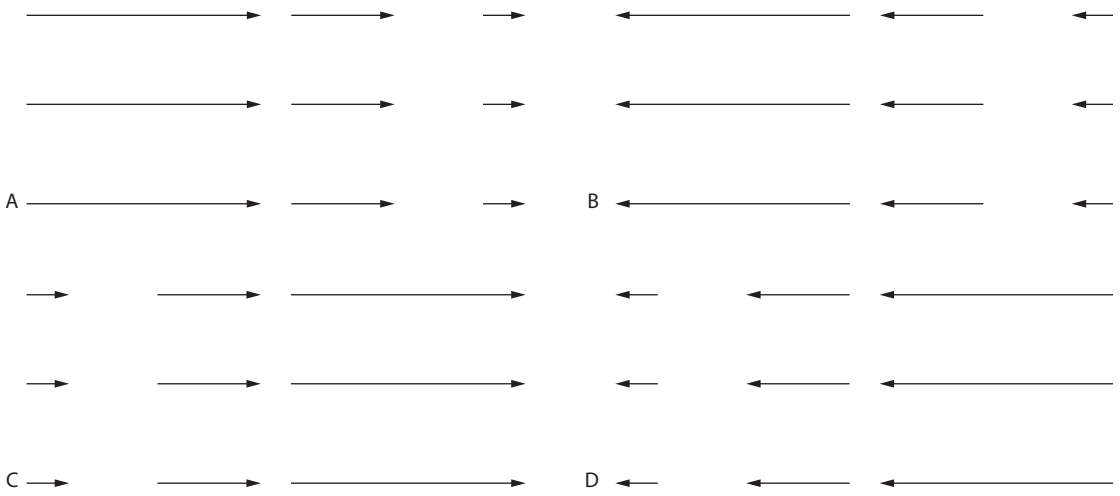
C -1.5×10^6 J

D 1.5×10^6 J

4 The diagram shows a series of electric equipotential lines. The difference in potential between consecutive lines is the same. The potential increases as we move to the right.

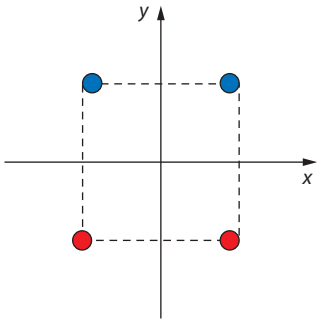


Which diagram best represents the electric field?



A
B
C
D

5 The diagram shows four charges of equal magnitude. The top charges are positive and the lower ones are negative. The charges placed at the vertices of a square whose centre is at the origin of the axes shown.



Where is the electric potential zero?

A along the x-axis only
B along the y-axis only
C along both axes
D at the origin only

6 A probe is orbiting a planet in a low circular orbit. It is desired to move the probe into a higher orbit. What are the changes in the probe's kinetic and gravitational potential energy in doing so?

	Kinetic energy	**Potential energy**
A	increases	increases
B	increases	decreases
C	decreases	increases
D	decreases	decreases

7 The gravitational potential at the surface of a spherical planet of radius R and uniform density is V. What is an expression for the magnitude of the gravitational field strength at the surface of the planet?

A $-VR$

B $-\frac{V}{R}$

C $-VR^2$

D $-\frac{V}{R^2}$

8 Two stars of the same mass M orbit a common centre with the same speed. The distance separating the stars is d. What is the total energy of the system?

A $-\frac{3GM^2}{4d}$

B $\frac{3GM^2}{4d}$

C $-\frac{GM^2}{2d}$

D $\frac{GM^2}{2d}$

9 A probe of mass m is launched from the surface of a planet of mass M and radius R with kinetic energy $\frac{3GMm}{4R}$. The probe settles into a circular orbit around the planet. What is the radius of the orbit?

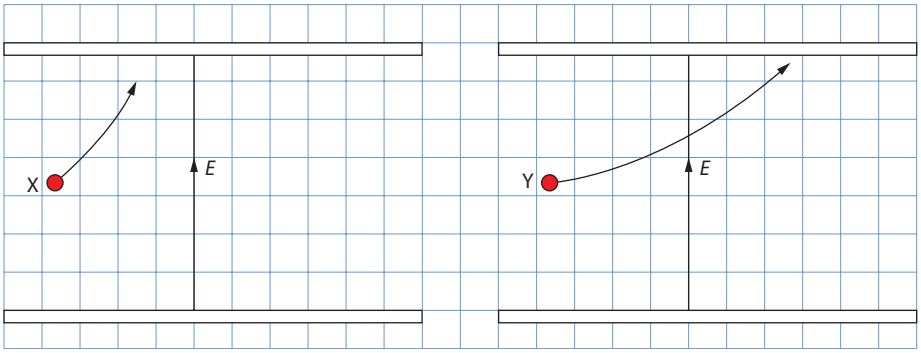
A R

B $2R$

C $3R$

D $4R$

10 Two charged particles, X and Y, enter the same region of uniform electric field with the same velocity. They follow different paths as shown. Gravity is negligible.



What can be deduced about the particles?

A the charge of X is greater than that of Y

B the charge of X is smaller than that of Y

C the charge to mass ratio for X is greater than that of Y

D the charge to mass ratio for X is smaller than that of Y