

- 8 (a) State one similarity and one difference between a gravitational field and an electric field.
- similarity:
-
- difference:
- [2]
- (b) Three particles A, B and C are each placed in a different type of field. Complete Fig. 8.1 to identify the type of the field in which each particle is situated. [3]

particle	charge on particle	initial direction of motion of particle	direction of force on particle	type of field
A	neutral	stationary	in the direction of field	
B	negative	along direction of field	opposite to direction of field	
C	positive	normal to direction of field	normal to direction of field	

Fig. 8.1

- (c) Fig. 8.2 shows some equipotential lines around Mars. The mass of Mars is 6.4×10^{23} kg and the radius of Mars is 3.4×10^6 m.

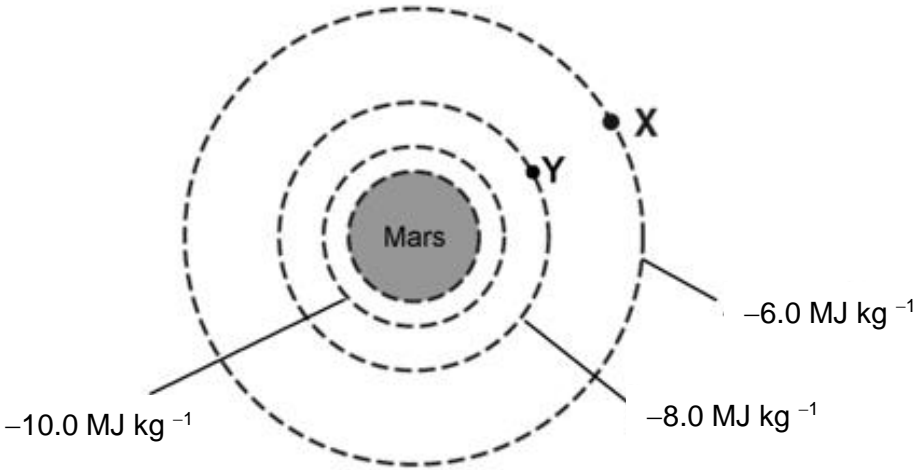


Fig. 8.2

- (i) Define *gravitational potential* at a point.

.....
 [1]

- (ii) Explain how Fig. 8.2 shows that the gravitational field strength decreases as the distance from the surface of the planet increases.

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 [2]

- (iii) A spacecraft at point X drops a satellite, of mass 90 kg, from rest onto the surface of the planet. Calculate the velocity of the satellite when it reaches point Y.

velocity = m s^{-1} [3]

- (d) In Rutherford's α -particle scattering experiment, an α -particle approaches a stationary gold ($^{197}_{79}\text{Au}$) nucleus.

- (i) Explain why gravitational potential has a negative value, whereas electric potential can be positive or negative.

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 [2]

- (ii) Without any calculations, suggest why in an α -particle scattering experiment gravitational effects are ignored.

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..... [1]

- (iii) Calculate the electric potential due to the gold nucleus at a distance of 2.6×10^{-12} m from its centre. State any assumptions you make.

electric potential = V

assumptions:

..... [3]

- (iv) For an α -particle approaching the stationary gold nucleus head-on, sketch the electric field lines between the α -particle and gold nucleus at the point of closest approach, in Fig. 8.3 below.



Fig. 8.3