EXAM PAPERS PRACTICE

Boost your performance and confidence with these topic-based exam questions

Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

Time allowed
49 Minutes

Score /41

Percentage %

Physics

Topic Questions

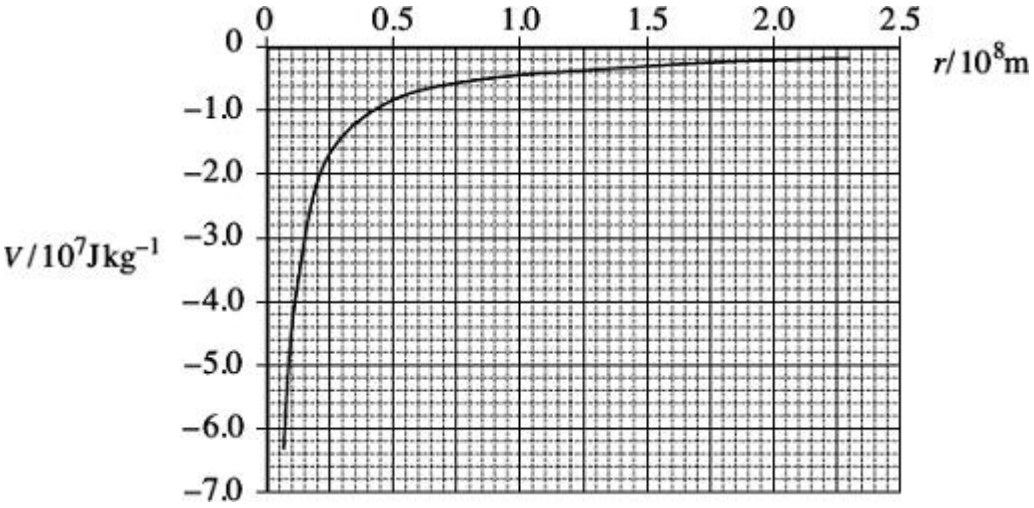
AQA
AS & A LEVEL
3.7 Fields and their consequences (A-level only)

1 At the surface of the Earth the gravitational field strength is g, and the gravitational potential is V. The radius of the Earth is R. An object, whose weight on the surface of the Earth is W, is moved to a height $3R$ above the surface. Which line, **A** to **D**, in the table gives the weight of the object and the gravitational potential at this height?

	weight	**gravitational potential**
A	$\frac{W}{16}$	$\frac{V}{4}$
B	$\frac{W}{4}$	$\frac{V}{3}$
C	$\frac{W}{4}$	$\frac{V}{4}$
D	$\frac{W}{16}$	$\frac{V}{3}$

(Total 1 mark)

2 The figure below shows the variation of gravitational potential, V, with distance from the centre of the Earth, r. The radius of the Earth is 6.4×10^6 m.



(a) Explain why the V values are negative.

.....

.....

.....

.....

.....

.....

(3)

(b) Use data from the graph to show that the mass of the Earth is approximately 6×10^{24} kg.

(3)

(c) (i) Calculate the work done in raising a satellite of mass 2100 kg from the surface of the Earth to a height of 850 km above the surface of the Earth.

work done ..... J

(3)

(ii) Calculate the change in the kinetic energy of the satellite when it moves from its
850 km orbit to one at a height of 700 km above the Earth's surface. Make it clear whether the change in kinetic energy is an increase or decrease.

kinetic energy change ..... J

(4)

(iii) Without performing any further calculations explain how the change in kinetic energy relates to the change of the potential energy when the satellite's orbit alters as in part (c)(ii).

.....

.....

.....

.....

.....

(2)

(Total 15 marks)

3. A 10 μF capacitor is fully charged to a pd of 3.0 kV. The energy stored in the capacitor can be used to lift a load of 5.0 kg through a vertical height *h*. What is the approximate value of *h*?

A 0.03 mm

B 0.9 mm

C 0.3 m

D 0.9 m

(Total 1 mark)

4. The gravitational potential at the surface of the Earth, of radius *R*, is V. What is the gravitational potential at a point at a height *R* above the Earth's surface?

A $\frac{V}{4}$

B $\frac{V}{2}$

C V

D $2V$

(Total 1 mark)

5 Which one of the following statements about gravitational fields is **incorrect**?

A Moving a mass in the direction of the field lines reduces its potential energy.

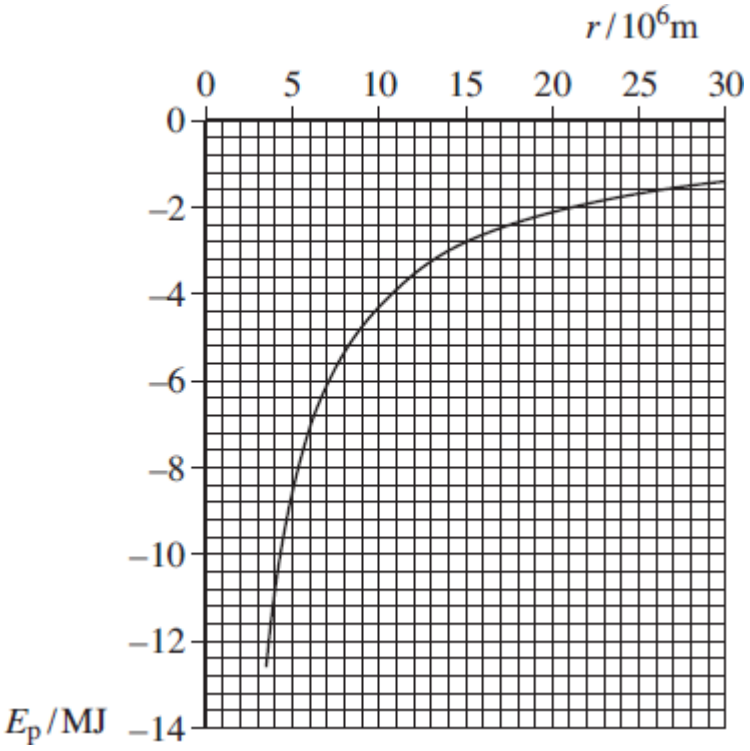
B A stronger field is represented by a greater density of field lines.

C Moving a mass perpendicularly across the field lines does not alter its potential energy.

D At a distance r from a mass the field strength is inversely proportional to r.

(Total 1 mark)

6 The graph below shows how the gravitational potential energy, E_p, of a 1.0 kg mass varies with distance, r, from the centre of Mars. The graph is plotted for positions above the surface of Mars.



(a) Explain why the values of E_p are negative.

.....

.....

.....

.....

.....

(2)

(b) Use data from the graph to determine the mass of Mars.

mass of Mars ..... kg

(3)

(c) Calculate the escape velocity for an object on the surface of Mars.

escape velocity ..... m s^{-1}

(3)

(d) Show that the graph data agree with $E_p \propto \frac{1}{r}$

(3)
(Total 11 marks)

7 When a charge moves between two points in an electric field, or a mass moves between two points in a gravitational field, energy may be transferred.
Which one of the following statements is correct?

A No energy is transferred when the movement is parallel to the direction of the field.

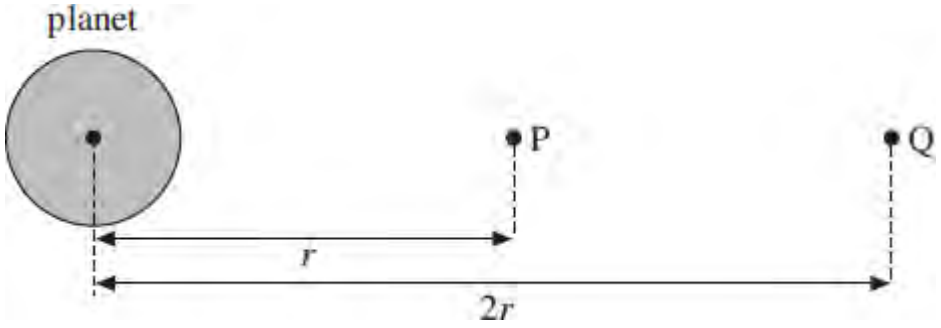
B The energy transferred is independent of the path followed.

C The energy transferred is independent of the start and finish points.

D Energy is transferred when the movement is perpendicular to the field lines.

(Total 1 mark)

8 The diagram shows two points, P and Q, at distances r and $2r$ from the centre of a planet.



The gravitational potential at P is −16 kJ kg^{-1}. What is the work done on a 10 kg mass when it is taken from P to Q?

A – 120 kJ

B – 80 kJ

C + 80 kJ

D + 120 kJ

(Total 1 mark)

9 Mars has a diameter approximately 0.5 that of the Earth, and a mass of 0.1 that of the Earth. The gravitational potential at the Earth's surface is −63 MJ kg^{-1}.
What is the approximate value of the gravitational potential at the surface of Mars?

A −13 MJ kg^{-1}

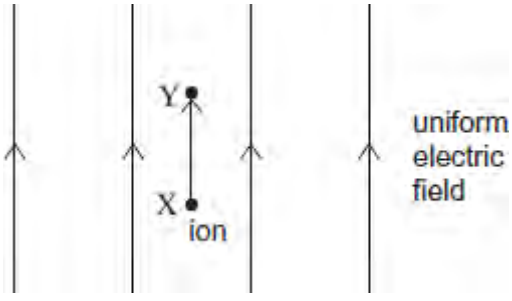
B −25 MJ kg^{-1}

C −95 MJ kg^{-1}

D −320 MJ kg^{-1}

(Total 1 mark)

10 A uniform electric field of electric field strength E is aligned so it is vertical. An ion moves vertically through a small distance Δd from point X to point Y in the field. There is a uniform gravitational field of field strength g throughout the region.



Which line, **A** to **D**, in the table correctly gives the gravitational potential difference, and the electric potential difference, between X and Y?

	Gravitational potential difference	Electric potential difference
A	$g\Delta d$	$E\Delta d$
B	$g\Delta d$	$\frac{E}{\Delta d}$
C	$\frac{g}{\Delta d}$	$E\Delta d$
D	$\frac{g}{\Delta d}$	$\frac{E}{\Delta d}$

(Total 1 mark)

11 Which one of the following statements about gravitational potential is correct?

A gravitational potential can have a positive value

B the gravitational potential at the surface of the Earth is zero

C the gravitational potential gradient at a point has the same numerical value as the gravitational field strength at that point

D the unit of gravitational potential is N kg^{-1}

(Total 1 mark)

12 (a) (i) State what is meant by the term **escape velocity**.

.....

.....

(1)

(ii) Show that the escape velocity, v, at the Earth's surface is given by $v = \sqrt{\frac{2GM}{R}}$

where M is the mass of the Earth
and R is the radius of the Earth.

(2)

(iii) The escape velocity at the Moon's surface is 2.37×10^3 m s^{-1} and the radius of the Moon is 1.74×10^6 m.

Determine the mean density of the Moon.

mean density ..... kg m^{-3}

(2)

(b) State **two** reasons why rockets launched from the Earth's surface do **not** need to achieve escape velocity to reach their orbit.

.....

.....

.....

.....

(2)
(Total 7 marks)

13 Which one of the following statements about gravitational potential is **incorrect**?

A It is analogous to the electric potential at a point in an electric field.

B It is equal to the gravitational potential energy of a mass of 1 kg.

C It is a vector quantity.

D The difference in gravitational potential between two points at different heights above the Earth depends on the position of the points.