Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Fields And Their Consequences(Gravitational Field)

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Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

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

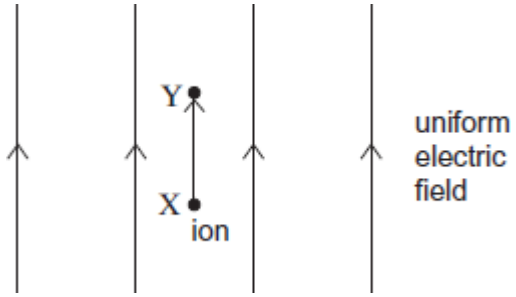
C the gravitational potential gradient at a point has the same numerical value as the gravitational field strength at that point

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

(Total 1 mark)

Q2.

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)

Q3.

When a space shuttle is in a low orbit around the Earth it experiences gravitational forces F_E due to the Earth, F_M due to the Moon and F_S due to the Sun. Which one of the following correctly shows how the magnitudes of these forces are related to each other?

mass of Sun = 1.99×10^{30} kg
mass of Moon = 7.35×10^{22} kg
mean distance from Earth to Sun = 1.50×10^{11} m
mean distance from Earth to Moon = 3.84×10^{8} m

A $F_E > F_S > F_M$

B $F_S > F_E > F_M$

C $F_E > F_M > F_S$

D $F_M > F_E > F_S$

(Total 1 mark)

Q4.

The gravitational field strengths at the surfaces of the Earth and the Moon are 9.8 N kg^{-1} and 1.7 N kg^{-1} respectively. If the mass of the Earth is 81 × the mass of the Moon, what is the ratio of the radius of the Earth to the radius of the Moon?

A 3.7

B 5.8

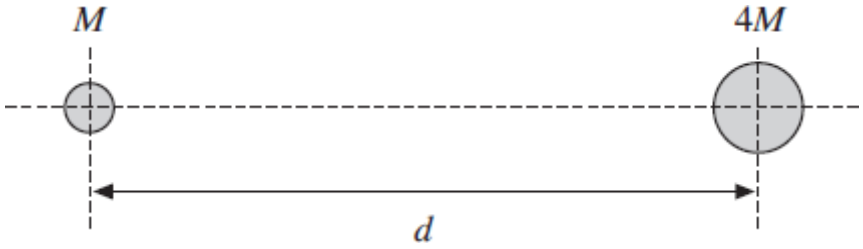
C 14

D 22

(Total 1 mark)

Q5.

Two stars of mass M and $4M$ are at a distance d between their centres.



The resultant gravitational field strength is zero along the line between their centres at a distance y from the centre of the star of mass M.

What is the value of the ratio $\frac{y}{d}$?

A $\frac{1}{2}$

B $\frac{1}{3}$

C $\frac{2}{3}$

D $\frac{3}{4}$

(Total 1 mark)

Q6.

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)

Q7.

A small mass is situated at a point on a line joining two large masses m_1 and m_2 such that it experiences no resultant gravitational force. Its distance from the centre of mass of m_1 is r_1 and its distance from the centre of mass of m_2 is r_2.

What is the value of the ratio $\frac{r_1}{r_2}$?

A $\frac{m_1^2}{m_2^2}$

B $\frac{m_2^2}{m_1^2}$

C $\sqrt{\frac{m_1}{m_2}}$

D $\sqrt{\frac{m_2}{m_1}}$

(Total 1 mark)

Q8.

Two satellites P and Q, of equal mass, orbit the Earth at radii *R* and 2*R* respectively. Which one of the following statements is correct?

A P has less kinetic energy and more potential energy than Q.

B P has less kinetic energy and less potential energy than Q.

C P has more kinetic energy and less potential energy than Q.

D P has more kinetic energy and more potential energy than Q.

(Total 1 mark)

Q9.

Which one of the following gives a correct unit for $\left(\frac{g}{G}\right)^2$?

A N m^{-2}

B N kg^{-1}

C N m

D N

(Total 1 mark)

Q10.

The gravitational field strength at the surface of the Earth is 6 times its value at the surface of the Moon. The mean density of the Moon is 0.6 times the mean density of the Earth.

What is the value of the ratio $\left(\frac{\text{radius of Earth}}{\text{radius of Moon}}\right)$?

A 1.8

B 3.6

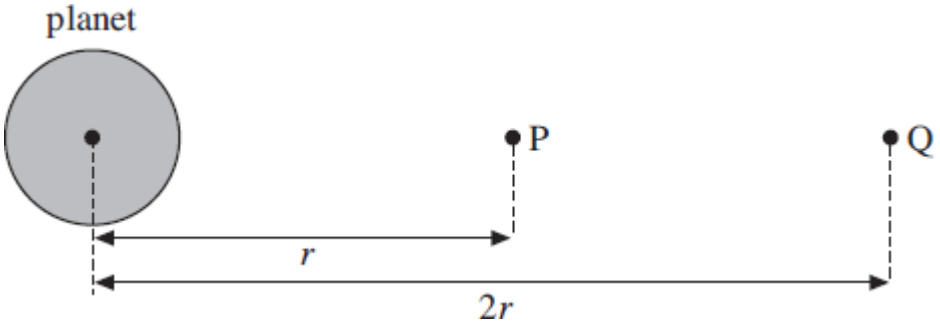
C 6.0

D 10

(Total 1 mark)

Q11.

The diagram shows two points, P and Q, at distances *r* and 2*r* 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)

Q12.

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)

Q13.

The Earth moves around the Sun in a circular orbit with a radius of 1.5×10^8 km.
What is the Earth's approximate speed?

A $1.5 \times 10^3 ms^{-1}$

B $5.0 \times 10^3 ms^{-1}$

C $1.0 \times 10^4 ms^{-1}$

D $3.0 \times 10^4 ms^{-1}$

(Total 1 mark)

Q14.

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)

Q15.

An object on the surface of a planet of radius *R* and mass *M* has weight *W*.
What would be the weight of the same object when on the surface of a planet of radius 2*R* and mass 2*M*?

A $\frac{W}{\cdot}$

B $\frac{W}{2}$

C W

D $2W$

(Total 1 mark)

Q16.

The gravitational field strength on the surface of a planet orbiting a star is 8.0 N kg^{-1}. If the planet and star have a similar density but the diameter of the star is 100 times greater than the planet, what would be the gravitational field strength at the surface of the star?

A 0.0008 N kg^{-1}

B 0.08 N kg^{-1}

C 800 N kg^{-1}

D 8000 N kg^{-1}

(Total 1 mark)

Q17.

Which one of the following statements about Newton's law of gravitation is correct?

Newton's law of gravitation explains

A the origin of gravitational forces.

B why a falling satellite burns up when it enters the Earth's atmosphere.

C why projectiles maintain a uniform horizontal speed.

D how various factors affect the gravitational force between two particles.

(Total 1 mark)

Q18.

Two satellites, P and Q, of the same mass, are in circular orbits around the Earth. The radius of the orbit of Q is three times that of P. Which one of the following statements is correct?

A The kinetic energy of P is greater than that of Q.

B The weight of P is three times that of Q.

C The time period of P is greater than that of Q.

D The speed of P is three times that of Q.

(Total 1 mark)

Q19.

If an electron and proton are separated by a distance of 5×10^{-11} m, what is the approximate gravitational force of attraction between them?

A 2×10^{-57} N

B 3×10^{-47} N

C 4×10^{-47} N

D 5×10^{-37} N

(Total 1 mark)

Q20.

A spherical planet of uniform density ρ has radius R.

Which line, **A** to **D**, in the table gives correct expressions for the mass of the planet and the gravitational field strength at its surface?

	mass of planet	**gravitational field strength at surface**
A	$\frac{4\pi R^2 \rho}{3}$	$\frac{4\pi GR\rho}{3}$
B	$\frac{4\pi R^3 \rho}{3}$	$\frac{4\pi GR\rho}{3}$
C	$\frac{4\pi R^2 \rho}{3}$	$\frac{4\pi G\rho}{3}$
D	$\frac{4\pi R^3 \rho}{3}$	$\frac{4\pi G\rho}{3}$

(Total 1 mark)