

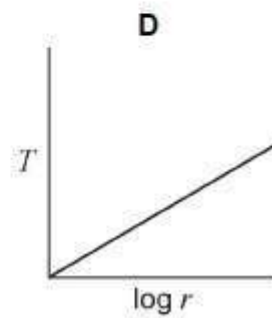
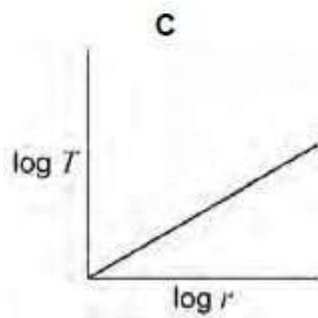
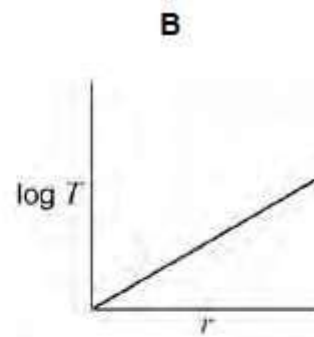
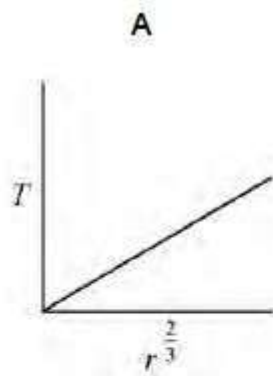
Gravitational Potential

TOPIC QUESTIONS

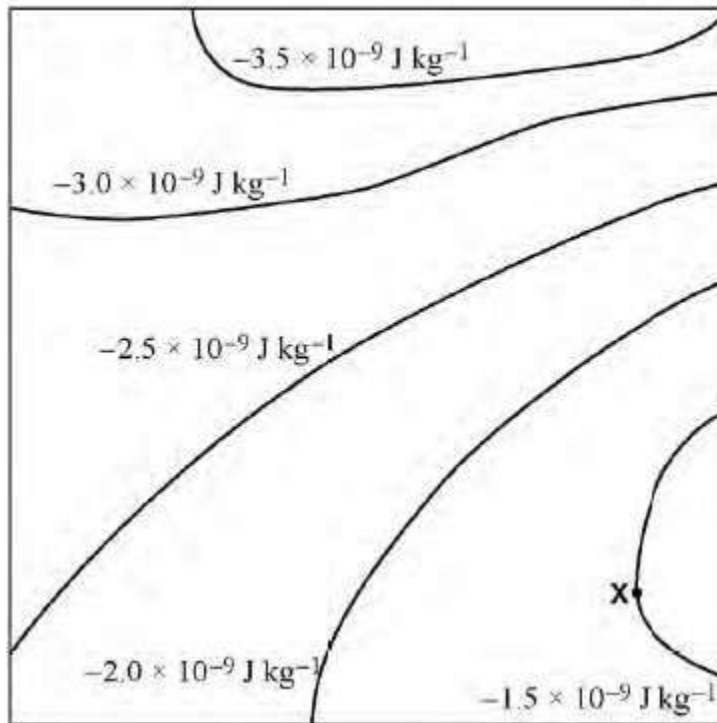
Level	A Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

1. Which graph shows the relationship between the time period T and the orbital radius r of a planet in orbit around the Sun?



2. The diagram shows equipotential lines near a group of asteroids.



Which arrow shows the direction of the gravitational field at **X**?

- A \uparrow
- B \downarrow
- C \leftarrow
- D \rightarrow

3. Planet **N** has a gravitational potential $-V$ at its surface. Planet **M** has double the density and double the radius of planet **N**. Both planets are spherical and have uniform density.

What is the gravitational potential at the surface of planet **M**?

- A $-16V$
- B $-8V$
- C $-4V$

D $-0.2V$

4. Satellites **N** and **F** have the same mass and are in circular orbits about the same planet. The orbital radius of **F** is greater than that of **N**.

Which is greater for **F** than for **N**?

- A gravitational force on the satellite
- B angular speed
- C kinetic energy
- D orbital period

5. A planet of mass M and radius R rotates so quickly that material at its equator only just remains on its surface.

What is the period of rotation of the planet?

A $2\pi\sqrt{\frac{R}{GM}}$

B $2\pi\sqrt{\frac{GM}{R}}$

C $2\pi\sqrt{\frac{R^3}{GM}}$

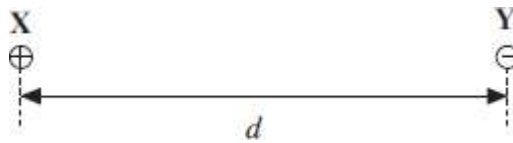
D $2\pi\sqrt{\frac{GM}{R^3}}$

6. Which one of the following statements is correct?

The force between two charged particles

- A is always attractive
- B can be measured in $\text{C}^2 \text{F}^{-1} \text{m}^{-1}$
- C is directly proportional to the distance between them
- D is independent of the magnitude of the charges

7. Two point charges, **X** and **Y**, exert a force F on each other when they are at a distance d apart.



When the distance between them is 20 mm, the force they exert on each other is

$0.5 F$. What is the distance d ?

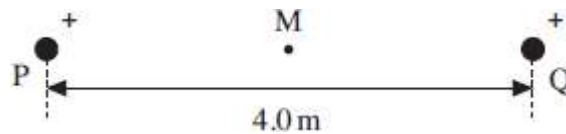
- A 7 mm
- B 14 mm
- C 15 mm
- D 28 mm

8. Which one of the following statements is correct?

When a negative ion is projected into an electric field

- A the field can change the magnitude of the velocity but not its direction
- B the field can change the direction of the velocity but not its magnitude
- C the field can change both the magnitude and the direction of the velocity
- D the ion will accelerate in the direction of the field

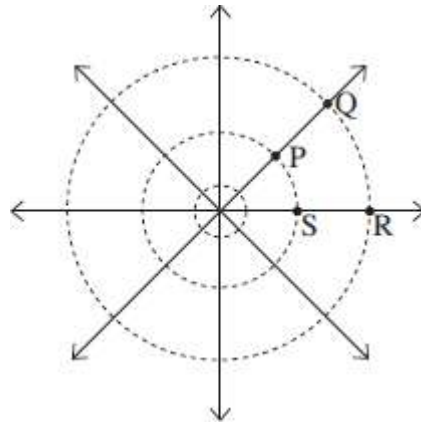
9. Two identical positive point charges, P and Q, are separated by a distance of 4.0 m. The resultant electric potential at point M, which is mid-way between the charges, is 25.0 V.



What would be the resultant electrical potential at a point 1.0 m closer to P?

- A 8.3 V
- B 12.5 V
- C 33.3 V
- D 37.5 V

10. The diagram below shows the field lines and equipotential lines around an isolated positive pointcharge.



Which one of the following statements concerning the work done when a small charge is moved in the field is **incorrect**?

- A when it is moved from either P to Q or S to R, the work done is the same in each case
- B when it is moved from Q to R no work is done
- C when it is moved around the path PQRS, the overall work done is zero
- D when it is moved around the path PQRS, the overall work done is equal to twice the work done in moving from P to Q

11. A planet of mass M and radius R rotates so rapidly that loose material at the equator only just remains on the surface. What is the period of rotation of the planet?

G is the universal gravitational constant.

- A $2\pi\sqrt{\frac{R}{GM}}$
- B $2\pi\sqrt{\frac{R^2}{GM}}$
- C $2\pi\sqrt{\frac{GM}{R^3}}$
- D $2\pi\sqrt{\frac{R^3}{GM}}$

12. The radius of a certain planet is x times the radius of the Earth and its surface gravitational field strength is y times that of the Earth.

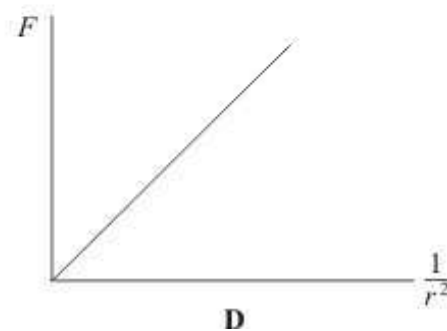
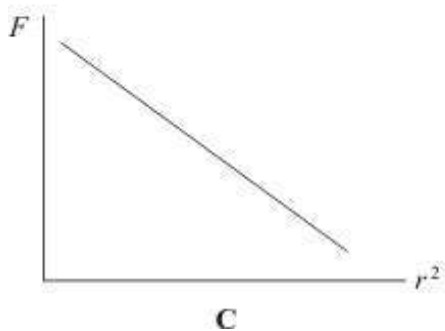
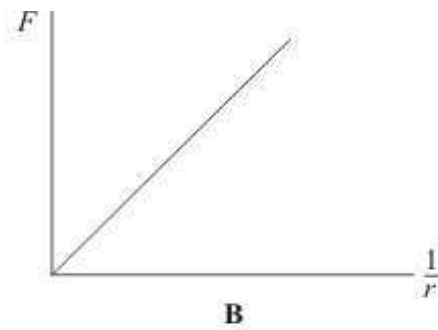
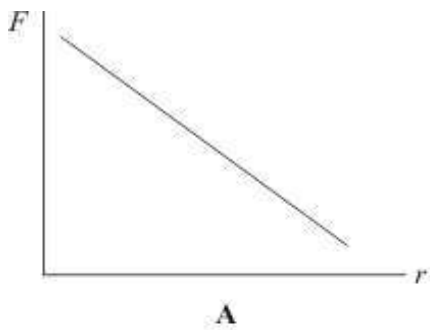
Which one of the following gives the ratio $\left(\frac{\text{mass of the planet}}{\text{mass of the Earth}}\right)$?

- A xy
- B x^2y
- C xy^2
- D x^2y^2

13. Which one of the following could be a unit of gravitational potential?

- A N
- B J
- C N kg^{-1}
- D $\frac{\text{J}}{\text{kg}}$

14. Which one of the following graphs correctly shows the relationship between the gravitational force, F , between two masses and their separation r .



15. When at the surface of the Earth, a satellite has weight W and gravitational potential energy $-U$. It is projected into a circular orbit whose radius is equal to twice the radius of the Earth. Which line, **A** to **D**, in the table shows correctly what happens to the weight of the satellite and to its gravitational potential energy?

	weight	gravitational potential energy
A	becomes $\frac{W}{2}$	increases by $\frac{U}{2}$
B	becomes $\frac{W}{4}$	increases by $\frac{U}{2}$
C	remains W	increases by U
D	becomes	increases by U

16. Two identical uniform spheres each of radius R are placed in contact. The gravitational force between them is F .

The spheres are now separated until the force of attraction is $\frac{F}{4}$.

What is the distance between the **surfaces** of the spheres after they have been separated?

- A** $2R$
- B** $4R$
- C** $8R$
- D** $12R$

17. A satellite of mass m is in a circular orbit at height R above the surface of a uniform spherical planet of radius R and density ρ .

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What is the force of gravitational attraction between the satellite and the planet?

A $\frac{\pi\rho GmR}{3}$

B $\frac{2\pi\rho GmR}{3}$

C $\frac{\pi\rho GmR^2}{3}$

D $\frac{2\pi\rho GmR^2}{3}$

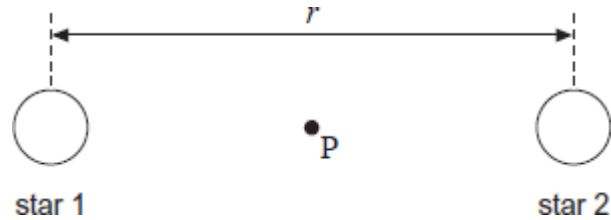
18. The following data refers to two planets, P and Q.

	Radius / km	Density / kg m^{-3}
planet P	8000	6000
planet Q	16 000	3000

The gravitational field strength at the surface of P is 13.4 N kg^{-1} . What is the gravitational field strength at the surface of Q?

- A 3.4 N kg^{-1}
- B 13.4 N kg^{-1}
- C 53.6 N kg^{-1}
- D 80.4 N kg^{-1}

19. The diagram shows an isolated binary star system. The two stars have equal masses, M , and the distance between their centres is r .



The point P is half-way between the two stars. What is the gravitational field strength at P?

- A zero
- B $-\frac{GM}{r^2}$
- C $-\frac{2GM}{r^2}$
- D $-\frac{4GM}{r^2}$

20. 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.