

Name _____

Date _____

Score: _____ / 15

30 minutes · 15 marks · calculator and data booklet allowed

- Answer all the questions.
- For each question, choose the answer you think is best and circle the letter.
- Each question is worth 1 mark.
- Take $g = 9.8 \text{ m s}^{-2}$.

1. What is the definition of gravitational field strength at a point?

- A. the force on a mass placed at that point
- B. the force per unit mass experienced by a small point mass at that point
- C. the work done per unit mass in bringing a small mass from infinity to that point
- D. the acceleration of a body of any size released at that point

2. Two bodies attract each other with a gravitational force F . The mass of one body is doubled and the distance between their centres is tripled. What is the new force?

- A. $2F/3$
- B. $6F$
- C. $2F/9$
- D. $F/9$

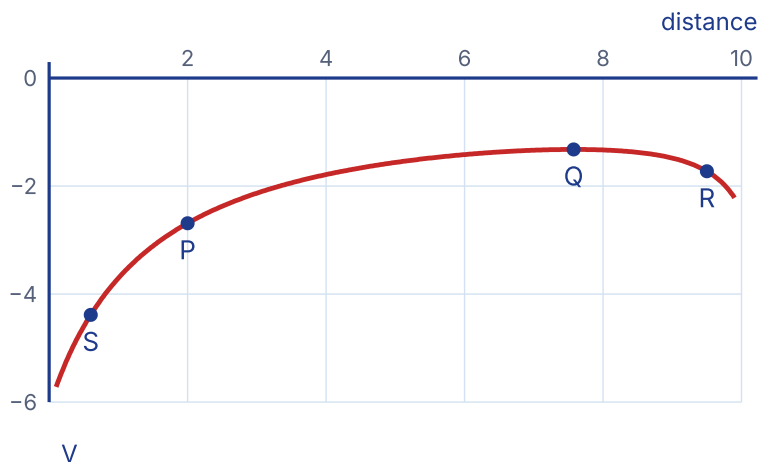
3. Planet X has 3 times the mass of the Earth and twice the radius. The gravitational field strength at the surface of the Earth is g . What is the field strength at the surface of X?

- A. $3g/4$
- B. $3g/2$
- C. $6g$
- D. $12g$

4. Two stars of mass M and $9M$ are a distance d apart, centre to centre. At what distance from the star of mass M is the net gravitational field zero?

- A. $d/10$
- B. $d/2$
- C. $3d/4$
- D. $d/4$

5. The graph shows how the gravitational potential V varies with distance along the line from a planet to its moon.



At which point is the net gravitational field zero?

- A. P
- B. Q
- C. R
- D. S

6. Which is a correct statement of one of Kepler's laws?

- A. A planet moves through equal arc lengths in equal times.
- B. Each planet moves on an ellipse with the Sun at the centre.
- C. The square of the orbital period is proportional to the cube of the semi-major axis.
- D. The orbital period is proportional to the cube of the semi-major axis.

7. Satellite X orbits a planet at radius r . Satellite Y orbits the same planet at radius $4r$. What is (orbital speed of Y)/(orbital speed of X)?

- A. $1/2$
- B. $1/4$
- C. 2
- D. $1/8$

8. Moon A orbits a planet with period T . Moon B orbits the same planet at 9 times the orbit radius of A. What is the period of B?

- A. $3T$
- B. $9T$
- C. $81T$
- D. $27T$

9. Astronauts in a space station orbiting 400 km above the Earth feel weightless. Why?
- A. There is no gravitational force on them at that height.
 - B. They and the station fall freely with the same acceleration, so the floor exerts no force on them.
 - C. The gravitational pull of the Moon balances that of the Earth.
 - D. The centripetal force cancels their weight.
-

10. What is the definition of the gravitational potential at a point P?
- A. the work done per unit mass in bringing a small mass from infinity to P
 - B. the work done in bringing a small mass from infinity to P
 - C. the work done per unit mass in moving a small mass from P to infinity
 - D. the gravitational potential energy of a mass at P
-

11. Two equal masses M are a distance d apart. What is the gravitational potential at the point half way between them?
- A. 0
 - B. $-2GM/d$
 - C. $-4GM/d$
 - D. $-8GM/d^2$
-

12. A body of mass m is moved from the surface of a planet (mass M , radius R) to a distance $2R$ from its centre. What is the work done against the gravitational field?
- A. GMm/R
 - B. $2GMm/R$
 - C. $GMm/4R$
 - D. $GMm/2R$
-

13. A satellite moves in a circular orbit around a planet. What is the work done on it by the gravitational force in half an orbit?
- A. GMm/r
 - B. zero
 - C. $-GMm/r$
 - D. $\pi r \times GMm/r^2$
-

14. Planet Y has twice the mass of the Earth and the same radius. What is (escape speed from Y)/(escape speed from the Earth)?
- A. $1/2$
 - B. 2
 - C. $\sqrt{2}$
 - D. 4
-

15. A satellite in a low circular orbit is acted on by a small drag force from the upper atmosphere. Which describes the changes?

- A.** orbit radius decreases, kinetic energy increases
 - B.** orbit radius decreases, kinetic energy decreases
 - C.** orbit radius stays the same, kinetic energy decreases
 - D.** orbit radius increases, kinetic energy decreases
-