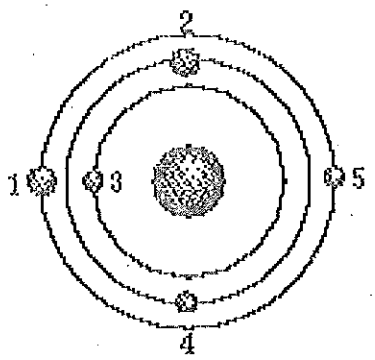
A.P. C Gravity Practice

1. The moon has a period of 27.3 d and is an average distance from the earth of 3.84×10^5 km. A communications satellite is placed in an earth orbit at 4.23×10^4 km from the center of the earth. What is the period of this satellite?

   a. 0.87 h b. 1.0 d c. 3.0 d d. 6.3 d e. 8.0 h

2. 

   Of the satellites shown revolving around the earth, the one with the greatest speed is

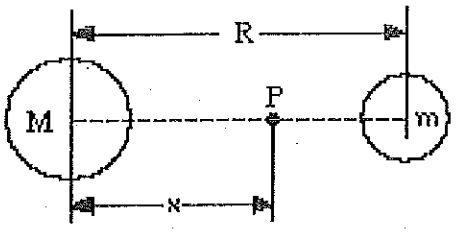
   a. 1 b. 2 c. 3 d. 4 e. 5

3. What is the difference in the force of gravity on a 1.0-kg mass at the bottom of the deepest ocean trench and that at the top of the highest mountain? Assume that $g = 9.8$ m/s^2 at sea level. The radius of the earth at sea level is 6.37×10^6 m. The deepest trench is the Marianas Trench, south of Guam, which has a depth $d = 1.103 \times 10^4$ m below sea level. The highest mountain is Everest in Nepal, which has a height of $h = 8.847 \times 10^3$ m above sea level. The difference is

   a. 0.061 N b. 0.0067 N c. 0.027 N d. 0.034 N e. 0.0062 N

4. You are in a spaceship that has a mass of 13×10^4 kg and is 2.2×10^{12} m from a black hole near the center of the galaxy. The gravitational force exerted by the black hole on the spaceship is 46 N. The force on the ship when it has moved to one-third of its original distance from the black hole is

   a. 410 N b. 140 N c. 150 N d. 5.0 N e. 730 N

5. 

   Two planets have masses M and m, and the ratio M/m = 25. The distance between the planets is R. The point P is between the planets as shown, and the distance between M and P is x. At P the gravitational forces on an object due to M and m are equal in magnitude. The value of x is

   a. 5R/6 b. 25R/36 c. R/25
   d. 6R/5 e. none of these.

6. At the surface of the moon, the acceleration due to the gravity of the moon is a. At a distance from the center of the moon equal to three times the radius of the moon, the acceleration due to the gravity of the moon is

a. 9a b. a/3 c. a/4 d. a/9 e. 27a

7. In the SI system, the units for gravitational field are

a. $kg \cdot m/s^2$ b. m/s^2 c. kg^2/m^2
d. N/m e. none of these.

8. If the mass of the earth is 6×10^{24} kg, the mass of the moon 7×10^{22} kg, the radius of the moon's orbit 4×10^8 m, and the value of the gravitational constant 6×10^{-11} $N \cdot m^2/kg^2$, the force between the earth and the moon is approximately

a. 5×10^4 N b. 2×10^{20} N c. 3×10^{50} N d. 7×10^{30} N e. 3×10^{28} N

9. You need an expression for the acceleration of the moon toward the earth. If the mass of the earth is M_e, the mass of the moon M_m, the separation of the earth and moon r, and the appropriate gravitational constant is G, the correct expression for the moon's acceleration is

a. GM_eM_m/r^2 b. $GM_eM_m^2/r^2$ c. GM_m/r^2 d. GM_e/r^2 e. GM_e/r^2M_m

10. The acceleration due to gravity in the vicinity of the earth

a. varies directly with the distance from the center of the earth.
b. is a constant that is independent of altitude.
c. varies inversely with the distance from the center of the earth.
d. varies inversely with the square of the distance from the center of the earth.
e. is described by none of these.

11. If a planet has a mass twice that of the earth and a radius four times that of the earth, the ratio of the acceleration due to gravity on the planet to that on the earth is

a. 1/8 b. 1/2 c. 1/16 d. 2/1 e. 12/1

12. What is the escape speed from the sun, beginning (from rest relative to the sun) at the orbit of the earth, $R = 1.50 \times 10^8$ km. (Given: $G = 6.67 \times 10^{-11}$ $N \cdot m^2/kg^2$; mass of the sun $= 2.0 \times 10^{30}$ kg.)

a. 3.0×10^4 m/s b. 2.1×10^4 m/s c. 1.3×10^6 m/s d. 9.4×10^5 m/s e. 4.2×10^4 m/s

13. The radius of the moon is R. A satellite orbiting the moon in a circular orbit has an acceleration due to the moon's gravity of 0.14 m/s^2. The acceleration due to gravity at the moon's surface is 1.62 m/s^2. The height of the satellite above the moon's surface is

a. 3.4R b. 0.42R c. 11R d. 2.4R e. 1.7R

14. In the absence of air resistance, the least speed with which a body must be projected vertically upward from the earth's surface ($m_e = 5.99 \times 10^{24}$ kg, $r_e = 6.37 \times 10^6$ m) if it is to reach an altitude of 800 km is

a. ~1.39×10^7 m/s b. ~3.73×10^3 m/s c. ~1.57×10^7 m/s
d. ~3.96×10^3 m/s e. none of these.

15. Suppose that a satellite is in a circular orbit at a height of 2.00×10^6 m above the earth's surface. What is the speed of a satellite in this orbit?

a. 8.31×10^1 m/s b. 6.90×10^3 m/s c. 4.76×10^7 m/s
d. 9.62×10^4 m/s e. none of these

16. Suppose that a satellite is in a circular orbit at a height of 2.00×10^6 m above the earth's surface. What is the period of the satellite's motion at this elevation?

a. 5.65 h b. 4.24 h c. 1.07 h d. 2.12 h e. none of these

17. A satellite in circular orbit 1.609×10^6 m above the surface of the earth ($r_e = 6.436 \times 10^6$ m) has an acceleration toward the earth of

a. 9.76 m/s^2 b. 6.25 m/s^2 c. 7.80 m/s^2 d. 8.73 m/s^2 e. 15.3 m/s^2

18. The radius R of a stable, circular orbit for a satellite of mass m and velocity v about a planet of mass M is given by

a. $R = Gv/M$ b. $R = Gv/mM$ c. $R = GmM/v$ d. $R = GM/mv$ e. $R = GM/v^2$