Practice Quiz Ch 12

1) At their closest approach, Venus and Earth are $4.20 \times 10^{10}$ m apart. The mass of Venus is $4.87 \times 10^{24}$ kg, the mass of Earth is $5.97 \times 10^{24}$ kg, and $G = 6.67 \times 10^{-11}$ N•m²/kg². What is the force exerted by Venus on Earth at that point?
A) $1.10 \times 10^{18}$ N
B) $4.62 \times 10^{28}$ N
C) $6.30 \times 10^{20}$ N
D) $1.72 \times 10^{19}$ N
Answer: A

2) Two identical spheres, each of mass $M$ and radius $R$ just touch each other. What is the magnitude of the gravitational force that they exert on each other?
A) $\frac{GM^2}{R^2}$
B) $\frac{GM^2}{2R^2}$
C) $\frac{GM^2}{4R^2}$
D) $\frac{2GM^2}{R^2}$
Answer: C

3) The moons of Mars, Phobos (Fear) and Deimos (Terror), are very close to the planet compared to Earth's Moon. Their orbital radii are 9,378 km and 23,459 km respectively. What is the ratio of the orbital speed of Phobos to that of Deimos?
A) 0.2528
B) 0.3998
C) 1.582
D) 3.956
Answer: C

4) Two bodies, one of mass $M$ and the other of mass $m$, are subject only to their mutual gravitational attraction. One possible motion is for both of them to revolve in concentric circles about their center of mass. What is the connection between the period of the revolutions and the separation $R$ between the two bodies in this case?
A) $2\pi R^{3/2}/\sqrt{G(M + m)}$
B) $2\pi R^{3/2}(M + m)^{1/2}/(GMm)^{1/2}$
C) $2\pi R^{3/2}(M + m)^{1/2}[G(M^2 + m^2)]^{1/2}$
D) $2\pi R^{3/2}(M + m)/(G)^{1/2}(Mm)^{3/4}$
Answer: A

5) Sirius A and Sirius B constitute a binary star pair in which the stars orbit their common center of mass with a period of 49.9 years. The stars are $2.40 \times 10^{12}$ m apart. Assume that the two stars have equal masses and that they move in a circle about their common center of mass. What is the mass of each star? $G = 6.67 \times 10^{-11}$ N•m²/kg².
A) $5.41 \times 10^{30}$ kg
B) $2.70 \times 10^{30}$ kg
C) $3.30 \times 10^{30}$ kg
D) $1.65 \times 10^{30}$ kg
Answer: D

6) Three masses are located as follows: a 3.5-kg mass is at the origin, a 4.2-kg mass at (0.0 m, 7.0 m), and a 6.5-kg mass at (24.0 m, 0.0 m). What is the gravitational energy of the system of masses? $G = 6.67 \times 10^{-11}$ N•m²/kg².
A) $-2.8 \times 10^{-10}$ J
B) $-2.0 \times 10^{-10}$ J
C) $-1.4 \times 10^{-10}$ J
D) $-3.2 \times 10^{-10}$ J
7) What is the ratio of potential energy to kinetic energy for a comet that has just enough energy to escape from the Sun's gravitational field?
   A) 1/2
   B) 1
   C) 2
   D) -1
   Answer: D

8) A space exploration satellite is orbiting a spherical asteroid whose mass is $4.65 \times 10^{16}$ kg and whose radius is 39,600 m, at an altitude of 12,400 m above the surface of the asteroid. Mission Control sends it a signal to fire a short burst of its retro rockets to bring its speed to zero m/s. What is the speed of the satellite when it hits the surface of the asteroid?
   A) 6.11 m/s
   B) 7.18 m/s
   C) 8.29 m/s
   D) 5.74 m/s
   Answer: A

9) A satellite is in an elliptical orbit around Earth. At one point on the ellipse, it is $25 \times 10^6$ m from the center of Earth and has a speed of 12,000 m/s. What is its speed when it is at another point on the ellipse, $95 \times 10^6$ m from the center of Earth? The mass of Earth is $5.97 \times 10^{24}$ kg and $G = 6.67 \times 10^{-11}$ N•m²/kg².
   A) 12000 m/s
   B) 11000 m/s
   C) 10000 m/s
   D) 9000 m/s
   Answer: B

10) Asteroid 433 Eros is one of the largest near-Earth asteroids. For purposes of this problem, assume it is spherical. The value of $g$ at its surface is 0.0060 m/s² and the escape velocity is only 9.49 m/s. What is the mass of Eros? $G = 6.67 \times 10^{-11}$ N•m²/kg².
    A) $2.3 \times 10^{16}$ kg
    B) $3.5 \times 10^{12}$ kg
    C) $5.1 \times 10^{15}$ kg
    D) $4.9 \times 10^{14}$ kg
    Answer: C

11) Because Earth's orbit is slightly elliptical, Earth actually gets closer to the Sun during part of the year. When Earth is closer to the Sun its orbital speed is
    A) less than when Earth is farthest away from the Sun.
    B) the same as when Earth is farthest away from the Sun.
    C) greater than when Earth is farthest away from the Sun.
    D) sometimes greater sometimes smaller than when Earth is farthest away from the Sun.
    Answer: C

12) How do the escape velocities for two rockets, the first weighing 20 N and the second weighing 20,000 N compare?
    A) The escape velocity for the lighter rocket is smaller than that for the heavier rocket.
    B) The escape velocity for the lighter rocket is the same as that for the heavier rocket.
    C) The escape velocity for the lighter rocket is greater than that for the heavier rocket.
    D) It is impossible to compare the two escape velocities.
    Answer: B

13) A satellite completes one full orbit around Earth. The work performed by Earth's gravitational force on
the satellite is
A) always positive.
B) zero J.
C) always negative.
D) positive most of the time.
Answer: B

14) Planet Z-34 has a mass equal to one-third that of Earth and a radius equal to one-third that of Earth. If \( v_e \) is the escape velocity for Earth, the escape velocity for Z-34 is
A) \( v_e \).
B) 3 \( v_e \).
C) \( v_e \)/9.
D) 9 \( v_e \).
Answer: A