Practice Quiz

1) What is the distance from the moon to the point between Earth and the Moon where the gravitational pulls of Earth and Moon are equal? The mass of Earth is $5.97 \times 10^{24}$ kg, the mass of the Moon is $7.35 \times 10^{22}$ kg, the distance between Earth and the Moon is $3.84 \times 10^8$ m, and $G = 6.67 \times 10^{-11}$ N\(\cdot\)m\(^2\)/kg\(^2\).

A) $3.45 \times 10^8$ m
B) $3.83 \times 10^7$ m
C) $4.69 \times 10^6$ m
D) $4.69 \times 10^7$ m
Answer: B

2) 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\(\cdot\)m\(^2\)/kg\(^2\). 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

3) A spaceship with a mass of $2.8 \times 10^6$ kg is traveling toward two asteroids, each with a mass of $5.0 \times 10^{16}$ kg, which are 40 km apart. Its path is perpendicular to the line joining the asteroids and aimed at the midpoint of that line. What is the net gravitational force exerted by the asteroids on the spaceship when the spaceship is 30 km away from that midpoint? $G = 6.67 \times 10^{-11}$ N\(\cdot\)m\(^2\)/kg\(^2\).

A) 12,000 N
B) 8000 N
C) 16,000 N
D) 6200 N
Answer: A

4) An astronaut drops a marble on the surface of Mars and observes that it takes 1.02 s for the marble to fall 2.00 m. She also knows that the radius of Mars is $3.39 \times 10^6$ m and that $G = 6.67 \times 10^{-11}$ N\(\cdot\)m\(^2\)/kg\(^2\). From this information, she can conclude that the mass of Mars is

A) $3.30 \times 10^{23}$ kg.
B) $6.62 \times 10^{23}$ kg.
C) $4.62 \times 10^{23}$ kg.
D) $8.09 \times 10^{23}$ kg.
Answer: B

5) You are on an airplane traveling with a constant velocity at an altitude of 20,000 m. What is the acceleration of gravity at that altitude? The radius of Earth is $6.37 \times 10^6$ m.

A) $9.81$ m/s\(^2\)
B) $9.78$ m/s\(^2\)
C) $9.75$ m/s\(^2\)
D) $9.72$ m/s\(^2\)
Answer: C

6) 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 period of revolution of Phobos to that of Deimos?

A) 0.2528
B) 0.3998
C) 1.582
D) 3.956
Answer: A
7) 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) $2\pi R^{3/2}/[G(M + m)]^{1/2}$

B) $2\pi R^{3/2}(M + m)^{1/2}/(G mm)^{1/2}$

C) $2\pi R^{3/2}(M + m)^{1/2}/[G(M^2 + m^2)]^{1/2}$

D) $2\pi R^{3/2}(M + m)/(G)^{1/2}(M m)^{3/4}$

Answer: A

8) Three masses are located as follows: a 3.0-kg mass is at the origin, a 4.5-kg mass at (0.0 m, 4.0 m), and a 2.5-kg mass at (3.0 m, 0.0 m). What is the gravitational energy of the system of masses? $G = 6.67 \times 10^{-11}$ N•m$^2$/kg$^2$.

A) $-3.8 \times 10^{-10}$ J

B) $-3.9 \times 10^{-10}$ J

C) $-5.4 \times 10^{-10}$ J

D) $-3.2 \times 10^{-10}$ J

Answer: C

9) 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

10) Kepler's second law tells us that planets sweep out equal areas in equal times. If you compare the amount of area per time swept by Earth with the one of Jupiter, you would conclude:

A) They sweep the same area per time.

B) They sweep different areas per time.

C) Jupiter sweeps a larger area per time because it has much more mass than Earth.

D) Earth sweeps a larger area per time because it has much less mass than Jupiter.

Answer: B

11) The mass of Pluto is $1.25 \times 10^{22}$ kg and its radius is $1.14 \times 10^6$ m. What is the value of $g$ at the surface of Pluto? $G = 6.67 \times 10^{-11}$ N•m$^2$/kg$^2$.

A) 0.642 m/s$^2$

B) 9.81 m/s$^2$

C) 3.72 m/s$^2$

D) 1.40 m/s$^2$

Answer: A

12) 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) $2\pi R^{3/2}/[G(M + m)]^{1/2}$

B) $2\pi R^{3/2}(M + m)^{1/2}/(G mm)^{1/2}$

C) $2\pi R^{3/2}(M + m)^{1/2}/[G(M^2 + m^2)]^{1/2}$

D) $2\pi R^{3/2}(M + m)/(G)^{1/2}(M m)^{3/4}$

Answer: A