Questions

Chapter 13
Gravitation

13-1 Newton's Law of Gravitation
13-2 Gravitation and Principle of Superposition
13-3 Gravitation Near Earth's Surface
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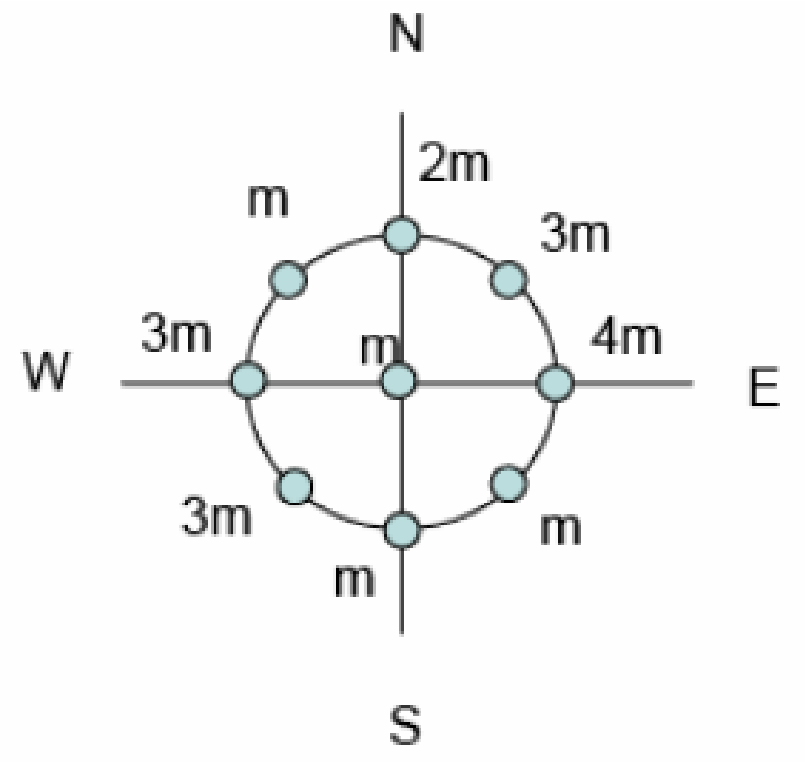
13-2 Gravitation and Principle of Superposition
F-062

Eight balls of different masses are placed along a circle as shown in Fig. 8 The net force on a ninth ball of mass m in the center of the circle is in the direction of:

A) E
B) SE
C) NE
D) N
E) W

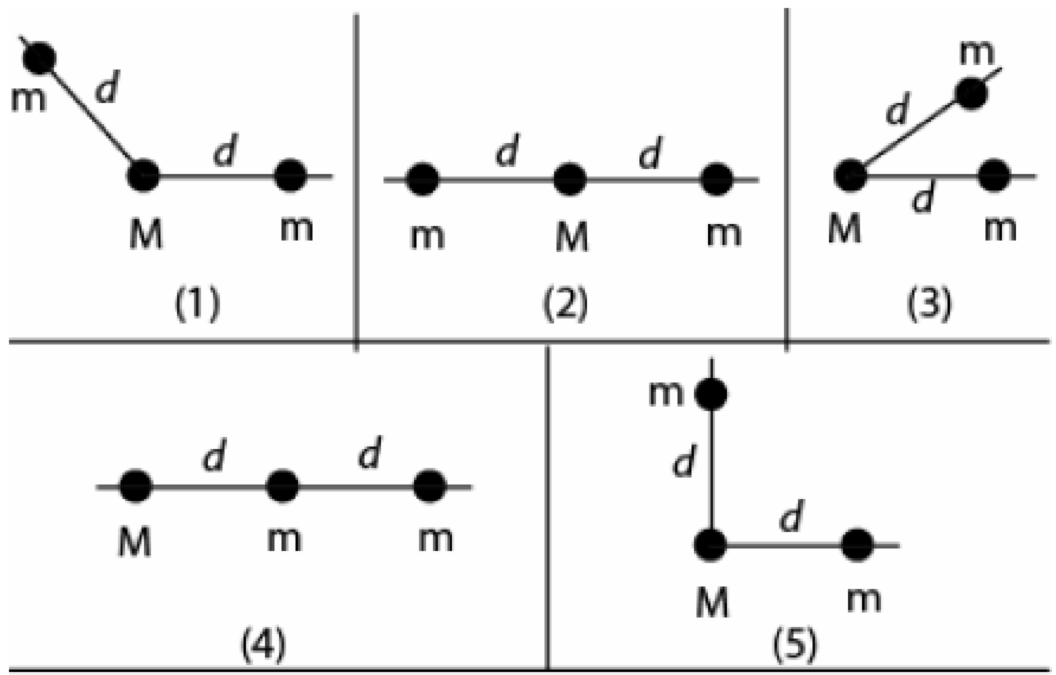


Answer C

13-2 Gravitation and Principle of Superposition
F-061

Fig. 12 shows five configurations of three particles, two of which have mass m and the other one has mass M. The configuration with the least (minimum) gravitational force on M, due to the other two particles is:

A) 5
B) 1
C) 3
D) 4
E) 2



Answer E

13-2 Gravitation and Principle of Superposition
F-042

Four point masses are at the corners of a square whose side is 20 cm long (see Fig 3). What is the magnitude of the net gravitational force on a point mass m5 = 2.5 kg located at the center of the square?

A) 3.3 $\times 10^{-8}$ N
B) 1.1 $\times 10^{-8}$ N
C) 2.2 $\times 10^{-8}$ N
D) 4.4 $\times 10^{-8}$ N
E) 6.6 $\times 10^{-8}$ N

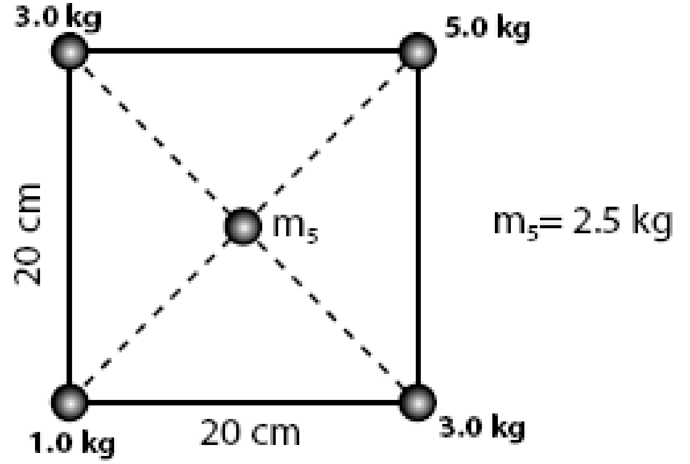


Figure 3

Answer A

13-2 Gravitation and Principle of Superposition
F-042

Two particles with masses M and 4*M are separated by a distance D . What is the distance from the mass M for which the net gravitational force on a mass m is zero?

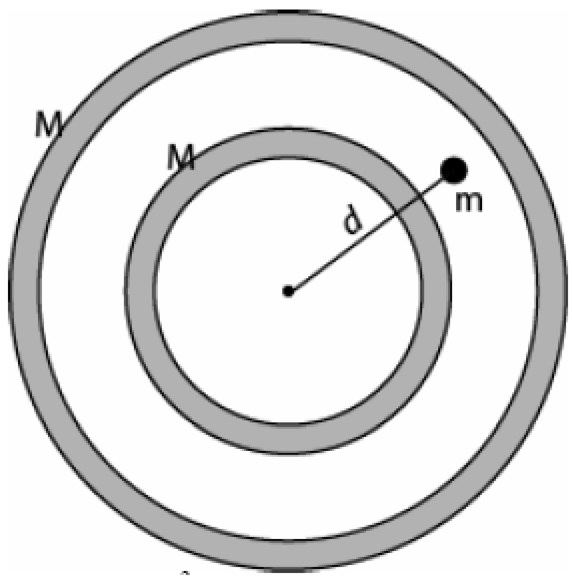
A) D/3
B) D/2
C) 3*D/4
D) 4*D/3
E) 2*D/3

Answer A

13-4 Gravitation Inside Earth
F-061

Two uniform concentric spherical shells each of mass M are shown in Fig. 11. The magnitude of the gravitational force exerted by the shells on a point particle of mass m located a distance d from the center, outside the inner shell and inside the outer shell, is:

A) GMm/d^2
B) $2GMm/d^2$
C) $GMm/(2d^2)$
D) $4GMm/d^2$
E) zero



Answer A

13-5 Gravitational Potential Energy
F-062

The escape velocity of an object of mass 200 kg on a certain planet is 60 km/s. When the object is on the surface of the planet, the gravitational potential energy of the object-planet system is:

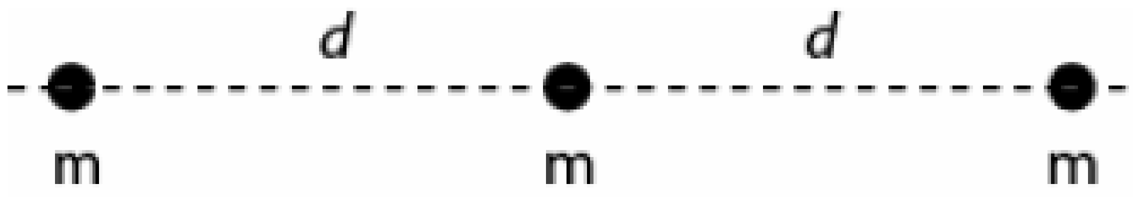
A) -3.6×10^{11} J
B) $+ 3.6 \times 10^{11}$ J
C) $- 3.6 \times 10^{5}$ J
D) $+ 3.6 \times 10^{5}$ J
E) 0 J

Answer A

13-5 Gravitational Potential Energy
F-061

Three identical particles each of mass m are placed on a straight line separated by a distance d as shown in Fig. 10. To remove the particle at the center to a point far away (where U = 0), the work that must be done by an external agent is given by:

A) 4 Gm^2/d
B) 2 Gm^2/d
C) – Gm^2/d
D) – $4Gm^2/d$
E) zero



Answer B

13-5 Gravitational Potential Energy
F-042

What is the escape speed on a spherical planet whose radius is 3200 km and whose gravitational acceleration at the surface is 4.00 m/s2?

A) 5.06 km/s
B) 3.58 km/s
C) 11.2 km/s
D) 9.80 km/s
E) 4.00 km/s

Answer A

13-5 Gravitational Potential Energy
F-042

An object is fired vertically upward from the surface of the Earth (Radius = R) with an initial speed of (Vesc)/2, where (Vesc = escape speed). Neglecting air resistance, how far above the surface of Earth will it reach?

A) R/2
B) R/3
C) 3*R
D) 2*R
E) R

Answer B

13-5 Gravitational Potential Energy
F-041

An object is fired vertically from the surface of Earth. It reaches a maximum height of 2 Re above the surface of Earth. What is the initial speed of the object? (Re= radius of Earth = 6.37×10^6 m, mass of Earth = 5.98×10^{24} kg)

A) 1.2×10^4 m/s
B) 2.6×10^4 m/s
C) 9.1×10^3 m/s
D) 7.5×10^3 m/s
E) 9.8 m/s

Answer C

13-6 Planets and Satellites: Kepler's Laws
F-062

A planet has two moons of masses $m_1 = m$ and $m_2 = 2m$ and orbit radii $r_1 = r$ and $r_2 = 2r$, respectively. The ratio of their periods T_1/T_2 is:

A) 0.13
B) 0.35
C) 1
D) 4
E) 0.71

Answer B

13-6 Planets and Satellites: Kepler's Laws
F-042

A planet requires 300 (Earth) days to complete its circular orbit about its sun (mass M = $6.0*10^{30}$ kg). The orbital speed of the planet is:

A) $6.5x10^4$ m/s
B) $5.4x10^4$ m/s
C) $4.6x10^4$ m/s
D) $3.5x10^4$ m/s
E) $7.5x10^4$ m/s

Answer C

13-6 Planets and Satellites: Kepler's Laws
F-041

The planet Mars has a satellite that travels in a circular orbit of radius 9.40×10^6 m with a period of 2.754×10^4 s. Calculate the mass of Mars from this information.

A) 6.48×10^{23} kg
B) 4.56×10^{26} kg
C) 3.95×10^{23} kg
D) 5.90×10^{26} kg
E) $1.00 * \times 10^{3}$ kg

Answer A

13-7 Satellites: Orbits and Energy
F-062

A satellite in a circular orbit around Earth has a kinetic energy of 1.0×10^8 J. The mechanical energy of the satellite-Earth system is:

A) $+ 2.0 \times 10^8$ J
B) 1.0×10^8 J
C) -2.0×10^8 J
D) -1.0×10^8 J
E) 0 J

Answer D

13-7 Satellites: Orbits and Energy
F-061

A satellite of mass m and kinetic energy K is in a circular orbit around a planet of mass M. The gravitational potential energy of this satellite-planet system is:

A) 4K
B) –K/2
C) K/2
D) –K
E) -2K

Answer E

13-7 Satellites: Orbits and Energy
F-041

A 100-kg spaceship is in a circular orbit of radius 2*Re about the Earth . How much energy is required to transfer the spaceship to an orbit of radius 4*Re ? (Re=radius of Earth= 6.37×10^6 m, mass of the Earth= 5.98×10^{24} kg)

A) 7.8×10^8 J.
B) 6.5×10^9 J.
C) 3.9×10^8 J.
D) 2.9×10^9 J.
E) 1.6×10^8 J.

Answer A