207. What is the effect on the gravitational force if

a. Both masses are multiplied by 3

$F_g \times 9$ direct to product of masses

b. The distance between centers is X4

$\frac{F_g}{16}$ inverse square to r

c. One mass is X2 and the other X3

$F_g \times 6$ direct to product of masses

d. The distance is divided by 2

$4F_g$ inverse to r so $r \div 2$ become $\frac{F_g}{\times 2^2}$

e. The distance is divided by 2 and one mass X3

$12F_g$ $r \div 2 = F_g \times 2^2 = 4F_g$

$m \times 3 = F_g \times 3 = 3F_g = 12F_g$

208. Two masses are attracted by a force of 20N.

a. What would the force between them be if both masses were tripled?

$m \times 9 = F_g \times 9$ so $180N$

$20N \times 9$

b. What would the force between them be if the distance separating them were doubled?

$r \times 2 = \frac{F_g}{4}$ so $\frac{20N}{4} = 5N$

209. An astronaut with a mass of 50 kg is standing on the Earth's surface.

a. Calculate her weight while on the Earth's surface.

$F_g = mg = (50kg)(9.81 m/s^2) = 490.5N$

b. The astronaut moves to an altitude that is one Earth radius above the surface of the Earth. Calculate her weight at this altitude.

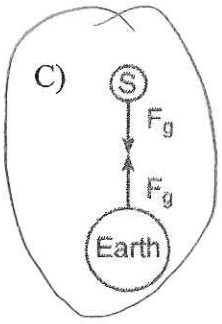
$r \times 2$ so $\frac{F_g}{4}$ $\frac{490.5N}{4} = 122.6N$

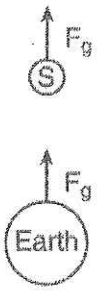
Skill 26-Universal Gravitation

210. Which diagram best represents the gravitational forces, F_g, between a satellite, S, and Earth?

A) 

B) 

C) 

D) 

always attractive & equal

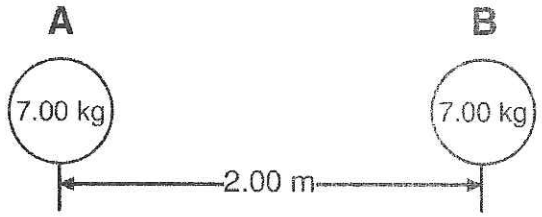
211. Gravitational forces differ from electrostatic forces in that gravitational forces are

A) attractive, only
B) repulsive, only
C) neither attractive nor repulsive
D) both attractive and repulsive

212. If the mass of one of two objects is increased, the force of attraction between them will

A) decrease
B) increase
C) remain the same

213. The diagram shows two bowling balls, A and B, each having a mass of 7.00 kilograms, placed 2.00 meters apart.



What is the magnitude of the gravitational force exerted by ball A on ball B?

A) 8.17×10^{-9} N
B) 1.63×10^{-9} N
C) 8.17×10^{-10} N
D) 1.17×10^{-10} N

$F_g = ?$
$G = 6.67 \times 10^{-11} \frac{N m^2}{kg^2}$
$m_1 = 7kg$ $m_2 = 7kg$
$r = 2m$

$F_g = \frac{G m_1 m_2}{r^2}$

214. The centers of two 15.0-kilogram spheres are separated by 3.00 meters. The magnitude of the gravitational force between the two spheres is approximately

A) 1.11×10^{-10} N
B) 3.34×10^{-10} N
C) 1.67×10^{-9} N
D) 5.00×10^{-9} N

$m_1 = 15kg$
$m_2 = 15kg$
$r = 3m$
$F_g = ?$

215. The radius of Mars is approximately one-half the radius of Earth, and the mass of Mars is approximately one-tenth the mass of Earth. Compared to the acceleration due to gravity on the surface of Earth, the acceleration due to gravity on the surface of Mars is

A) smaller
B) larger
C) the same

$r \div 2$ means $g \times 4$ $g = 4/10$
$m \div 10$ means $g \div 10$

Skill 26-Universal Gravitation

216. Gravitational force F exists between point objects A and B separated by distance R. If the mass of A is doubled and distance R is tripled, what is the new gravitational force between A and B?

A) $\frac{2F}{9}$
B) $\frac{2F}{3}$
C) $\frac{3F}{2}$
D) $\frac{9F}{2}$

$m \times 2$ means $F_g \times 2$
$r \times 3$ means $F_g \div 9$
$F_g = \frac{2}{9}$

217. What is the magnitude of the gravitational force between two 5.0-kilogram masses separated by a distance of 5.0 meters?

A) 5.0×10^{0} N
B) 3.3×10^{-10} N
C) 6.7×10^{-11} N
D) 1.3×10^{-11} N

$F_g = G\frac{(5kg)(5kg)}{(5m)^2}$

218. The gravitational force of attraction between two objects would be increased by

A) doubling the mass of both objects, only $\times 4$
B) doubling the distance between the objects, only $\div 4$
C) doubling the mass of both objects and doubling the distance between the objects $\times 4 \div 4 = \times 1$
D) doubling the mass of one object and doubling the distance between the objects $\times 2 \div 4 = \times \frac{1}{2}$

219. The magnitude of the gravitational force between two objects is 20. Newtons. If the mass of each object were doubled, the magnitude of the gravitational force between the objects would be

A) 5.0 N
B) 10. N
C) 20. N
D) 80 N

$m \times 4$ is $F_g \times 4$ so $(20N)(4) = 80N$

220. Compared to the mass of an object at the surface of the Earth, the mass of the object a distance of two Earth radii from the center of the Earth is

A) the same
B) twice as great
C) one-half as great
D) one-fourth as great

mass does not change

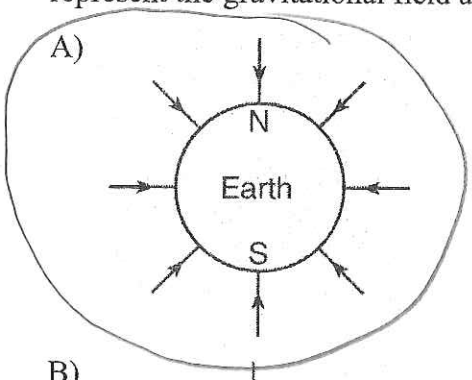
221. As a meteor moves from a distance of 16 Earth radii to a distance of 2 Earth radii from the center of Earth, the magnitude of the gravitational force between the meteor and Earth becomes

A) $\frac{1}{8}$ as great
B) 8 times as great
C) 64 times as great
D) 4 times as great

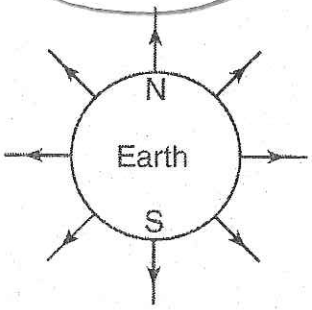
$r \div 8$ means $F_g \times 8^2$

222. In which diagram do the field lines best represent the gravitational field around Earth?

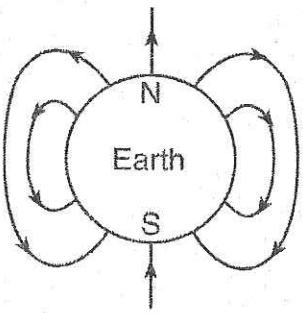
A)



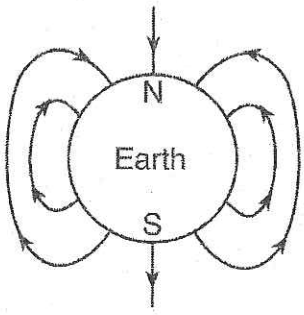
B)



C)

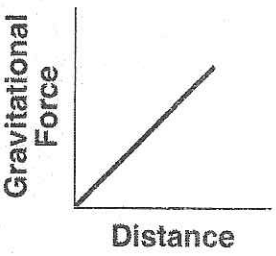


D)

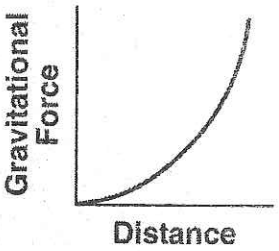


223. Which graph represents the relationship between the magnitude of the gravitational force exerted by Earth on a spacecraft and the distance between the center of the spacecraft and center of Earth? [Assume constant mass for the spacecraft.]

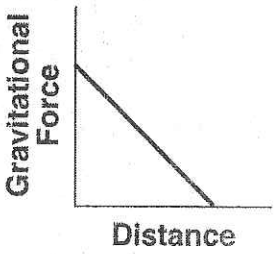
A)



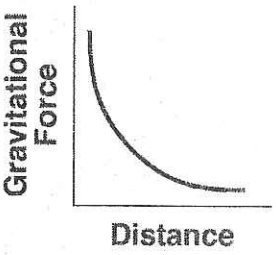
B)



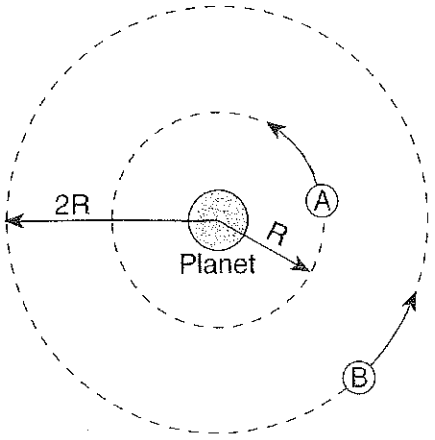
C)



D)



224. The diagram below represents two satellites of equal mass, *A* and *B*, in circular orbits around a planet.



Compared to the magnitude of the gravitational force of attraction between satellite *A* and the planet, the magnitude of the gravitational force of attraction between satellite *B* and the planet is

A) half as great
B) twice as great
C) one-fourth as great
D) four times as great

$r \times 2 = \frac{F_g}{4}$

225. An object weighs 200. Newtons at a distance of 100. kilometers above the center of a small uniform planet. How much will the object weigh 200. kilometers above the planet's center?

A) 400. N
B) 100. N
C) 50.0 N
D) 25.0 N

$r \times 2 = \frac{F_g}{4}$ $\frac{200N}{4} = 50N$

226. What is the magnitude of the gravitational force between an electron and a proton separated by a distance of 1.0×10^{-10} meter?

A) 1.0×10^{-47} N
B) 1.5×10^{-46} N
C) 1.0×10^{-37} N
D) 1.5×10^{-36} N

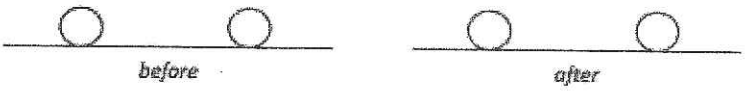
$F_g = \frac{(6.67 \times 10^{-11} Nm^2/kg^2)(9.11 \times 10^{-31} kg)(1.67 \times 10^{-27} kg)}{(1 \times 10^{-10} m)^2}$

227. If the distance between a spaceship and the center of the Earth is increased from one Earth radius to 4 Earth radii, the gravitational force acting on the spaceship becomes approximately

A) 1/16 as great
B) 1/4 as great
C) 16 times greater
D) 4 times greater

$r \times 4 = \frac{F_g}{16}$

228. A 2kg ball moving at 3 m/s collides with a 3 kg ball at rest. Assuming that the 2.0 kg ball stops after the collision, what is the velocity of the 3 kg ball after the collision



229. A 50 kg football player moving at 2 m/s east collides with a 70kg player moving at 4 m/s west. At what speed will the two players be moving if they are locked together after they collide?

230. A 1000 kg car moving at 3.0 m/s east collides with a 1500 kg car moving west. If the two cars stop after the collision, what velocity did the 1500 kg car have before the collision?

231. A 100 kg cannon has a 5.0 kg cannon ball ready for launch. If the cannonball is fired with an initial velocity of 20 m/s, what is the recoil velocity of the cannon?