Quiz Average **8.4** **Quiz High Score** **10**

PH 220 **Quiz # 07 (10 pts)** **Name** **Solution**

Ganymede is the largest Moon in the Solar System. It orbits Jupiter with a period of 7.155 days $= 6.182 \times 10^5$s. The mass of Ganymede is known to be 1.482×10^{23} kg. It has an orbit with a radius of 1.070×10^9 m . What is the mass of Jupiter using this information?

A. 7.91×10^{26} kg

B. $\mathbf{1.90 \times 10^{27}}$ **kg**

C. 1.10×10^{24} kg

D. 4.81×10^{25} kg

Newton's form of Kepler's third law is

$$T^2 = \frac{4\pi^2}{Gm_{Jupiter}} r^3$$

Solve for mass of Jupiter

$$m_{Jupiter} = \left(\frac{4\pi^2}{G}\right)\frac{r^3}{T^2} = \left(\frac{4\pi^2}{6.67 \times 10^{-11} N \, m^2/kg^2}\right)\frac{(1.070 \times 10^9 m)^3}{(6.182 \times 10^5)^2} =$$

$$m_{Jupiter} = \left(5.919 \times 10^{11} kg \, s^2/m^3\right)\frac{1.225 \times 10^{27} m^3}{3.822 \times 10^{11} s^2} = 1.90 \times 10^{27}\ kg$$

So, the correct answer is B !

A neutron star has a mass of 3.98×10^{30} kg. The radius of the star is 1.10×10^4 m. What is the value of the acceleration of gravity at the surface of the neutron star?

A. $2.03 \times 10^{-33}\ m/s^2$

B. $2.41 \times 10^{27}\ m/s^2$

C. $\mathbf{2.19 \times 10^{12}\ m/s^2}$

D. $2.41 \times 10^{16}\ m/s^2$

$$g = \frac{Gm}{R^2} = \frac{\left(6.67 \times 10^{-11} N \, m^2/kg^2\right)(3.98 \times 10^{30}\ kg)}{(1.10 \times 10^4\ m)^2} = 2.19 \times 10^{12}\ m/s^2$$

So, the correct answer is C !

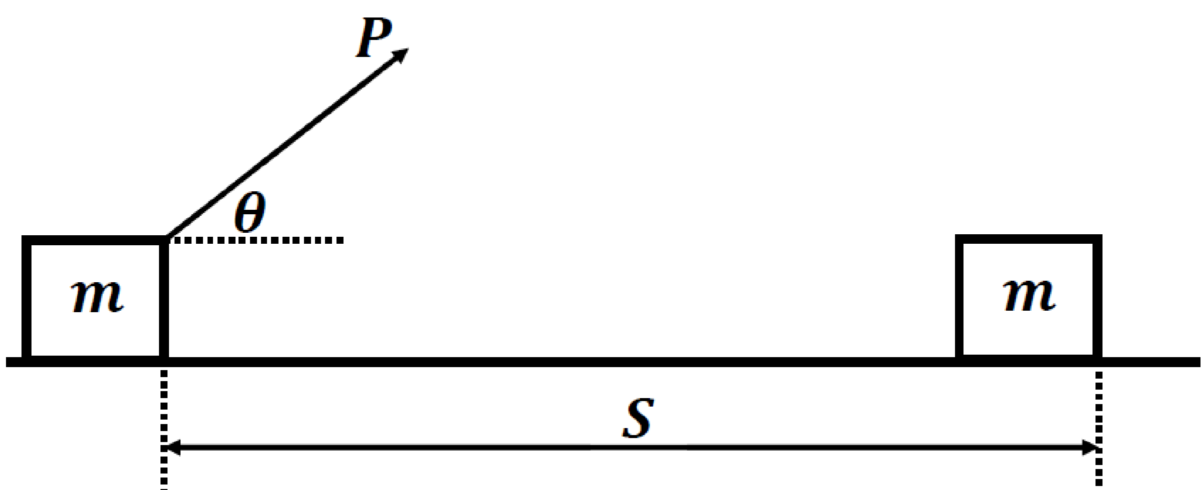
A ball has a mass of $0.145\ \mathrm{kg}$ and the ball is thrown with an initial velocity upward with a value of $16.3\ ^{\mathrm{m}}/_{\mathrm{s}}$, which allows the ball to reach a height of $13.6\ \mathrm{m}$ before the ball momentarily stops and then begins to fall back to the ground. How much work did gravity do on the ball as it traveled to the high point above the ground?

A.	$+32.1\ \mathrm{J}$	**C.**	$+19.3\ \mathrm{J}$
B.	$-32.1\ \mathrm{J}$	**D.**	$\mathbf{-19.3\ J}$

$$W = \overrightarrow{F_{Grav}} \cdot \overrightarrow{S_y} = mgh\ \cos(180°) = -mgh = -(0.145\ kg)\left(9.80\ ^{m}/_{s^2}\right)(13.6\ m)$$

$$W = -19.3\ J$$

So, the correct answer is D !



A mass $(\mathrm{m} = 12.3\ \mathrm{kg})$ is pulled by a force $(\mathrm{P} = 103.\ \mathrm{N}\ @43.7°\ \text{above horizontal})$, which moves the mass a distance $(\mathrm{S} = 65.4\ \mathrm{m})$. How work is done by the P force?

A. $\mathbf{+4870\ J}$ **B.** $+4650\ \mathrm{J}$ **C.** $-4870\ \mathrm{J}$ **D.** $-4650\ \mathrm{J}$

$$W = \vec{P} \cdot \vec{S} = P\cos(\theta)\, S = (103.\ N)\cos(43.7°)\,(65.4\ m) = +4870\ J$$

So, the correct answer is A !

What is the angle between vector $\vec{A} = 3(\hat{\imath}) - 4(\hat{\jmath})$ and vector $\vec{B} = -5(\hat{\imath}) + 12(\hat{\jmath})$?

A.	$14.0°$	**C.**	$194.°$
B.	$\mathbf{166.°}$	**D.**	$346.°$

$$\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y = |\vec{A}||\vec{B}| \cos(\theta_{AB})$$

Solving for $\cos(\theta_{AB})$

$$\cos(\theta_{AB}) = \frac{A_x B_x + A_y B_y}{|\vec{A}||\vec{B}|} = \frac{A_x B_x + A_y B_y}{\left(\sqrt{A_x^2 + A_y^2}\right)\left(\sqrt{B_x^2 + B_y^2}\right)}$$

$$\cos(\theta_{AB}) = \frac{(3)(-5) + (-4)(12)}{\sqrt{(3)^2 + (-4)^2}\sqrt{(-5)^2 + (12)^2}} = \frac{-63}{\sqrt{25}\sqrt{169}} = \frac{-63}{(5)(13)} = \frac{-63}{65} = -0.969$$

$$\theta_{AB} = \cos^{-1}(-0.969) = 166.°$$

So, the correct answer is B !

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