Physics Problem Set 7 - due Mon. May 23 by 6pm (9043592)

Question 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1. Question Details OSColPhys1 4.P.021.WA. [2707314]

Since astronauts in orbit are apparently weightless, a clever method of measuring their masses is needed to monitor their mass gains or losses to adjust diets. One way to do this is to exert a known force on an astronaut and measure the acceleration produced. Suppose a net external force of 58.0 N is exerted and the astronaut's acceleration is measured to be 0.912 m/s^2. Calculate her mass.

63.6 kg

Supporting Materials

Physical Constants

2. Question Details OSColPhys1 4.P.007.WA. [2707312]

An object of mass 11.0 kg subjected to a non-zero net force moves with an acceleration of 2.9 m/s^2.

(a) Determine the net force acting on it. (Enter the magnitude only.)

31.9 N

(b) What acceleration would a 22.0-kg object have if the same net force is applied to it?

1.45 m/s^2

Supporting Materials

Physical Constants

3. Question Details OSColPhys1 4.P.016.WA. [2707405]

Two horizontal forces, $\vec{P}$ and $\vec{Q}$, are acting on a block that is placed on a table. We know that $\vec{P}$ is directed to the left but the direction of $\vec{Q}$ is unknown; it could either be directed to the right or to the left. The object moves along the x-axis. Assume there is no friction between the object and the table. Here $P = -2.0$ N and the mass of the block is 4.0 kg.

(a) What is the magnitude and direction of $\vec{Q}$ when the block moves with constant velocity? (Indicate the direction with the sign of your answer.)

[ ] 2 N

(b) What is the magnitude and direction of $\vec{Q}$ when the acceleration of the block is $+7.2$ m/s^2. (Indicate the direction with the sign of your answer.)

[ ] 30.8 N

(c) Find the magnitude and direction of $\vec{Q}$ when the acceleration of the block is -7.2 m/s^2. (Indicate the direction with the sign of your answer.)

[ ] -26.8 N

Supporting Materials

Physical Constants

4. Question Details OSColPhys1 4.P.027.Tutorial.WA. [2707379]

A 78-kg man stands on a bathroom scale inside an elevator. Draw free body diagrams!!

(a) The elevator accelerates upward from rest at a rate of 1.20 m/s^2 for 1.50 s. What does the scale read during this 1.50 s interval?

[ ] 858 N

(b) The elevator continues upward at constant velocity for 8.50 s. What does the scale read now?

[ ] 764 N

(c) While still moving upward, the elevator's speed decreases at a rate of 0.450 m/s^2 for 3.00 s. What is the scale reading during this time?

[ ] 729 N

Supporting Materials

Physical Constants

5. Question Details OSColPhys1 4.P.008.WA. [2707404]

You work at a garden store for the summer. You lift a bag of fertilizer with a force of 110 N, and it moves upward with an acceleration of 0.775 m/s^2.

Draw a free body diagram!

(a) What is the mass of the fertilizer bag?

[ ] 10.4 kg

(b) How much does the fertilizer bag weigh?

[ ] 102 N

Supporting Materials

Physical Constants

6. Question Details OSColPhys1 6.P.023.WA. [2611719]

A rotating space station is said to create "artificial gravity"—a loosely-defined term used for an acceleration that would be crudely similar to gravity. The outer wall of the rotating space station would become a floor for the astronauts, and centripetal acceleration supplied by the floor would allow astronauts to exercise and maintain muscle and bone strength more naturally than in non-rotating space environments. If the space station is 180 m in diameter, what angular velocity would produce an "artificial gravity" of 9.80 m/s^2 at the rim?

[ ] 3.15 rpm

Supporting Materials

Physical Constants

7. Question Details OSColPhys1 6.P.010.WA. [2611539]

Mary and her younger brother Alex decide to ride the carousel at the State Fair. Mary sits on one of the horses in the outer section at a distance of 2.0 m from the center. Alex decides to play it safe and chooses to sit in the inner section at a distance of 1.3 m from the center. The carousel takes 5.8 s to make each complete revolution.

(a) What is Mary's angular speed ω_M and tangential speed v_M?

ω_M = [ ] 0.172 rev/s

v_M = [ ] 2.17 m/s

(b) What is Alex's angular speed ω_A and tangential speed v_A?

ω_A = [ ] 0.172 rev/s

v_A = [ ] 1.41 m/s

Supporting Materials

Physical Constants

8. Question Details OSColPhys1 6.P.018.WA. [2611772]

Helicopter blades withstand tremendous stresses. In addition to supporting the weight of the helicopter, they are spun at rapid rates and experience large centripetal accelerations, especially at the tip.

(a) Calculate the centripetal acceleration at the tip of a 3.80-m-long helicopter blade that rotates at 340 rev/min.

[ ] 4820 m/s^2

(b) Compare the tangential speed of the tip with the speed of sound (taken to be 340 m/s on this day).

$\frac{v}{v_{sound}} =$ [ ] 0.398

Supporting Materials

Physical Constants

9. Question Details OSColPhys1 6.P.027.WA. [2611761]

(a) A 23.0-kg child is riding a playground merry-go-round that is rotating at 30.0 rpm. What centripetal force must she exert to stay on if she is 1.50 m from its center?

[ ] 341 N

(b) What centripetal force does she need to stay on an amusement park merry-go-round that rotates at 3.00 rpm if she is 6.40 m from its center?

[ ] 14.5 N

(c) Compare each force with her weight.

$\frac{\text{force from part (a)}}{\text{weight}} =$ [ ] 1.51

$\frac{\text{force from part (b)}}{\text{weight}} =$ [ ] 0.0645

Supporting Materials

Physical Constants

10. Question Details OSColPhys1 6.P.040.WA. [2611472]

(a) What is the acceleration of gravity on the surface of the Moon? The mass of the moon is 7.35×10^{22} kg and its radius is 1.74×10^{6} m.

[ ] 1.62 m/s^2

(b) What is the acceleration of gravity on the surface (or outer limit) of Mercury? The mass of Mercury is 3.30×10^{23} kg and its radius is 2.44×10^{6} m.

[ ] 3.7 m/s^2

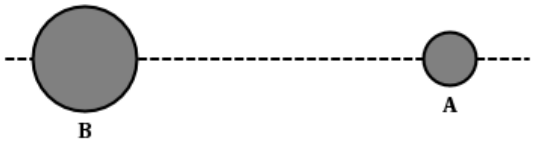
Supporting Materials

Physical Constants

11. Question Details OSColPhys1 6.P.047.WA. [2611781]

Two spheres A and B are placed in the arrangement shown below.

(a) If $m_A = 2m$ and $m_B = 6m$, where on the dashed line should a third sphere C of mass $6m$ be placed so that the net force on it is zero?



- between A and B, closer to B
- at the midpoint between A and B
- between A and B, closer to A
- to the left of B
- to the right of A

(b) If the distance between the two spheres A and B is 500 cm, find the location for the third sphere C so that the net force on it is zero.

[ ] 317 cm to the right of sphere B

Supporting Materials

Physical Constants

12. Question Details OSColPhys1 6.P.046.WA. [2611562]

A heavier mass m_1 and a lighter mass m_2 are 18.5 cm apart and experience a gravitational force of attraction that is 9.60×10^{-9} N in magnitude. The two masses have a combined value of 5.45 kg. Determine the value of each individual mass.

m_1 = [ ] 4.31 kg

m_2 = [ ] 1.14 kg

Supporting Materials

Physical Constants

13. Question Details OSColPhys1 6.P.053.WA. [2611755]

NASA launches a satellite into orbit at a height above the surface of the Earth equal to the Earth's mean radius. The mass of the satellite is 660 kg. (Assume the Earth's mass is 5.97×10^{24} kg and its radius is 6.38×10^{6} m.)

(a) How long does it take the satellite to go around the Earth once?
[ ] 3.99 h

(b) What is the orbital speed of the satellite?
[ ] 5590 m/s

(c) How much gravitational force does the satellite experience?
[ ] 1610 N

answer this in reverse order:
(c) first,
(b) next,
(a) last

Supporting Materials

Physical Constants

14. Question Details OSColPhys1 6.P.052.WA. [2611569]

Determine the orbital speed of a satellite that circles the Earth with a period of 2.00×10^{4} s. The mass of the Earth is 5.97×10^{24} kg.
[ ] 5000 m/s

Supporting Materials

Physical Constants

15. Question Details OSColPhys1 6.P.056.WA. [2611585]

Astronomical observations of our Milky Way galaxy indicate that it has a mass of about $8. \times 10^{11}$ solar masses. A star orbiting near the galaxy's periphery is 5.7×10^{4} light years from its center. (For your calculations, assume that the galaxy's mass is concentrated near its center.)

(a) What should the orbital period of that star be?
[ ] 2.42e+08 yr

(b) If its period is 6.5×10^{7} years instead, what is the mass of the galaxy? Such calculations are used to imply the existence of "dark matter" in the universe and have indicated, for example, the existence of very massive black holes at the centers of some galaxies.
[ ] 1.11e+13 solar masses

Dark Matter!

Supporting Materials

Physical Constants

Assignment Details

Name (AID): **Physics Problem Set 7 - due Mon. May 23 by 6pm (9043592)**
Submissions Allowed: **5**
Category: **Homework**
Code:
Locked: **No**
Author: **Chowdary, Krishna (** chowdark@evergreen.edu **)**
Last Saved: **May 17, 2016 11:17 AM PDT**
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