

Sample Final 105_fall 2009

1. One mile is equal to 1609 meters; one hour is equal to 3600 seconds, *mph* is “1 mile per hour”. The speed of **17 m/s** is equivalent to the speed of:

- A) 17 *mph*
- B) 38 *mph***
- C) 7.6 *mph*
- D) 17000 *mph*
- E) 38 m/s

2. A box with the dimensions of **2.54 cm × 12.7 cm × 5.08 cm** has a volume of:
Use 1 inch = 2.54 cm, 1 m = 100cm



- A) 10 inch³**
- B) 100 inch³
- C) 164 inch³
- D) 164 inch
- E) 164 m³

3. At a stop light, a truck traveling at 15 m/s passes a car as it starts from rest. The truck travels at constant velocity and the car accelerates at 3 m/s². How much time does the car take to catch up to the truck?

- A) 5 s
- B) 10 s**
- C) 15 s
- D) 20 s
- E) 25 s

4. An object dropped from the window of a tall building hits the ground in 12.0 s. If its acceleration is 9.8 m/s², the height of the window above the ground is :

- A) 29.4 m
- B) 58.8 m
- C) 118 m
- D) 353 m
- E) 706 m**

5. The angle between vectors $\underline{A} = 4 \underline{i} - 3 \underline{j}$ and $\underline{B} = -4 \underline{i} - 3 \underline{j}$ is equal to
REMEMBER \underline{i} and \underline{j} are unit vectors along +x and +y

- A) 0°
- B) 0.28
- C) 45°
- D) 74°
- E) 106°**

6. A vector in the xy plane has a magnitude of 25 m and an x component of 12 m. The angle it makes with the positive x axis is:

- A) 26°
- B) 29°
- C) 61°**
- D) 64°
- E) 241°

7. A large cannon is fired from ground level over level ground at an angle of 30° above the horizontal. The muzzle speed is 490 m/s. Neglecting air resistance, the projectile will travel what horizontal distance before striking the ground? :

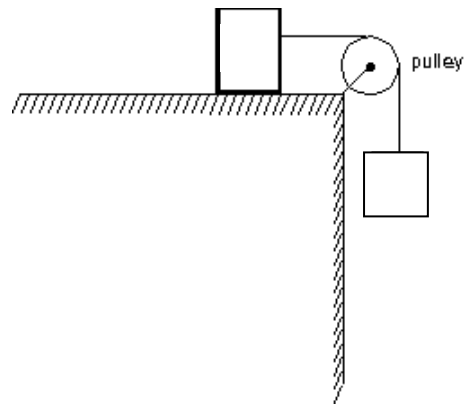
- A) 1.08 km
- B) 2.13 km
- C) 10.8 km
- D) 21.3 km**
- E) 42.5 km

8. A ball is pushed with an initial velocity of 4.0 m/s. It has a constant acceleration of 1.6 m/s^2 . What is the ball's velocity after 8.0s?

- a. 10 m/s
- b. 12 m/s
- c. 16 m/s
- d. 17 m/s**
- e. 19 m/s

9. Two blocks with the masses of **5.0 kg** on table and **2.0 kg** are connected by a string as shown. If the pulley is massless and the surface is frictionless these masses move with acceleration. Find the magnitude of tension in the string:

- A) 20 N
- B) 35 N
- C) 50 N
- D) 14 N**
- E) 0.0 N

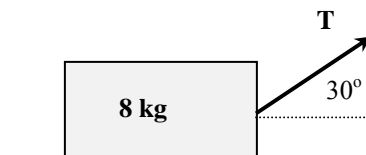


10. Two blocks in the above figure, are exchanged so that the **2.0 kg** mass is on table and the **5.0 kg** mass is hanging. The table surface has friction ($\mu_k = 0.4$) but these masses move with constant velocity. Find the magnitude of tension in the string:

- A) 20 N
- B) 35 N
- C) 50 N**
- D) 14 N
- E) 0.0 N

11. A 8-kg block is pulled along a rough horizontal surface ($\mu_k = 0.2$) by a rope that exerts a 30 N tension force directed 30° above the horizontal. What is the magnitude of the friction force on the block?

- (A) 13 N**
- (B) 28 N
- (C) 45 N
- (D) 70 N
- (E) 80 N



12. An automobile of mass 2 000 kg moving at 20 m/s is braked suddenly with a constant braking force of 5 000 N. How far does the car travel before stopping?

- a. 2.5 m
- b. 66 m
- c. 80 m**
- d. 20 m
- e. 102 m

13. A 5-kg object is moving at 7 m/s. A 2-N force is applied in the opposite direction of motion and then removed after the object has traveled an additional 20 m. What is its final kinetic energy?

- a. 83 J**
- b. 122 J
- c. 210 J
- d. 40 J
- e. 25 J

14. A 2 kg crate starting at rest slides down a rough 5.0-m long ramp, inclined at 25 degree with the horizontal. 20 J of energy is lost to friction. What will be the speed of the crate at the bottom of the incline?

- a. 0.98 m/s
- b. 1.9 m/s
- c. 4.7 m/s**
- d. 3.2 m/s
- e. 5.6 m/s

15. An athlete of mass 70 kg on a trampoline leaps straight up into the air with an initial speed of 9.0 m/s. Find the kinetic energy of the athlete when she is halfway up to her maximum height.

- a. 0 J
- b. 1400 J**
- c. 2800 J
- d. 700 J
- e. 2100 J

16. A jet engine develops 1.0×10^5 N of thrust in moving an airplane forward at a speed of 250 m/s. What is the power developed by the engine?

- a. 50 MW
- b. 10 MW
- c. 65 MW
- d. 500 kW
- e. 25 MW**

17. A 10kg mass drops on a vertical spring (spring constant $k = 5.0 \times 10^4$ N/m) from a height of 5m. Neglect air resistance. What is the maximum compression of the spring?

- a. 1.4×10^{-1} m**
- b. 2.0×10^{-2} m
- c. 1.0×10^{-1} m
- d. 1.0×10^{-2} m
- e. 2.8×10^{-1} m

18. A Hooke's law spring is compressed a distance d and is used to launch a mass m vertically to a height h above its starting position. Next, the spring is compressed by $2d$ and is used to launch the same mass. How high does the mass now rise above its starting position?

ANS: $4h$

19. Alex throws a 0.15-kg rubber ball down onto the floor. The ball's speed just before impact is 6.5 m/s, and just after is 3.5 m/s. If the ball is in contact with the floor for 0.025 s, what is the magnitude of the average force applied by the floor on the ball?

- a. **60 N**
- b. 133 N
- c. 3.0 N
- d. 3.5 N
- e. 87 N

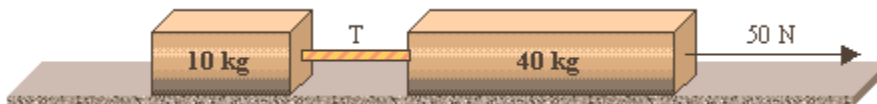
20. A 4-kg mass moves to the right with a speed of 8 m/s. It collides head - on with a 6 kg mass moving to the left with a speed of 3 m/s. If the collision is perfectly inelastic, what is the speed of the masses after the collision?

- a. 0.1 m/s
- b. 0.5 m/s
- c. **1.4 m/s**
- d. 4.4 m/s
- e. 5.2 m/s

21. Two cars collide at an intersection. The collision is perfectly inelastic. The cars stick and travel together after the collision. Car 1 with mass 1500 kg, is travelling east at 15 m/s. Car 2 with mass 2000 kg, is travelling north at 20 m/s. After the collision, what is the wreck's velocity magnitude and direction? Give the direction as an angle relative to east.

ANS: **13 m/s at 60°**

22. A 10-kg block is connected to a 40-kg block as shown in the figure. The surface on which the blocks slide is frictionless. A force of 50 N pulls the blocks to the right. What is the magnitude of the tension T in the rope that connects the two blocks?

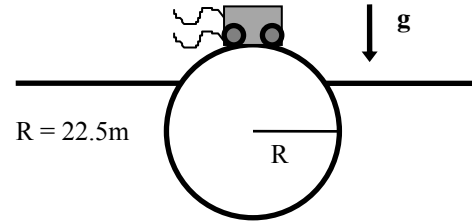


- (A) 0 N
- (B) **10 N**
- (C) 20 N
- (D) 40 N
- (E) 50 N

23. A 2 000-N weight is suspended in equilibrium by two cables. Cable 1 applies a horizontal force to the right of the object and has a tension, T_1 . Cable 2 applies a force upward and to the left at an angle of 45.0° to the negative x axis and has a tension, T_2 . Find T_1 .
- 2 000 N
 - 4 440 N
 - 6 310 N
 - 3 340 N
 - 1 120 N

24. A small 600-kg car travels across the crest of a circular hump of radius 22.5 m. What is the maximum speed at which the car can go over the hump without losing contact with the road?

- 30 m/s
- 28 m/s
- 20 m/s
- 15 m/s
- 10 m/s



25. A small coin is placed on a flat horizontal turntable. The turntable is observed to make one revolution in 3.14 s.

(a) What is the speed of the coin when it rides without slipping at a distance 0.3 m from the center of the turntable? [

ANS: 0.6 m/s

(b) What is the coefficient of static friction between the coin and the turntable, if the coin is observed to slide off the turntable when it is more than 0.3 m from the center of the turntable? Use $g = 10 \text{ m/s}^2$. [1.5 points]

ANS: 0.12

26. A block of mass 5 kg rests on a plane inclined at 25° to the horizontal, as shown below. Between the block and the plane, the coefficient of static friction is 0.25, and the coefficient of kinetic friction is 0.15. Use $g = 10 \text{ m/s}^2$.

What is the minimum force F , parallel to the plane, that will prevent the sled from slipping down the plane?

ANS: 9.8N

