

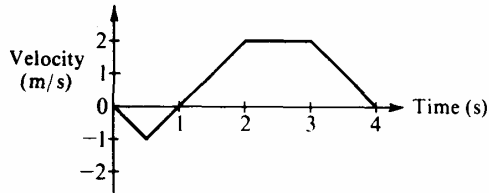
AP PHYSICS SUMMER ASSIGNMENT

Due: September 6, 2011

This will count for a test grade for 1st quarter. Please feel free to work together but identical answers are prohibited.

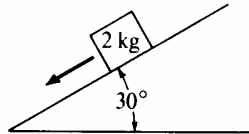
Concepts to review before completing the summer assignment:

- *Scalar Quantities: Distance, Speed, Time, Mass*
- *Vector Quantities: Displacement, Velocity, Acceleration, Weight, Force*
- *Kinematics*
 - *Constant acceleration*
 - *Free fall due to gravity*
 - *Circular Motion*
- *Forces*
 - *Newton's 2nd Law*
 - *Free Body Diagrams*
 - *Weight*
 - *Normal force*
 - *Frictional force*
- *Projectile Motion*
- *Energy*
 - *Potential Energy*
 - *Kinetic Energy*



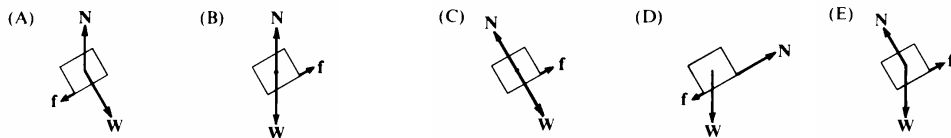
1. The graph above shows the velocity versus time for an object moving in a straight line. At what time after $t = 0$ does the object again pass through its initial position?
 (A) Between 0 and 1 s (B) 1 s (C) Between 1 and 2 s (D) 2 s (E) Between 2 and 3 s

Questions 2 - 3

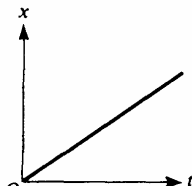


A 2-kilogram block slides down a 30° incline as shown above with an acceleration of 2 meters per second squared.

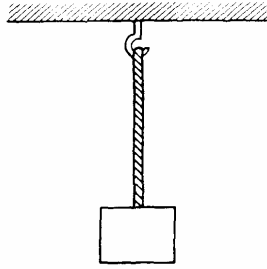
2. Which of the following diagrams best represents the gravitational force W , the frictional force f , and the normal force N that act on the block?



4. The magnitude of the frictional force along the plane is most nearly
 (A) 2.5 N (B) 5 N (C) 6 N (D) 10 N (E) 16 N
5. A body moving in the positive x direction passes the origin at time $t = 0$. Between $t = 0$ and $t = 1$ second, the body has a constant speed of 24 meters per second. At $t = 1$ second, the body is given a constant acceleration of 6 meters per second squared in the negative x direction. The position x of the body at $t = 11$ seconds is
 (A) +99m (B) +36m (C) - 36 m (D) - 75 m (E) - 99 m



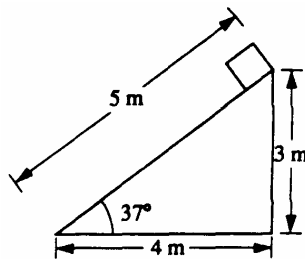
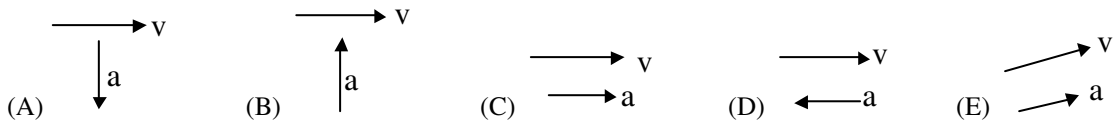
6. The displacement x of an object moving along the x -axis is shown above as a function of time t . The acceleration of this object must be
 (A) zero (B) constant but not zero (C) increasing (D) decreasing (E) equal to g
7. An object is released from rest on a planet that has no atmosphere. The object falls freely for 3.0 meters in the first second. What is the magnitude of the acceleration due to gravity on the planet?
 (A) 1.5 m/s^2 (B) 3.0 m/s^2 (C) 6.0 m/s^2 (D) 10.0 m/s^2 (E) 12.0 m/s^2



8. A uniform rope of weight 50 newtons hangs from a hook as shown above. A box of weight 100 newtons hangs from the rope. What is the tension in the rope?
- (A) 50 N throughout the rope (B) 75 N throughout the rope (C) 100 N throughout the rope
 (D) 150 N throughout the rope (E) It varies from 100 N at the bottom of the rope to 150 N at the top.
9. A truck traveled 400 meters north in 80 seconds, and then it traveled 300 meters east in 70 seconds. The magnitude of the average velocity of the truck was most nearly
- (A) 1.2 m/s (B) 3.3 m/s (C) 4.6 m/s (D) 6.6 m/s (E) 9.3 m/s

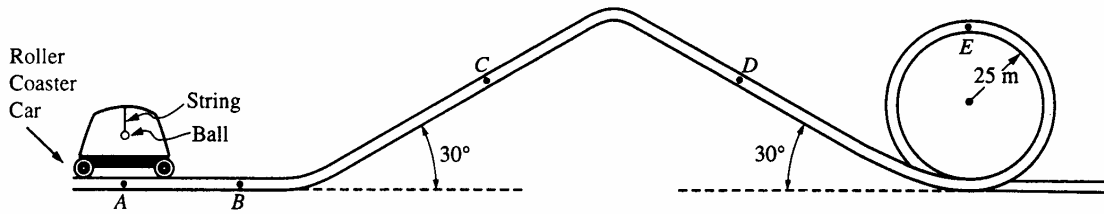


10. An automobile moves at constant speed down one hill and up another hill along the smoothly curved surface shown above. Which of the following diagrams best represents the directions of the velocity and the acceleration of the automobile at the instant that it is at the lowest position, as shown?



A plane 5 meters in length is inclined at an angle of 37° , as shown above. A block of weight 20 newtons is placed at the top of the plane and allowed to slide down.

11. The mass of the block is most nearly
- (A) 1.0 kg (B) 1.2 kg (C) 1.6 kg (D) 2.0 kg (E) 2.5 kg
12. The magnitude of the normal force exerted on the block by the plane is most nearly
- (A) 10 N (B) 12 N (C) 16 N (D) 20 N (E) 33 N
13. The work done on the block by the gravitational force during the 5-meter slide down the plane is most nearly
- (A) 20 J (B) 60 J (C) 80 J (D) 100 J (E) 130 J



Note: Figure not drawn to scale.

FR1. (15 points)Part of the track of an amusement park roller coaster is shaped as shown above. A safety bar is oriented lengthwise along the top of each car. In one roller coaster car, a small 0.10-kilogram ball is suspended from this bar by a short length of light, inextensible string.

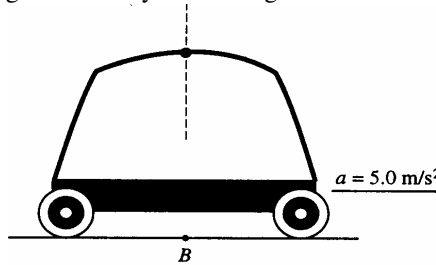
- a. Initially, the car is at rest at point A.
 - i. On the diagram below, draw and label all the forces acting on the 0.10-kilogram ball.



- ii. Calculate the tension in the string.

The car is then accelerated horizontally, goes up a 30° incline, goes down a 30° incline, and then goes around a vertical circular loop of radius 25 meters. For each of the four situations described in parts (b) to (e), do all three of the following. In each situation, assume that the ball has stopped swinging back and forth. 1) Determine the horizontal component T_h of the tension in the string in newtons and record your answer in the space provided. 2) Determine the vertical component T_v of the tension in the string in newtons and record your answer in the space provided. 3) Show on the adjacent diagram the approximate direction of the string with respect to the vertical. The dashed line shows the vertical in each situation.

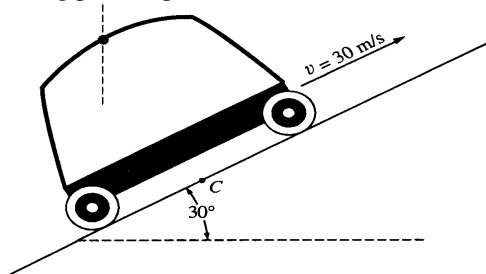
- b. The car is at point B moving horizontally to the right with an acceleration of 5.0 m/s^2 .



$T_h =$ _____

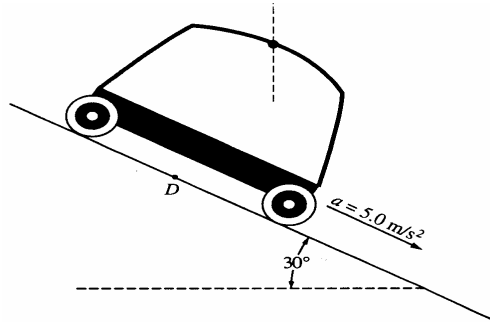
$T_v =$ _____

- c. The car is at point C and is being pulled up the 30° incline with a constant speed of 30 m/s.



$T_h =$ _____

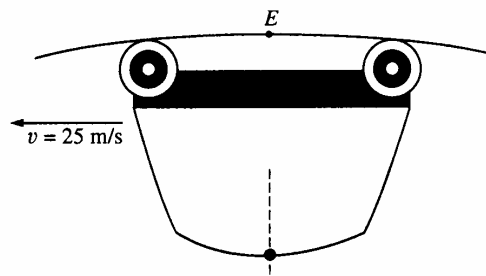
$T_v =$ _____



- d. The car is at point D moving down the incline with an acceleration of 5.0 m/s^2 .

$$T_h = \underline{\hspace{4cm}}$$

$$T_v = \underline{\hspace{4cm}}$$

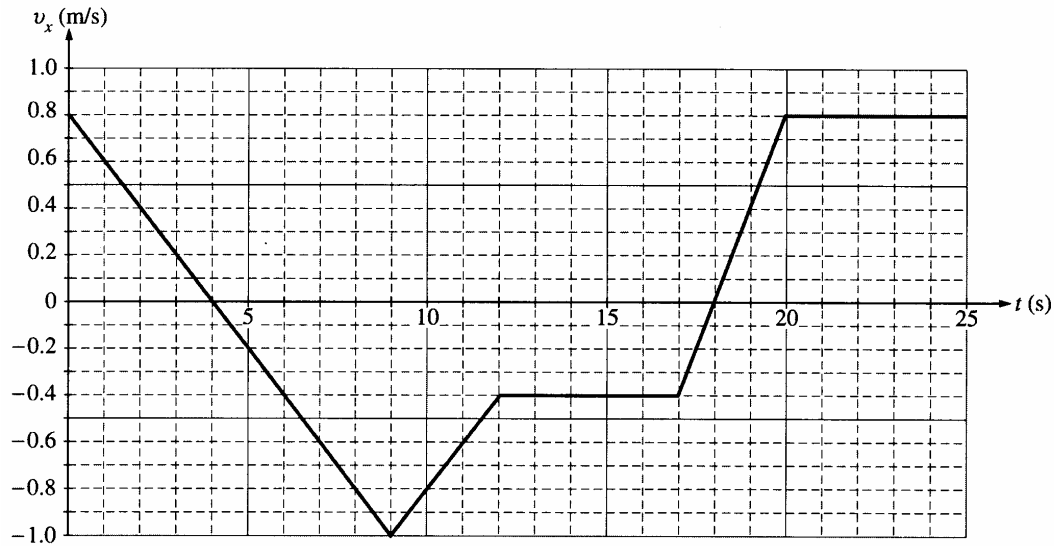


- e. The car is at point E moving upside down with an instantaneous speed of 25 m/s and no tangential acceleration at the top of the vertical loop of radius 25 meters .

$$T_h = \underline{\hspace{4cm}}$$

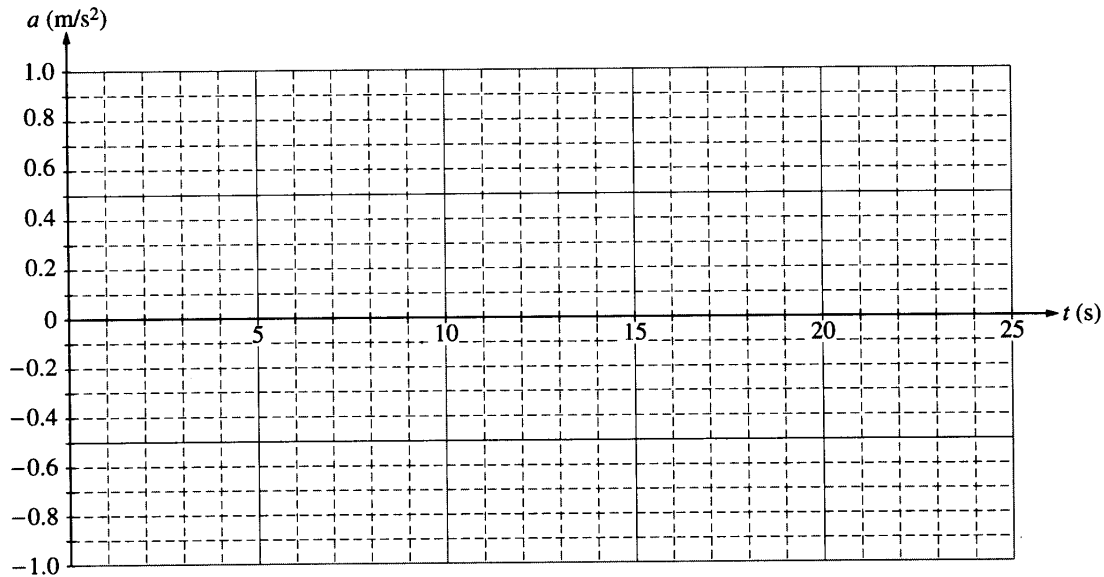
$$T_v = \underline{\hspace{4cm}}$$

FR2. A 0.50 kg cart moves on a straight horizontal track. The graph of velocity v versus time t for the cart is given below.



- Indicate every time t for which the cart is at rest.
- Indicate every time interval for which the speed (magnitude of velocity) of the cart is increasing.
- Determine the horizontal position x of the cart at $t = 9.0$ s if the cart is located at $x = 2.0$ m at $t = 0$.

On the axes below, sketch the acceleration a versus time t graph for the motion of the cart from $t = 0$ to $t = 25$ s.



- From $t = 25$ s until the cart reaches the end of the track, the cart continues with constant horizontal velocity. The cart leaves the end of the track and hits the floor, which is 0.40 m below the track. Neglecting air resistance, determine each of the following:
 - The time from when the cart leaves the track until it first hits the floor
 - The horizontal distance from the end of the track to the point at which the cart first hits the floor
 - The kinetic energy of the cart immediately before it hits the floor