Physics 1401 - Exam 1
Review - Chapter 1,2

13. Which of the following is NOT one of the fundamental units in the SI system?
    A) newton
    B) meter
    C) kilogram
    D) second
    E) All of the above are fundamental units in the SI system.
    Ans: A

9. What do the following prefixes mean:
    "kilo" means

    "centi" means

    "micro" means

    "milli" means

    "nano" means

    "mega" means

    "pico" means

15. The density of seawater was measured to be 1.07 g/cm^3. This density in SI units is
    A) 1.07×10^{-3} kg/m^3
    B) $(1/1.07) \times 10^3$ kg/m^3
    C) 1.07×10^3 kg
    D) 1.07×10^{-3} kg
    E) 1.07×10^3 kg/m^3
    Ans: E

16. To convert a quantity from km/h to m/s, you must
A) multiply by 1000 and divide by 60.
B) multiply by 1000 and divide by 3600.
C) multiply by 60 and divide by 1000.
D) multiply by 3600 and divide by 1000.
E) None of these is correct.
Ans: B

21. In doing a calculation, you end up with a fraction having m/s in the numerator and m/s^2 in the denominator. The result will have units of
A) m^2/s^3 B) s^{-1} C) s^3/m^2 D) s E) m/s
Ans: D

33. Evaluate:

$$(4.0 \times 10^{-6})(3.0 \times 10^{4})$$

A) 12×10^{10} B) 1.2×10^{-10} C) 12×10^{-5} D) 1.2×10^{-1} E) 12×10^{-10}
Ans: D

34. Evaluate:

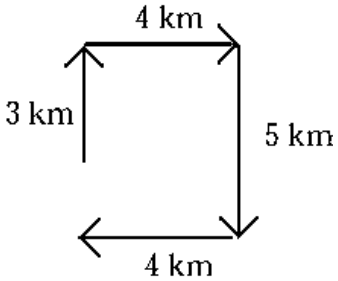
$$\frac{(2\pi \times 10^{3})(3.0 \times 10^{7})}{(4.2 \times 10^{5})^{2}}$$

A) 1.1×10^{5} B) 1.7×10^{-4} C) 3.6×10^{-8} D) 4.5×10^{5} E) 1.1
Ans: E

37. When we look up in the sky the Sun appears about as big as the moon; however, we know that the Sun is much further away. Given that the radius of the Sun is about 7×10^8 m and that the radius of the moon is about 2×10^6 m, calculate approximately the number of times the volume of the moon could fit inside the volume of the Sun.
A) 4×10^2 B) 4×10^6 C) 4×10^7 D) 1×10^5 E) 2×10^5
Ans: C

1. A particle moves from $x_1 = 30$ cm to $x_2 = -40$ cm. The displacement of this particle is
A) 30 cm B) 40 cm C) 70 cm D) –70 cm E) –40 cm
Ans: D

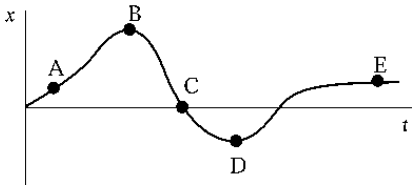
3.



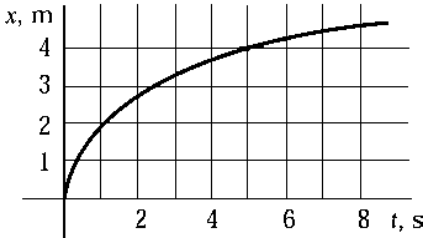
Four successive displacements of 3 km, 4 km, 5 km, and 4 km are at right angles to each other as shown in the diagram. The magnitude of the resultant displacement is
A) 2 km B) 16 km C) 3 km D) 5 km E) None of these is correct.
Ans: A

6. You drive for 30 min at 100 km/h and then stop for 15 min. You then drive for 45 min at 80 km/h. Your average speed for the entire trip is
A) 73 km/h B) 83 km/h C) 88 km/h D) 90 km/h E) 97 km/h
Ans: A

7. The displacement of an object for a round trip between two locations
A) is always greater than zero.
B) is always less than zero.
C) is zero.
D) can be greater than or less than but not equal to zero.
E) can have any value.
Ans: C

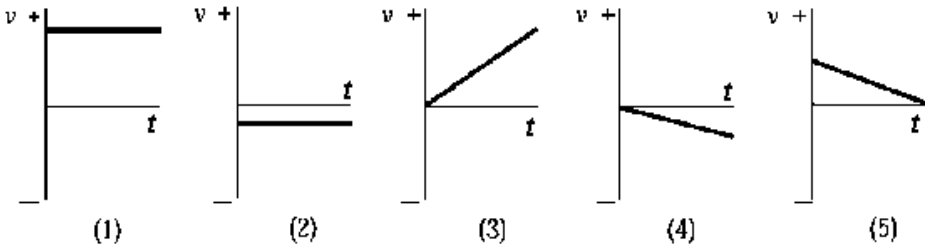
9. 

An object, located at the origin when $t = 0$, moves along the x axis as shown in the diagram. At which point is the object farthest from its starting point?
A) A B) B C) C D) D E) E
Ans: B

10. 

The graph shows how the position of a particle depends on time. Which choice is closest to the average speed of the particle in the time interval between 0 and 6 s?
A) 0.40 m/s B) 0.67 m/s C) 0.75 m/s D) 1.50 m/s E) 2.22 m/s
Ans: B

Use the following to answer questions 11-13:



11. Which graph of *v* versus *t* best describes the motion of a particle whose velocity is constant and negative?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: B

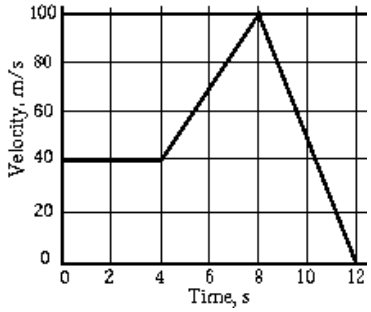
12. In which graph of *v* versus *t* does the particle end up closest to its starting point?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: D

13. In which graph of *v* versus *t* does the particle end up farthest from its starting point?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: A

15. Assume that the Deschutes River has straight and parallel banks and that the current is 0.75 m/s. Drifting down the river, you fall out of your boat and immediately grab a piling of the Warm Springs Bridge. You hold on for 40 s and then swim after the boat with a speed relative to the water of 0.95 m/s. The distance of the boat downstream from the bridge when you catch it is
A) 67 m B) 90 m C) 78 m D) 54 m E) 120 m
Ans: D

17. A river 1.00 mile wide flows with a constant speed of 1.00 mi/h. A woman leaves from a point on the river bank. The woman rows a boat 1.00 mi directly upstream and returns to the starting point. Her speed in still water is 2.00 mi/h. The travel time for the woman is
A) 2.00 h B) 1.15 h C) 1.00 h D) 1.33 h E) 0.67 h
Ans: D

19.



The graph shows the velocity of a particle as a function of time. In the 12 s shown, the particle travels

A) 0 m B) 1200 m C) 640 m D) 440 m E) 200 m

Ans: C

20. If the position of an object is plotted vertically on a graph and the time is plotted horizontally, the instantaneous velocity at a particular time is

A) the height of the curve at that time.
B) the total length of the curve.
C) the slope of the tangent to the curve at that time.
D) the area under the curve from zero to that time.
E) impossible to determine from this type of plot.

Ans: C

31. A Ford truck enters a highway and travels at a uniform speed of 50 mph. Half an hour later a Jaguar enters the highway at the same junction and heads in the same direction at 55 mph. How long after the Ford entered the highway does the Jaguar catch up with the truck?

A) 5.0 hrs B) 6.0 hrs C) 1.0 hrs D) 1.6 hrs E) 5.5 hrs

Ans: E

36. A particle that is moving along a straight line decelerates uniformly from 40 cm/s to 20 cm/s in 5.0 s and then has a constant acceleration of 20 cm/s^2 during the next 4.0 s. The average speed over the whole time interval is

A) 57 cm/s B) 140 cm/s C) 86 cm/s D) 43 cm/s E) 97 cm/s

Ans: D

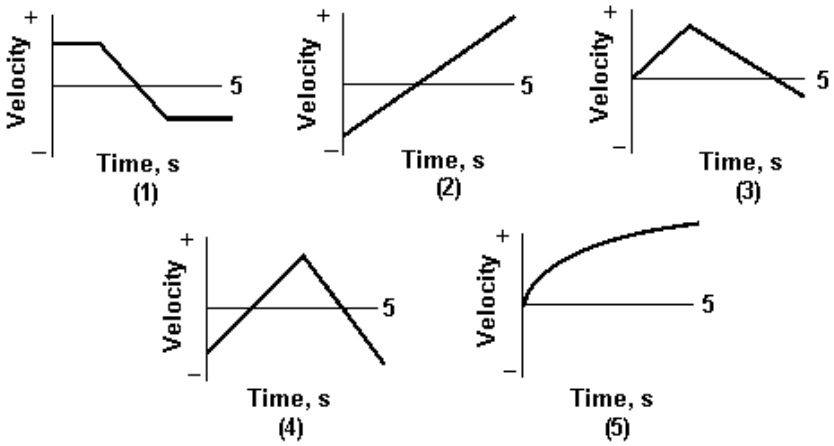
39. A particle decelerates uniformly from a speed of 30 cm/s to rest in a time interval of 5.0 s. It then has a uniform acceleration of 10 cm/s^2 for another 5.0 s. The particle moves in the same direction along a straight line. The average speed over the whole time interval is
A) 20 cm/s B) 35 cm/s C) 38 cm/s D) 100 cm/s E) 12 cm/s
Ans: A

52. A Lamborghini sports car can accelerate from zero to 60 mph in 4 seconds. It can decelerate from 60 mph to rest in 120 ft. What is the ratio of average acceleration over average deceleration? (1 mile = 5280 ft)
A) 1.74×10^{-5} B) 1.47 C) 0.682 D) 0.0114 E) 0.688
Ans: C

56. A racecar starts from rest and accelerates at a constant rate and reaches a speed of 160 km/h (100 mph) in 6.0 seconds. It continues at this speed for another 5 seconds. What is the car's average speed during the first 11 seconds?
A) 34.3 m/s B) 29.3 m/s C) 22.2 m/s D) 32.3 m/s E) 44.4 m/s
Ans: D

61. A projectile is fired vertically upward with a speed of 62 m/s. In the absence of air resistance, the maximum height the projectile attains is
A) 25 km B) 98 m C) 200 m D) 19 km E) 3 m
Ans: C

Use the following to answer questions 63-65:



63. In which graph does the particle have no acceleration at $t = 5$ s?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: A

64. In which graph does the particle have a constant acceleration for the entire 5 s?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: B

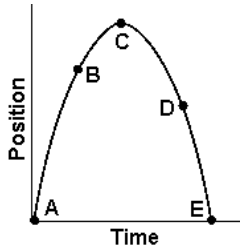
65. In which graph does the particle never have a constant acceleration?
A) 1 B) 2 C) 3 D) 4 E) 5
Ans: E

67. An object is at $x = -3$ m and has a velocity of –4 m/s. It is observed to be slowing down. Its acceleration is
A) positive.
B) negative.
C) zero.
D) negative until the object stops and then positive.
E) impossible to determine based on the information provided.
Ans: A

72. A ball is thrown upward from an 80-ft tower with an initial vertical speed of 40 ft/s. If air resistance is ignored, the ball's speed when it reaches the ground will be
A) 67 ft/s B) 1.3×10^2 ft/s C) 1.2×10^2 ft/s D) 49 ft/s E) 82 ft/s
Ans: E

73. A balloon is ascending at a rate of 16 ft/s at a height of 32 ft above the ground when a package is dropped. The time taken, in the absence of air resistance, for the package to reach the ground is
A) 1.0 s B) 1.5 s C) 2.0 s D) 2.5 s E) 3.0 s
Ans: C

78.



A ball has been thrown vertically upward. The graph shows the ball's position as a function of time. Which one of the following statements best describes the motion of the ball?
A) The velocity of the ball is the same at points A, B, C, D, and E.
B) The acceleration of the ball is 9.8 m/s^2 at points A, B, D, and E and zero at point C.
C) The acceleration of the ball is –9.8 m/s^2 at points A, B, D, and E and zero at point C.
D) The ball is the same distance above the ground at points B and D.
E) The velocity of the ball changes continuously during its flight.
Ans: E

80. A baseball is thrown vertically up to a height of 30 m on the earth. If the same ball is thrown up on the moon with the same initial speed how much further will it travel up? (Assume $g_{moon} = g_{earth}/6$)
A) 5.0 m B) 25 m C) 12 m D) 180 m E) 150 m
Ans: E

82. A sandbag is released from a rising air balloon and hits the ground 7 seconds later. From what height was the sandbag dropped from if at the moment of release the balloon was travelling upward at 3 m/s.
A) 219 m B) 240 m C) 459 m D) 261 m E) 55 m
Ans: A

Physics 1401
Chapter 3, 4 Review

4. A car travels due east at 22 m/s. It makes a turn due south and continues to travel at 22 m/s. What is the change in velocity of the car?
   (a) 22 m/s, due east
   (b) 22 m/s, due south
   (c) 31 m/s, 45° south of west
   (d) 31 m/s, 45° south of east
   (e) zero m/s

5. A car travels along a highway with a velocity of 24 m/s, west. The car exits the highway and 4.0 s later, its instantaneous velocity is 16 m/s, 45° north of west. What is the magnitude of the average acceleration of the car during the four-second interval?
   (a) 2.4 m/s^2
   (b) 4.2 m/s^2
   (c) 1.2 m/s^2
   (d) 11 m/s^2
   (e) 17 m/s^2

7. An electronic tracking device is placed on a police dog to monitor its whereabouts relative to the police station. At time t_1 = 23 min, the dog's displacement from the station is 1.2 km, 33° north of east. At time t_2 = 57 min, the dog's displacement from the station is 2.0 km, 75° north of east. Find the magnitude and direction of the dog's average velocity between these two times.
   (a) 0.52 m/s, 88° north of east
   (b) 1.4 m/s, 31° west of north
   (c) 1.6 m/s, 42° north of east
   (d) 0.67 m/s, 21° west of north
   (e) 0.80 m/s, 42° west of north

12. An eagle is flying due east at 8.9 m/s carrying a gopher in its talons. The gopher manages to break free at a height of 12 m. What is the magnitude of the gopher's velocity as it reaches the ground?
   (a) 22 m/s
   (b) 18 m/s
   (c) 11 m/s
   (d) 9.8 m/s
   (e) 8.9 m/s

■ 13. At time $t = 0$ s, a puck is sliding on a horizontal table with a velocity 3.00 m/s, 65.0° above the $+x$ axis. As the puck slides, a constant acceleration acts on it that has the following components: $a_x = -0.460$ m/s^2 and $a_y = -0.980$ m/s^2. What is the velocity of the puck at time $t = 1.50$ s?

(a) 1.83 m/s, 62.0° above the $+x$ axis
(b) 2.04 m/s, 71.3° above the $+x$ axis
(c) 1.06 m/s, 58.7° above the $+x$ axis
(d) 2.20 m/s, 55.0° above the $+x$ axis
(e) 1.38 m/s, 65.2° above the $+x$ axis

◘ 4. A car travels due east at 22 m/s. It makes a turn due south and continues to travel at 22 m/s. What is the change in velocity of the car?

12. A mass of 25 kg is acted on by two forces: $\vec{F}_1$ is 15 N due east, and $\vec{F}_2$ is 10 N due north. The acceleration of the mass is

A) 0.72 m/s^2, 56.3º north of east.
B) 0.20 m/s^2, due east.
C) 0.72 m/s^2, 33.7º north of east.
D) 1.0 m/s^2, 33.7º north of east.
E) 0.20 m/s^2, 56.3º north of east.

Ans: C

1. An electronic tracking device is placed on a police dog to monitor its whereabouts relative to the police station. At time $t_1 = 23$ min, the dog's displacement from the station is 1.2 km, 33° north of east. At time $t_2 = 57$ min, the dog's displacement from the station is 2.0 km, 75° north of east. Find the magnitude and direction of the dog's average velocity between these two times.

(a) 0.52 m/s, 88° north of east
(b) 1.4 m/s, 31° west of north
(c) 1.6 m/s, 42° north of east
(d) 0.67 m/s, 21° west of north
(e) 0.80 m/s, 42° west of north

2. At time $t = 0$ s, a puck is sliding on a horizontal table with a velocity 3.00 m/s, 65.0° above the $+x$ axis. As the puck slides, a constant acceleration acts on it that has the following components: $a_x = -0.460$ m/s^2 and $a_y = -0.980$ m/s^2. What is the velocity of the puck at time $t = 1.50$ s?

(a) 1.83 m/s, 62.0° above the $+x$ axis
(b) 2.04 m/s, 71.3° above the $+x$ axis
(c) 1.06 m/s, 58.7° above the $+x$ axis
(d) 2.20 m/s, 55.0° above the $+x$ axis
(e) 1.38 m/s, 65.2° above the $+x$ axis

17. A football is kicked at an angle θ with respect to the horizontal. Which one of the following statements best describes the *acceleration* of the football during this event if air resistance is neglected?

(a) The acceleration is zero m/s^2 at all times.
(b) The acceleration is 9.8 m/s^2 at all times.
(c) The acceleration is zero m/s^2 when the football has reached the highest point in its trajectory.
(d) The acceleration is positive as the football rises, and it is negative as the football falls.
(e) The acceleration starts at 9.8 m/s^2 and drops to some constant lower value as the ball approaches the ground.

18. A baseball is hit upward and travels along a parabolic arc before it strikes the ground. Which one of the following statements is necessarily true?

(a) The acceleration of the ball decreases as the ball moves upward.
(b) The velocity of the ball is zero m/s when the ball is at the highest point in the arc.
(c) The acceleration of the ball is zero m/s2 when the ball is at the highest point in the arc.
(d) The *x*-component of the velocity of the ball is the same throughout the ball's flight.
(e) The velocity of the ball is a maximum when the ball is at the highest point in the arc.

Questions 49 through 51 refer to the statement below:
A projectile is fired horizontally with an initial speed of 50.0 m/s. Neglect air resistance.

49. What is the magnitude of the displacement of the projectile 3.00 s after it is fired?

(a) 29.4 m (c) 150 m (e) 194 m
(b) 44.1 m **(d) 156 m**

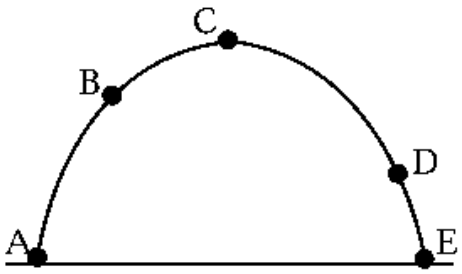
50. What is the speed of the projectile 3.00 s after it is fired?

(a) 29.4 m/s **(c) 58.0 m/s** (e) 98.6 m/s
(b) 50.0 m/s (d) 79.4 m/s

51. What is the magnitude of the acceleration of the projectile 3.00 s after it is fired?

(a) 9.8 m/s2 (c) 29.4 m/s2 (e) 4.07 m/s2
(b) 16.6 m/s2 (d) 5.42 m/s2

Use the following to answer questions 64-66:



64. The figure represents the parabolic trajectory of a ball going from A to E in earth gravity but without air resistance. What is the direction of the acceleration at point B?
A) It is up and to the right.
B) It is down and to the left.
C) It is straight up.
D) It is straight down.
E) The acceleration of the ball is zero.
Ans: D

65. The figure represents the parabolic trajectory of a ball going from A to E in earth gravity but without air resistance. What is the direction of the acceleration at point C?
A) It is to the right.
B) It is to the left.
C) It is straight up.
D) It is straight down.
E) The acceleration of the ball is zero.
Ans: D

66. The figure represents the parabolic trajectory of a ball going from A to E in earth gravity but without air resistance. At point C the velocity of the ball is
A) a maximum and is directed to the right.
B) directed to the left.
C) a maximum.
D) a minimum and is directed to the right.
E) zero.
Ans: D

7. A body moves with constant speed in a straight line. Which of the following statements must be true?
A) No force acts on the body.
B) A single constant force acts on the body in the direction of motion.
C) A single constant force acts on the body in the direction opposite to the motion.
D) A net force of zero acts on the body.
E) A constant net force acts on the body in the direction of motion.
Ans: D

8. A force accelerates a body of mass *M*. The same force applied to a second body produces three times the acceleration. What is the mass of the second body?
A) *M* B) 3*M* C) *M*/3 D) 9*M* E) *M*/9
Ans: C

9. A force accelerates a body of mass *M*. A second body requires twice as much force to produce the same acceleration. What is the mass of the second body?
A) *M* B) 2*M* C) *M*/2 D) 4*M* E) *M*/4
Ans: B

Section: 4-2 Topic: Force, Mass, and Newton's Second Law Type: Numerical

10. A net force of 64 N acts on a mass of 16 kg. The resulting acceleration is
A) 16 m/s^2 B) 0.51 m/s^2 C) 64 m/s^2 D) 9.0 m/s^2 E) 4.0 m/s^2
Ans: E

Section: 4-2 Topic: Force, Mass, and Newton's Second Law Type: Numerical

12. A mass of 25 kg is acted on by two forces: $\vec{F}_1$ is 15 N due east, and $\vec{F}_2$ is 10 N due north. The acceleration of the mass is
A) 0.72 m/s^2, 56.3º north of east.
B) 0.20 m/s^2, due east.
C) 0.72 m/s^2, 33.7º north of east.
D) 1.0 m/s^2, 33.7º north of east.
E) 0.20 m/s^2, 56.3º north of east.
Ans: C

Section: 4-2 Topic: Force, Mass, and Newton's Second Law Type: Numerical

13. A mass m is traveling at an initial speed $v_0 = 25.0$ m/s. It is brought to rest in a distance of 62.5 m by a force of 15.0 N. The mass is
A) 37.5 kg B) 3.00 kg C) 1.50 kg D) 6.00 kg E) 3.75 kg
Ans: B

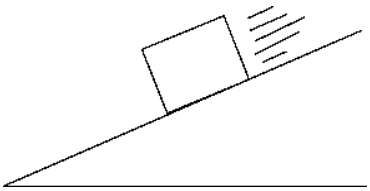
23. Rachel has been reading her physics book. She takes her weighing scales into an elevator and stands on them. If her normal weight is 690 N (155 lbs), and the elevator moves upward at 0.25g and then down at 0.25g, what is the difference between the up and down scale readings?
A) 690 N B) 520 N C) 170 N D) 345 N E) 1.04×10^3 N
Ans: D

29. An astronaut lands on an earthlike planet and drops a small lead ball with a mass of 76.5 g from the top of her spaceship. The point of release is 18 m above the surface of the planet and the ball takes 2.5 s to reach the ground. The astronaut's mass on earth is 68.5 kg. Her weight on the planet is
A) 69.0 N B) 395 N C) 670 N D) 990 N E) 1.02 kN
Ans: B

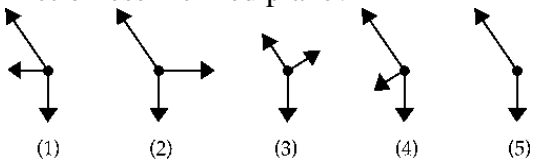
40. We all know it makes sense to bend one's knees when dropping from a height. Suppose a very silly 70-kg person were instead to drop down from a height of 1.4 m onto the ground and stop stiffly within a distance of only 0.60 cm. Calculate how many times his own weight is the average force his body feels.
A) 15 B) 24 C) 2.3×10^3 D) 6.1×10^2 E) 2.3×10^2
Ans: E

52. Spiral springs A and B are identical. When a weight of 12 N is fastened to the hook on A, the hook is lowered 2 cm. If a weight of 18 N is fastened to the hook on B, that hook is lowered
A) 8 cm B) 6 cm C) 3 cm D) 4 cm E) 5 cm
Ans: C

54.



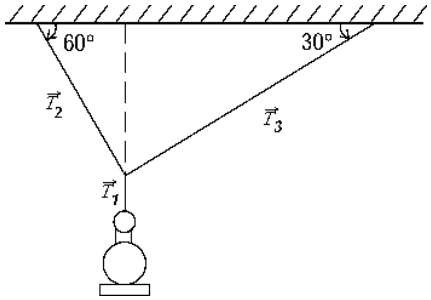
Which of the following free-body diagrams represents the block sliding down a frictionless inclined plane?



A) 1 B) 2 C) 3 D) 4 E) 5
Ans: E

58. A horse-drawn coach is decelerating at 3.0 m/s^2 while moving in a straight line horizontally. A 350-g mass is hanging on a string 1.6 m long from the ceiling of the coach. The angle that the string makes with the vertical is
A) 9.3º toward the front of the coach.
B) 17º toward the front of the coach.
C) 9.3º toward the back of the coach.
D) 2.5º toward the front of the coach.
E) 0º, or straight down.
Ans: B

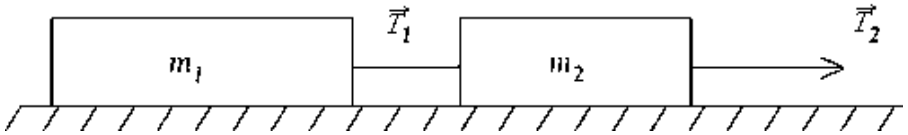
60.



A lamp with a mass m = 42.6 kg is hanging from wires as shown. The tension $\vec{T}_1$ in the vertical wire is
A) 210 N B) 417 N C) 570 N D) 360 N E) 730 N
Ans: B

75. A particle has a mass of 6.0×10^{-6} kg and a velocity of 800 m/s along the x axis when a force of 14.4×10^{-5} N along the y axis acts on the particle at right angles to its velocity. The acceleration of the particle is
A) 24 m/s^2 along the x axis.
B) zero.
C) impossible to determine; forces never act at right angles to velocities.
D) 24 m/s^2 along the y axis.
E) tangential.
Ans: D

82.



Two masses, m_1 and m_2, connected by a massless string, are accelerated uniformly on a frictionless surface as shown. The ratio of the tensions $\vec{T}_1/\vec{T}_2$ is given by
A) m_1/m_2 B) m_2/m_1 C) $(m_1 + m_2)/m_2$ D) $m_1/(m_1 + m_2)$ E) $m_2/(m_1 + m_2)$
Ans: D

83.

A mass $2m$ is attached by a string to another mass m as illustrated. A force of $\vec{N}$ newtons acts on mass m to accelerate the system. The force $\vec{F}$ in the string, which acts on mass $2m$, is
A) $(2/3)N$ B) N C) $2N$ D) $3N$ E) $(3/2)N$
Ans: A

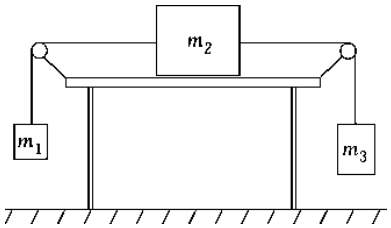
84. You are riding an elevator that is accelerating upward at 2.20 m/s^2. You have a spring balance accurately calibrated in newtons. When you hang a mass of 10.0 kg on the balance, the reading of the balance is
A) 120 N B) 981 N C) 76.0 N D) 10.0 N E) 9.81 N
Ans: A

86. A mass *m* is hanging on a string that passes over a pulley and is then attached to another mass 3*m* that is resting on a horizontal table. Neglect friction. Mass *m* is held motionless and is then released. When it has fallen a distance *h,* it will have a speed *v* which can be calculated from the formula

A) $v = \sqrt{(gh/4)}$
B) $v = \sqrt{(gh/2)}$
C) $v = \sqrt{(gh)}$
D) $v = \sqrt{(2gh)}$
E) None of these is correct.

Ans: B

90.

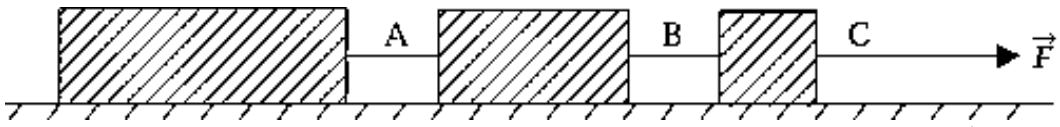


For this problem, assume no friction. A mass m_2 = 3.5 kg rests on a horizontal table and is attached by strings to masses m_1 = 1.5 kg and m_3 = 2.5 kg as shown. The masses m_1 and m_3 hang freely. The system is initially held at rest. After it is released, the acceleration of mass m_2 will be

A) zero B) 1.3 m/s^2 C) 5.2 m/s^2 D) 8.7 m/s^2 E) 9.8 m/s^2

Ans: B

91.

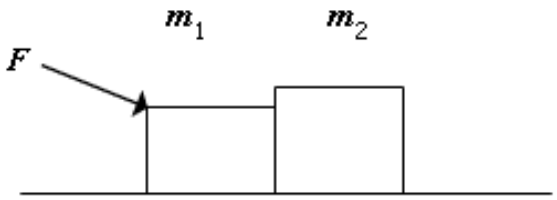


Three boxes are connected by stretchless strings and are pulled by a force $\vec{F}$ as shown in the figure. Which string has to be the strongest so as not to break?

A) A
B) B
C) C
D) A, B, and C must be equally strong.
E) A and B must be equally strong.

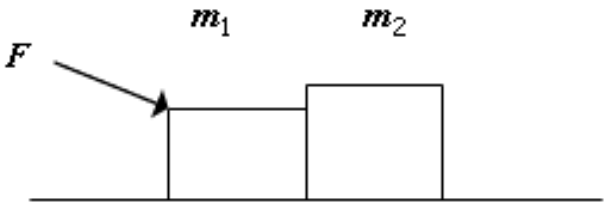
Ans: C

96.



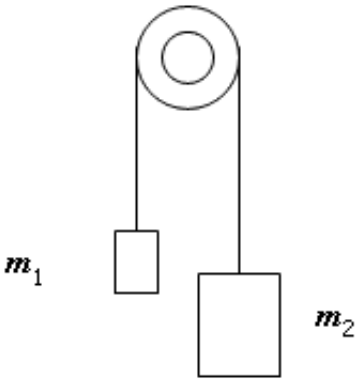
A force of $F = 90$ N is exerted on mass m_1 as shown. Both m_1 and m_2 accelerate to the right at 3 m/s along the frictionless surface. The force F makes an angle of 25 degrees to the horizontal. If $m_2 = 10$ kg, calculate the mass m_1.
A) 2.7 kg B) 17 kg C) 27 kg D) 1.8 kg E) 24 kg
Ans: B

97.



A force of $F = 90$ N is exerted on mass m_1 as shown. Both m_1 and m_2 accelerate to the right at 3 m/s^2 along the frictionless surface. The force F makes an angle of 25 degrees to the horizontal. Calculate the force that the horizontal surface exerts on mass m_1. (m_2 = 10 kg)
A) 2.5×10^2 N B) 1.5×10^2 N C) 82 N D) 3.5×10^2 N E) 2.1×10^2 N
Ans: A

99.



Two masses m_1 = 12 kg and m_2 = 35 kg are held connected by a massless rope hung over a frictionless light pulley. If the masses are released then the magnitude of the tension in the string is

A) 343 N B) 58.0 N C) 226 N D) 458 N E) 175 N

Ans: E