

Exam 2 PREP
Chapters 4 & 5

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 1) If a 5.0 kg box is pulled simultaneously by a 10.0 N force and a 5.0 N force, then its acceleration must be 3.0 m/s^2 . 1) _____
- 2) In order to get an object moving, you must push harder on it than it pushes back on you. 2) _____
- 3) When a small car is towing a large car by a very light (massless) horizontal rope, the rope exerts equal size forces on both cars. 3) _____
- 4) An elevator suspended by a vertical cable is moving downward but slowing down. The tension in the cable must be greater than the weight of the elevator. 4) _____
- 5) If the rockets of a spaceship in outer space (far from all gravity) suddenly lose power and go off, the spaceship will gradually slow to a stop. 5) _____
- 6) A bucket is being lowered by a rope with a constant downward acceleration. The tension in the rope must be equal to the weight of the bucket. 6) _____
- 7) A 75 pound box rests on a perfectly smooth horizontal surface. Any horizontal force greater than zero will cause it to start moving. 7) _____
- 8) A 615 N student standing on a scale in an elevator notices that the scale reads 645 N. From this information, the student knows that the elevator must be moving upward. 8) _____
- 9) A box of mass m is pulled with a constant acceleration a along a horizontal frictionless floor by a wire that makes an angle of 15 degrees above the horizontal. The tension in this wire is greater than ma . 9) _____
- 10) A stone rolls down a sloping hillside. The normal force that the surface of the hill exerts on the stone is equal to the stone's weight. 10) _____

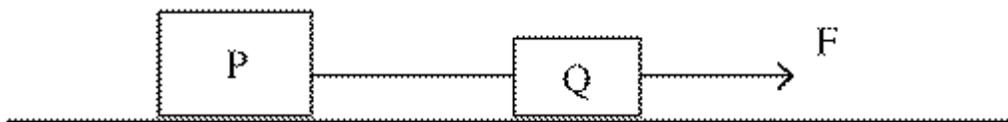
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 11) Consider what happens when you jump up in the air. Which of the following is the most accurate statement? 11) _____
 - A) Since the ground is stationary, it cannot exert the upward force necessary to propel you into the air. Instead, it is the internal forces of your muscles acting on your body itself which propels the body into the air.
 - B) You are able to spring up because the earth exerts a force upward on you which is stronger than the downward force you exert on the earth.
 - C) It is the upward force exerted by the ground that pushes you up, but this force can never exceed your weight.
 - D) When you push down on the earth with a force greater than your weight, the earth will push back with the same magnitude force and thus propel you into the air.

- 12) Suppose you are playing hockey on a new-age ice surface in which there is no friction between the ice and the hockey puck. You wind up and hit the puck as hard as you can. Just after the puck loses contact with your stick, the puck 12) _____
- A) will speed up a little, and then slow down.
 - B) will speed up a little, and then move at a constant speed.
 - C) will start to slow down.
 - D) will not slow down or speed up.

- 13) You are making a circular turn in your car when you hit a big patch of ice, causing the force of friction between the tires and the road to become zero. While the car is on the ice, it 13) _____
- A) continues to follow a circular path, but with a radius larger than the original radius.
 - B) moves along a straight-line path.
 - C) continues to follow the same circular path as initially.
 - D) moves along a path that is neither straight nor circular.

- 14) Two bodies P and Q on a perfectly smooth horizontal surface are connected by a light cord. The mass of P is greater than that of Q. A horizontal force \vec{F} is applied to Q as shown in the figure, accelerating the bodies to the right. 14) _____

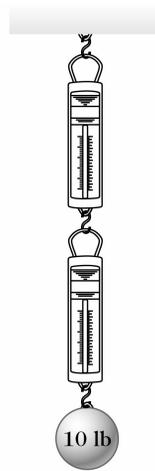


The magnitude of the force exerted by the connecting cord on **body P** will be

- A) less than F but not zero.
 - B) equal to F.
 - C) greater than F.
 - D) zero.
- 15) If you jumped out of a plane, you would begin speeding up as you fall downward. Eventually, due to wind resistance, your velocity would become constant with time. After this occurs, the magnitude of the force of wind resistance is 15) _____
- A) is slightly smaller than the force of gravity acting on you.
 - B) equal to the force of gravity acting on you.
 - C) is greater than the force of gravity acting on you.
 - D) is much smaller than the force of gravity acting on you.
- 16) Suppose the force of wind resistance is proportional to the speed of the object and in the direction opposite the object's velocity. If you throw an object upward, when is the magnitude of the acceleration the highest? 16) _____
- A) It is highest at the top of its trajectory.
 - B) The acceleration of the object is the same throughout the entire trajectory.
 - C) It is highest right after the object is released.
- 17) A ball is thrown vertically upward, reaches a highest point, and comes back down. At the **top** of its path, what forces, if any, act on the ball? Explain your answer. 17) _____
- A) no forces
 - B) only a downward force
 - C) only an upward force
 - D) an upward and a downward force, opposing and equal

- 18) Bill and Susan are both standing on identical skateboards (with really good ball bearings), initially at rest. Bill weighs three times as much as Susan. Bill pushes horizontally on Susan's back, causing Susan to start moving away from Bill. Immediately after Bill stops pushing,
- A) Susan is moving away from Bill, and Bill is stationary.
 - B) Susan and Bill are moving away from each other, and Susan's speed is three times less than that of Bill.
 - C) Susan and Bill are moving away from each other, and Susan's speed is three times that of Bill.
 - D) Susan and Bill are moving away from each other, with equal speeds.

18) _____

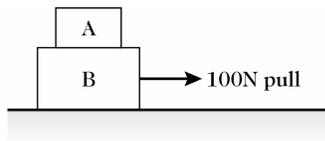


- 19) In the figure, a 10 lb weight is suspended from two spring scales, each of which has negligible weight. Thus
- A) each scale will show a reading between one and 10 lb, such that the sum of the two is 10 lb. However, exact readings cannot be determined without more information.
 - B) the lower scale will read zero, the top scale will read 10 lb.
 - C) the top scale will read zero, the lower scale will read 10 lb.
 - D) each scale will read 5 lb.
 - E) None of these is true.

19) _____

20) Two blocks, A and B, are being pulled to the right along a horizontal surface by a horizontal 100 N pull, as shown in the figure. Both of them are moving together at a constant velocity of 2.0 m/s to the right, and both weigh the same. Which of the figures below shows a correct free-body diagram of the horizontal forces acting on upper block, A?

20) _____



A) (No horizontal forces act on A.)

B)

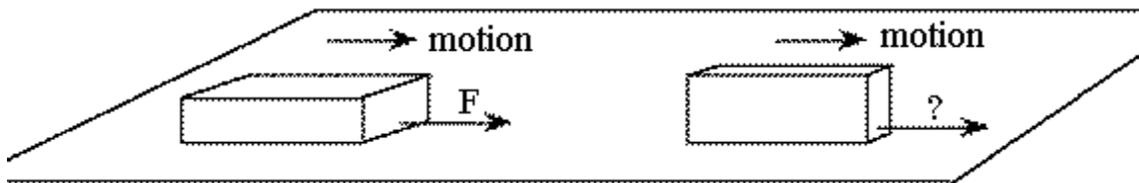
C)

D)

E)

21) A brick initially has its largest-area face in contact with a rough surface, as shown on the left in the figure. A force F is required to pull the brick along the surface at constant speed.

21) _____

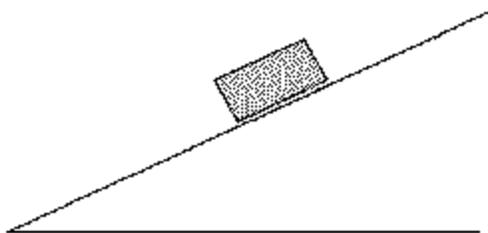


The brick is now flipped so that a face of smaller area is in contact, as on the right in the figure. The material of the brick is uniform on all faces. What force is now required to pull the brick along at constant speed as before?

- A) a greater force
- B) the same force
- C) a smaller force
- D) One cannot say without knowing the coefficient of friction.

22) A block is at rest on a rough incline as shown.

22) _____

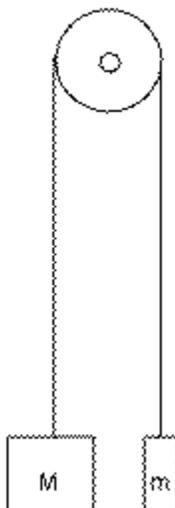


The frictional force acting on the block, along the incline, is

- A) greater than the weight of the block.
- B) zero.
- C) equal to the weight of the block.
- D) less than the weight of the block.

23) Two unequal masses M and m are connected by a light cord passing over a pulley of negligible mass. When released, the system accelerates. Friction is negligible.

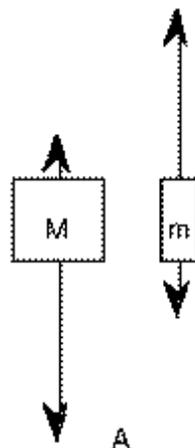
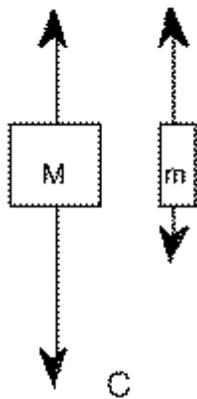
23) _____



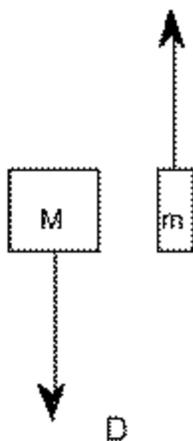
Which figure below gives the correct free-body force diagrams for the two masses in the moving system?

A)

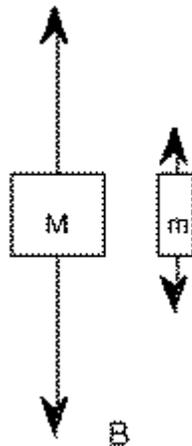
B)



C)

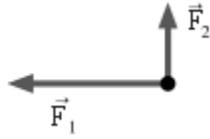


D)



- 24) A cyclist is riding up a hill having a constant slope of 30° with respect to the horizon at a constant speed (in a straight line). Which statement is true? 24) _____
- A) The net force on the bike (due to gravity, the normal force, and friction) is zero.
 B) The net force on the bike (due to gravity, the normal force, and friction) is in the opposite direction of motion.
 C) The net force on the bike (due to gravity, the normal force, and friction) is in the direction of motion.
 D) None of the above statements are true.
- 25) A 27 kg object is accelerated at a rate of 1.7 m/s^2 . What force does the object experience? 25) _____
- A) 98 N B) 63 N C) 46 N D) 16 N
- 26) A child pulls on a wagon handle at an angle 37° above the horizontal with a force of 45 N. If the wagon accelerates at 8.1 m/s^2 horizontally, what is the mass of the wagon? Assume frictional forces are negligible. 26) _____
- A) 4.4 kg B) 3.1 kg C) 3.7 kg D) 5.6 kg
- 27) A 1100 kg car traveling at 27 m/s starts to decelerate and comes to a complete stop in 578.0 m. What is the average braking force acting on the car? 27) _____
- A) -690 N B) -410 N C) -340 N D) -550 N
- 28) Two forces act on a 55 kg object. One force has magnitude 65 N directed 59° clockwise from the positive x-axis, and the other has a magnitude 35 N at 32° clockwise from the positive y-axis. What is the magnitude of this object's acceleration? 28) _____
- A) 1.1 m/s^2 B) 1.5 m/s^2 C) 1.3 m/s^2 D) 1.7 m/s^2

- 29) The figure shows two forces acting on an object. They have magnitudes $F_1 = 6.3 \text{ N}$ and $F_2 = 2.1 \text{ N}$. What third force will cause the object to be in equilibrium? 29) _____

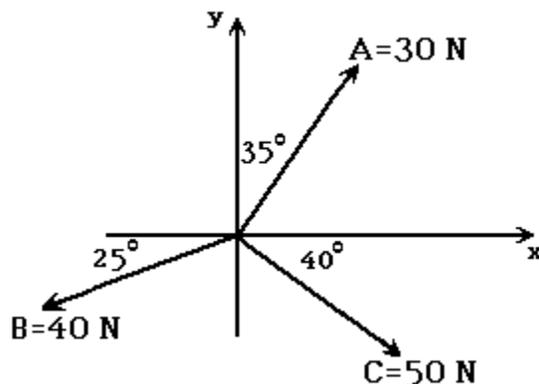


- A) 4.2 N at 162° counterclockwise from \vec{F}_1 B) 6.6 N at 162° counterclockwise from \vec{F}_1
 C) 4.2 N at 108° counterclockwise from \vec{F}_1 D) 6.6 N at 108° counterclockwise from \vec{F}_1
- 30) The figure shows two forces of equal magnitude acting on an object. If the common magnitude of the forces is 4.6 N and the angle between them is 40° , what third force will cause the object to be in equilibrium? 30) _____



- A) 7.0 N pointing to the right B) 3.5 N pointing to the right
 C) 4.3 N pointing to the right D) 8.6 N pointing to the right
- 31) Joe and Bill are playing tug-of-war. Joe is pulling with a force of 200 N . Bill is simply hanging on to the rope. Neither person is moving. What is the tension of the rope? 31) _____
 A) 200 N B) 300 N C) 0 N D) 400 N
- 32) A fish is to be weighed at the harbor. If the mass of the fish is 69.0 kg , what will be the reading on the scale? (Use $g = 9.8 \text{ m/s}^2$.) 32) _____
 A) 7.74 N B) 7.04 N C) 676 N D) 744 N
- 33) A skydiver reaches a "terminal velocity" of 120 km/h . If the skydiver has a mass of 59.0 kg , what is the magnitude of the upward force on the skydiver due to wind resistance? (Use $g = 9.8 \text{ m/s}^2$.) 33) _____
 A) 5.42 N B) 578 N C) 6.02 N D) 636 N
- 34) A 80 N force is needed to slide a 50.0 kg box across a flat surface at a constant velocity. What is the coefficient of kinetic friction between the box and the floor? (Use $g = 9.8 \text{ m/s}^2$.) 34) _____
 A) 0.16 B) 0.15 C) 0.13 D) 0.18
- 35) You push downward on a trunk at an angle 25° below the horizontal with a force of 750 N . If the trunk is on a flat surface and the coefficient of static friction is 0.76 , what is the most massive trunk you will be able to move? (Use $g = 9.8 \text{ m/s}^2$.) 35) _____
 A) 68 kg B) 82 kg C) 54 kg D) 59 kg

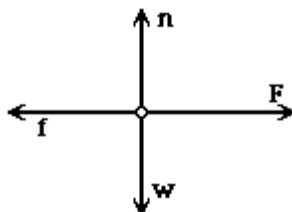
Figure 5.5



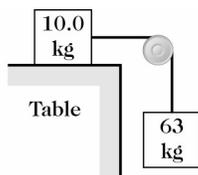
Three forces A, B, and C act on a body as shown. A fourth force F is required to keep the body in equilibrium.

- 36) In Figure 5.5, the x-component of force F is closest to: 36) _____
 A) -28 N B) -32 N C) +28 N D) +19 N E) +32 N

Figure 5.7

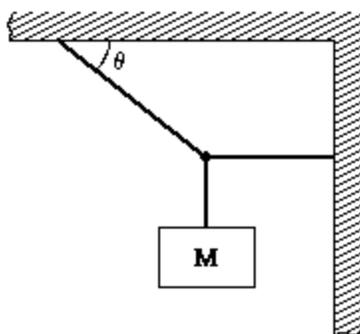


- 37) A box with weight 40 N is on a rough horizontal surface. An external force F is applied horizontally to the box. A normal force and a friction force are also present, denoted by n and f. A force diagram, showing the four forces that act on the box, is shown in Figure 5.7. When force F equals 8.8 N, the box is in motion at constant velocity. The box decelerates when force F is removed. The magnitude of the acceleration of the box is closest to: 37) _____
 A) 2.2 m/s² B) 0.55 m/s² C) zero D) 1.1 m/s² E) 1.7 m/s²
- 38) A 10.0 kg block on a table is connected by a string to a 63 kg mass, which is hanging over the edge of the table. Assuming that frictional forces may be neglected, what is the magnitude of acceleration of the 10.0 kg block when the other block is released? (See the figure.) 38) _____



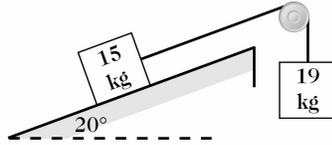
- A) 9.0 m/s² B) 8.5 m/s² C) 7.5 m/s² D) 8.1 m/s²

Figure 5.8

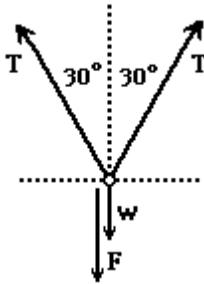


- 39) In Figure 5.8, a block of mass M hangs in equilibrium. The rope which is fastened to the wall is horizontal and has a tension of 38 N. The rope which is fastened to the ceiling has a tension of 59 N, and makes an angle Θ with the ceiling. The angle Θ is _____
- A) 40° B) 50° C) 65° D) 45° E) 33°
- 40) A person who normally weighs 200 pounds is standing on a scale inside an elevator. The elevator is moving upwards with a speed of 7 m/s, and then begins to slow down at a rate of 5 m/s^2 . Before the elevator begins to slow down, the reading of the scale is _____, and while the elevator is slowing down, the reading of the scale is _____. _____
- A) less than 200 pounds, 100 pounds
 B) 200 pounds, 100 pounds
 C) greater than 200 pounds, 100 pounds
 D) greater than 200 pounds, 0 pounds
 E) None of the above
- 41) Kieran takes off down a 50 m high, 10° slope on his jet-powered skis. The skis have a thrust of 280 N. The combined mass of skis and Kieran is 50kg (the fuel mass is negligible). Kieran's speed at the bottom is 40 m/s. What is the coefficient of kinetic friction of his skis on snow? _____
- A) 0.47 B) 0.29 C) 0.58 D) 0.23
- 42) A skydiver reaches a "terminal velocity" of 120 km/h. If the skydiver has a mass of 76.0 kg, what is the magnitude of the upward force on the skydiver due to wind resistance? (Use $g = 9.8 \text{ m/s}^2$.) _____
- A) 7.76 N B) 820 N C) 6.98 N D) 745 N
- 43) A 147 N force is needed to slide a 50.0 kg box across a flat surface at a constant velocity. What is the coefficient of kinetic friction between the box and the floor? (Use $g = 9.8 \text{ m/s}^2$.) _____
- A) 0.28 B) 0.34 C) 0.25 D) 0.30
- 44) A 6.0 kg box slides down an inclined plane that makes an angle of 39° with the horizontal. If the coefficient of kinetic friction is 0.19, at what rate does the box accelerate down the slope? (Use $g = 9.8 \text{ m/s}^2$.) _____
- A) 6.2 m/s^2 B) 5.5 m/s^2 C) 4.7 m/s^2 D) 5.2 m/s^2

- 45) A 15 kg block is on a ramp that is inclined at 20° above the horizontal. It is connected by a string to a 19 kg mass that hangs over the top edge of the ramp. Assuming that frictional forces may be neglected, what is the magnitude of the acceleration of the 19 kg block? (See the figure.) 45) _____



- A) 3.8 m/s^2 B) 4.5 m/s^2 C) 4.0 m/s^2 D) 4.2 m/s^2
- 46) If I weigh 741 N on Earth and 5320 N on the surface of a nearby planet, what is the acceleration due to gravity on that planet? 46) _____
- A) 51.4 m/s^2 B) 81.0 m/s^2 C) 61.2 m/s^2 D) 70.4 m/s^2
- 47) Jason takes off across level water on his jet-powered skis. The combined mass of Jason and skis is 75 kg (the mass of the fuel is negligible). The skis have a thrust of 200 N and a coefficient of kinetic friction on water of 0.1. Unfortunately, the skis run out of fuel after only 90 s. What is Jason's top speed? 47) _____
- A) 24 m/s B) 240 m/s C) 150 m/s D) 90 m/s



- 48) A 6.0 kg box is held at rest by two ropes that form 30° angles with the vertical. An external force F acts vertically downward on the box. The force exerted by each of the two ropes is denoted by T . A force diagram, showing the four forces that act on the box in equilibrium, is shown in the figure. The magnitude of force F is 410 N. The magnitude of force T is closest to: 48) _____
- A) 271 N B) 188 N C) 235 N D) 470 N E) 376 N
- 49) An object at rest on an inclined plane starts to slide when the incline angle is increased to 17° . What is the coefficient of static friction between the object and the incline? (Use $g = 9.8 \text{ m/s}^2$.) 49) _____
- A) 0.33 B) 0.37 C) 0.31 D) 0.27
- 50) What is the mass of an object that experiences a gravitational force of 685 N near Earth's surface? 50) _____
- A) 68.5 kg B) 72.7 kg C) 69.9 kg D) 71.3 kg
- 51) An object that weighs 75.0 N is pulled on a horizontal surface by a horizontal pull of 50.0 N to the right. The friction force on this object is 30.0 N to the left. The acceleration of the object is closest to 51) _____
- A) 2.61 m/s^2 B) 0.267 m/s^2 C) 1.07 m/s^2 D) 10.5 m/s^2