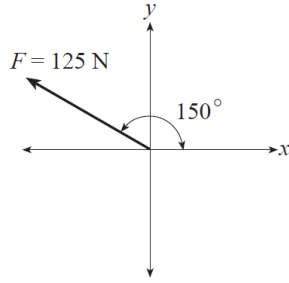


Forces Review Package

Multiple Choice Section

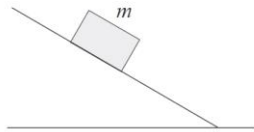
1. Consider the diagram below.



What are the components of the 125 N force?

	<i>x</i> -COMPONENT	<i>y</i> -COMPONENT
A.	-62.5 N	72.2 N
B.	-72.2 N	62.5 N
C.	-62.5 N	108 N
D.	-108 N	62.5 N

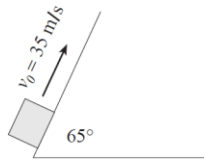
2. A block of mass m remains at rest on an incline as shown in the diagram.



The force acting up the ramp on this block is

- A. 0.
- B. mg .
- C. less than mg .
- D. more than mg .

3. An object is fired up a frictionless ramp as shown in the diagram.



If the initial velocity is 35 m/s, how long does the object take to return to the starting point?

- A. 3.6 s
- B. 3.9 s
- C. 7.9 s
- D. 17 s

4. A constant net force acting on an object results in the object having a constant

- A. velocity.
- B. momentum.
- C. acceleration.
- D. kinetic energy.

5. A curling rock is travelling to the right across the ice as shown in the diagram.



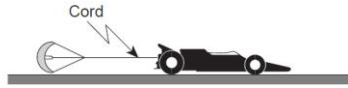
Which of the following best represents the forces acting on the curling rock?

- A.
- B.
- C.
- D.

6. A book is at rest on a desk. Which of the following statements concerning the book is correct?

- A. The desk exerts no force on the book.
- B. The book exerts no force on the desk.
- C. There are no forces acting on the book.
- D. The forces acting on the book are balanced.

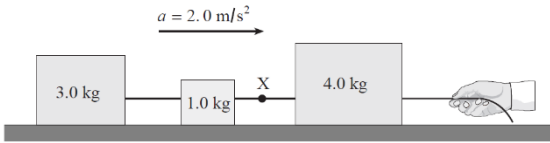
7. An 810 kg dragster is being decelerated by a parachute at 2.5 m/s^2 as shown in the diagram.



What is the tension in the cord at this moment?

- A. 0 N
- B. $2.0 \times 10^3 \text{ N}$
- C. $5.9 \times 10^3 \text{ N}$
- D. $7.9 \times 10^3 \text{ N}$

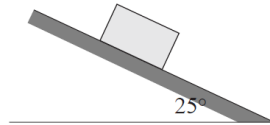
8. The system of blocks on a frictionless surface in the diagram below is accelerating at 2.0 m/s^2 .



What is the tension in the cord at X?

- A. 2.0 N
- B. 6.0 N
- C. 8.0 N
- D. 16 N

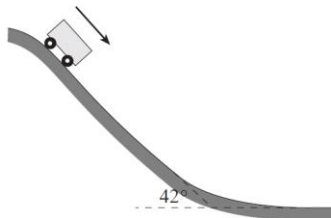
9. A 5.0 kg block remains stationary on an inclined surface.



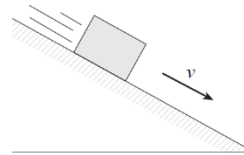
What is the friction force acting on the block?

- A. 21 N
- B. 23 N
- C. 44 N
- D. 49 N

10. What is the acceleration of the roller coaster car in the diagram below? Ignore friction.



An object is sliding down an inclined plane at a constant speed.



- A. 6.6 m/s^2
- B. 7.3 m/s^2
- C. 8.8 m/s^2
- D. Depends on car's mass.

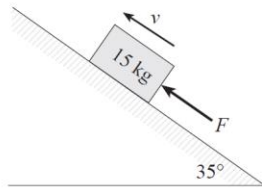
11.

Which of the following represents the free-body diagram for the object?

- A.
- B.
- C.
- D.

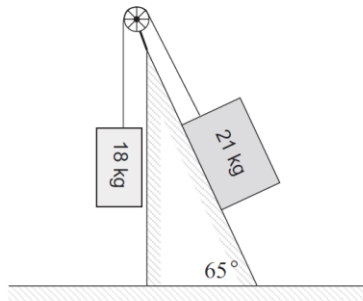
12. A 45 kg woman is standing in an elevator that is accelerating downwards at 2.0 m/s^2 . What force (normal force) does the elevator floor exert on the woman's feet during this acceleration?
- A. 90 N
 B. 350 N
 C. 440 N
 D. 530 N

13. A 15 kg block is pushed up a 35° incline. A friction force of 110 N exists between the block and the incline.



What minimum force F , would be necessary to move the block up the incline at a constant speed?

- A. 26 N
 B. 84 N
 C. 150 N
 D. 190 N
14. A large mass, M , collides with a stationary small mass, m . During the collision, the forces exerted on each mass are measured. Which of the following is correct about the magnitude of the forces?
- A. No force is exerted during the collision.
 B. The large mass, M , exerts a greater force on the small mass, m .
 C. The small mass, m , exerts a greater force on the large mass, M .
 D. Both masses exert equal forces on each other during the collision.
15. Two masses are connected together by a rope and pulley on a frictionless inclined plane as shown.



When the system is released, what is the initial acceleration of the 21 kg mass?

	MAGNITUDE OF THE ACCELERATION	DIRECTION THE MASS WILL TRAVEL
A.	0.26 m/s^2	up the incline
B.	0.26 m/s^2	down the incline
C.	0.48 m/s^2	up the incline
D.	0.48 m/s^2	down the incline

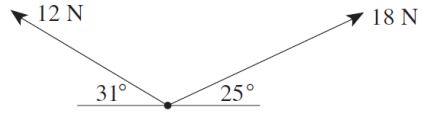
16. Newton's second law of motion is best shown by which of the following equations?

- A. $a = \frac{v}{t}$
 B. $a = \frac{F_{net}}{m}$
 C. $F_{net} = mv$
 D. $F_{net} = a\left(\frac{d}{t^2}\right)$

17. A 45 kg rock experiences a force of gravity of 168 N on the surface of Mars. What is the gravitational field strength on the surface of Mars?

- A. 1.6 N/kg
- B. 2.6 N/kg
- C. 3.7 N/kg
- D. 9.8 N/kg

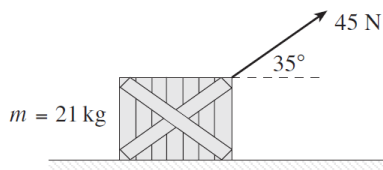
18. Two forces act at a single point as shown.



What is the magnitude of the resulting force?

- A. 15 N
- B. 22 N
- C. 27 N
- D. 30 N

19. A force of 45 N is applied at an angle of 35° above the horizontal to pull a 21 kg crate across a floor as shown below.

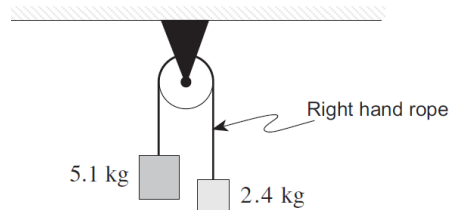


What is the normal force on the crate?

- A. 26 N
- B. 170 N
- C. 180 N
- D. 210 N

20.

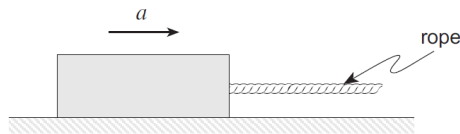
A frictionless pulley is set up with two hanging masses as shown below.



What is the tension in the right hand rope while the masses move freely?

- A. 8.5 N
- B. 24 N
- C. 26 N
- D. 32 N

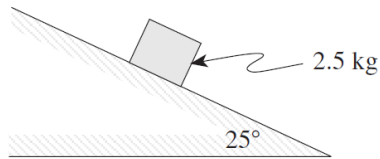
21. The block in the diagram below is being accelerated to the right across a rough surface by a force applied through the rope.



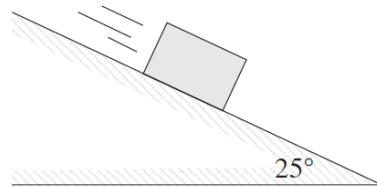
Which of the following best represents a free-body diagram for the block?

- A.
- B.
- C.
- D.

22. What is the normal force on the block in the diagram below?

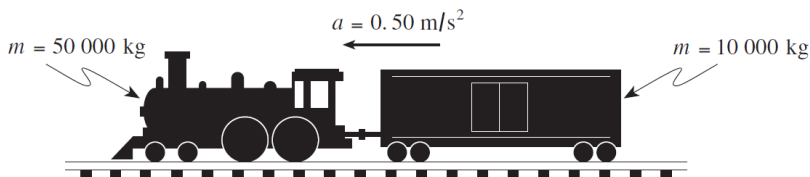


- A. 0.0 N
 B. 10 N
 C. 22 N
 D. 25 N
23. A 1.5 kg block slides down the incline at a constant speed.



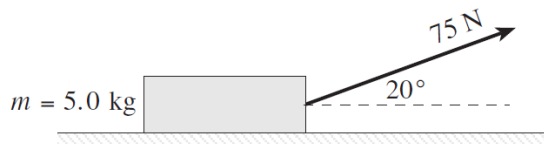
What is the net force on this block?

- A. 0 N
 B. 6.2 N
 C. 13 N
 D. 15 N
24. A locomotive pulling a freight car accelerates at 0.50 m/s^2 as shown in the diagram.



What is the tension in the coupling linking the locomotive and car? (Ignore friction.)

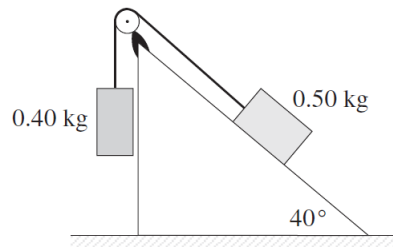
- A. 5 000 N
 B. 25 000 N
 C. 30 000 N
 D. 390 000 N
25. A 5.0 kg block is being pulled to the right by a 75 N force.



What is the normal force on this block?

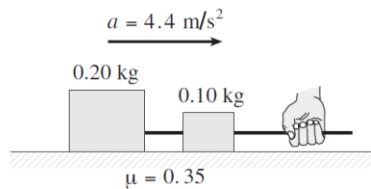
- A. 23 N
 B. 26 N
 C. 49 N
 D. 75 N

26. Two masses are connected by a string as shown in the diagram.



What is the magnitude of the acceleration of these masses? (Ignore friction.)

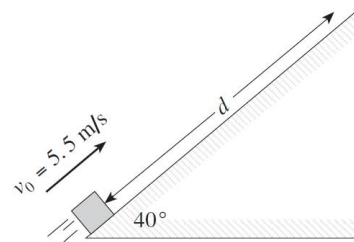
- A. 0.11 m/s^2
 B. 0.19 m/s^2
 C. 0.86 m/s^2
 D. 1.1 m/s^2
27. The system of blocks shown in the diagram below is being accelerated to the right at 4.4 m/s^2 .



What pulling force is applied by the hand?

- A. 0.3 N
 B. 1.0 N
 C. 1.3 N
 D. 2.3 N

28. A block is launched up the frictionless incline in the diagram below with an initial speed of 5.5 m/s .



What is the maximum displacement, d , of the block up the incline?

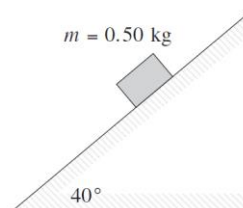
- A. 0.44 m
 B. 0.87 m
 C. 1.5 m
 D. 2.4 m

29. Which of the following are units for gravitational field strength?

- A. kg/m
 B. $\text{kg} \cdot \text{m/s}^2$
 C. N/kg
 D. N/kg^2

30.

The block shown in the diagram below remains at rest.

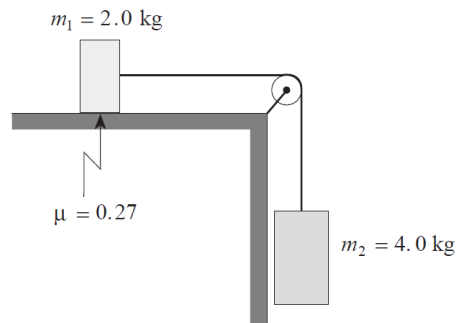


What is the friction force acting on the block?

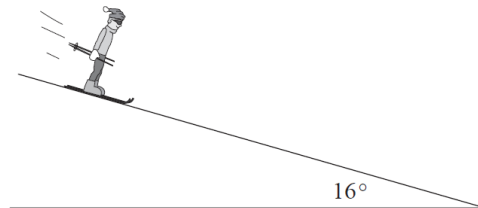
- A. 0 N
 B. 3.1 N
 C. 3.8 N
 D. The friction force cannot be calculated.

Written Response Section

1. Two masses are connected by a light string over a frictionless massless pulley. There is a coefficient of friction of 0.27 between mass m_1 and the horizontal surface.

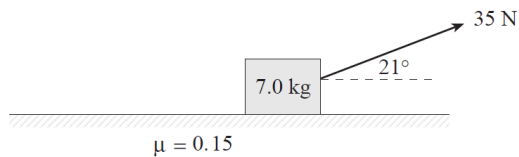


- a) Draw and label a free body diagram showing the forces acting on mass m_1 . **(2 marks)**
- b) What is the acceleration of mass m_2 ? **(5 marks)**
2. A 75 kg Olympic skier takes 20 s to reach a speed of 25 m/s from rest while descending a uniform 16° slope.



What is the coefficient of friction between the skis and the slope surface? **(7 marks)**

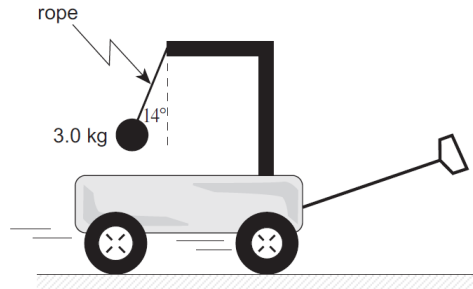
3. A 35 N force applied at 21° to the horizontal is used to pull a mass as shown.



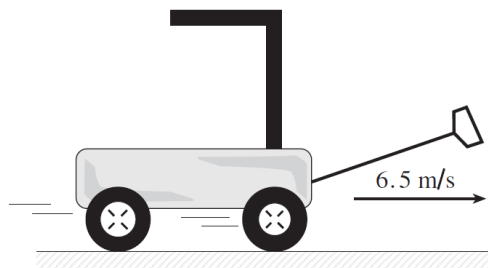
The coefficient of friction between the floor and the mass is 0.15.

- a) Draw and label a free body diagram showing the forces acting on the mass. **(2 marks)**
- b) What is the acceleration of the mass? **(5 marks)**

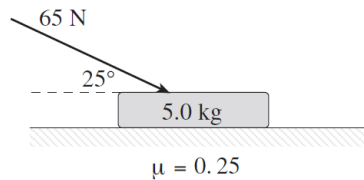
4. A 3.0 kg mass hangs at one end of a rope that is attached to a support on a child's wagon as shown in the diagram. The wagon is pulled to the right. (You may ignore air resistance.)



- a) Draw and label a free body diagram showing the forces acting on the mass. **(2 marks)**
- b) What is the acceleration of the wagon? **(3 marks)**
- c) On the diagram below, sketch the position of the mass when the cart reaches a constant velocity of 6.5 m/s. **(1 mark)**



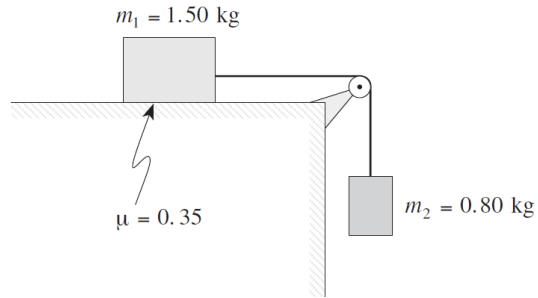
- d) Using principles of physics, explain why the mass will be in this position. **(3 marks)**
5. A 65 N force is applied to a 5.0 kg object as shown.



The coefficient of friction between the object and the horizontal surface is 0.25.

- a) Draw and label a free body diagram showing the forces acting on the object. **(2 marks)**
- b) What is the acceleration of the object? **(5 marks)**

6. Two masses are connected by a light string passing across a frictionless pulley as shown in the diagram below. The coefficient of friction between mass m_1 and the horizontal surface is 0.35.



a) Draw and label a free body diagram showing the forces acting on mass m_1 . **(2 marks)**

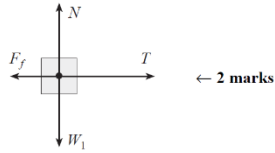
b) What is the tension in the connecting string? **(5 marks)**

Answers:

1. D
2. C
3. C
4. C
5. D
6. D
7. B
8. C
9. A
10. A
11. D
12. B
13. D
14. D
15. B
16. B
17. C
18. A
19. C
20. D
21. D
22. C
23. A
24. A
25. A
26. C
27. D
28. D
29. C
30. B

WR Answers:

1. a) Draw and label a free body diagram showing the forces acting on mass m_1 . (2 marks)



- b) What is the acceleration of mass m_2 ? (5 marks)

$$a = \frac{F_{net}}{m} \quad \leftarrow \frac{1}{2} \text{ mark}$$

$$= \frac{m_2 g - \mu m_1 g}{(m_1 + m_2)} \quad \leftarrow 3 \frac{1}{2} \text{ marks}$$

$$= \frac{4.0 \text{ kg}(9.8 \text{ N/kg}) - (0.27)(2.0 \text{ kg})(9.8 \text{ N/kg})}{(2.0 \text{ kg} + 4.0 \text{ kg})} \quad \leftarrow \frac{1}{2} \text{ mark}$$

$$= 5.7 \text{ m/s}^2 \quad \leftarrow \frac{1}{2} \text{ mark}$$

2. What is the coefficient of friction between the skis and the slope surface? (7 marks)

$$a = \frac{\Delta v}{\Delta t}$$

$$= \frac{25 \text{ m/s}}{20 \text{ s}}$$

$$= 1.25 \text{ m/s}^2 \quad \leftarrow 2 \text{ marks}$$

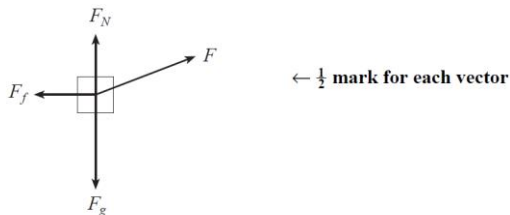
$$\left. \begin{aligned} ma &= mg \sin \theta - \mu mg \cos \theta \\ a &= g \sin \theta - \mu g \cos \theta \end{aligned} \right\} \leftarrow 3 \text{ marks}$$

$$\mu = \frac{g \sin \theta - a}{g \cos \theta} \quad \leftarrow 1 \text{ mark}$$

$$= \frac{9.8 \text{ m/s}^2 \cdot \sin 16^\circ - 1.25 \text{ m/s}^2}{9.8 \text{ m/s}^2 \cdot \cos 16^\circ}$$

$$= 0.15 \quad \leftarrow 1 \text{ mark}$$

3. a) Draw and label a free body diagram showing the forces acting on the mass. (2 marks)



- b) What is the acceleration of the mass? (5 marks)

$$a = \frac{F_{net}}{m} \quad \leftarrow \frac{1}{2} \text{ mark}$$

$$F_{net} = F_x - F_f$$

$$= 35 \times \cos 21^\circ - 0.15(7.0 \times 9.8 - 35 \times \sin 21^\circ) \quad \leftarrow 4 \text{ marks}$$

$$= 32.68 - 8.41$$

$$F_{net} = 24.3 \text{ N}$$

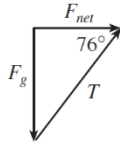
$$a = \frac{24.3 \text{ N}}{7.0 \text{ kg}} = 3.5 \text{ m/s}^2 \quad \leftarrow \frac{1}{2} \text{ mark}$$

4.

a) Draw and label a free body diagram showing the forces acting on the mass. (2 marks)

1 mark for each force ($\frac{1}{2}$ for labelling, $\frac{1}{2}$ for direction drawn correctly)

b) What is the acceleration of the wagon? (3 marks)



$$\tan 76^\circ = \frac{F_g}{F_{net}}$$

$$F_{net} = \frac{F_g}{\tan 76^\circ}$$

$$= \frac{3.0 \times 9.8}{\tan 76^\circ}$$

$$= 7.33 \text{ N} \quad \leftarrow 2 \text{ marks}$$

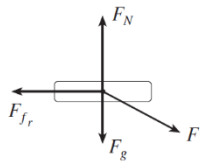
$$a = \frac{F_{net}}{m}$$

$$a = \frac{7.33}{3.0}$$

$$a = 2.4 \text{ m/s}^2 \quad \leftarrow 1 \text{ mark}$$

5.

a) Draw and label a free body diagram showing the forces acting on the object. (2 marks)

 $\leftarrow 2 \text{ marks}$

b) What is the acceleration of the object? (5 marks)

$$a = \frac{F_{net}}{m} \quad \leftarrow 1 \text{ mark}$$

$$F_{net} = F_x - F_{fr} \quad \leftarrow 1 \text{ mark}$$

$$= F_x - \mu F_N$$

$$= F \cos 25 - \mu(F_g + F_y) \quad \leftarrow 2 \text{ marks}$$

$$= F \cos 25 - \mu(F_g + F \sin 25)$$

$$= 65 \cdot \cos 25 - 0.25(5.0 \cdot 9.8 + 65 \cdot \sin 25)$$

$$= 58.9 - 19.1$$

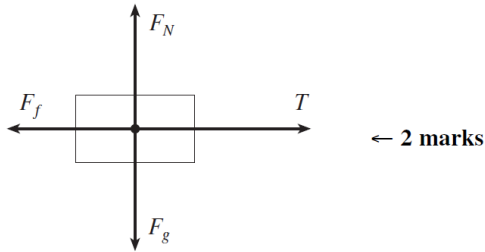
$$= 39.8 \text{ N}$$

$$\therefore a = \frac{39.8}{5.0}$$

$$= 8.0 \text{ m/s}^2 \quad \leftarrow 1 \text{ mark}$$

6.

a) Draw and label a free body diagram showing the forces acting on mass m_1 . (2 marks)



b) What is the tension in the connecting string? (5 marks)

$$T - F_f = m_1 a$$

$$F_{2g} - T = m_2 a$$

Combining:

$$a = \frac{F_{2g} - F_f}{m_1 + m_2} \quad \leftarrow 2 \text{ marks}$$

$$= \frac{m_2 g - \mu m_1 g}{m_1 + m_2}$$

$$= \frac{0.80 \cdot 9.8 - 0.35 \cdot 1.50 \cdot 9.8}{1.50 + 0.80}$$

$$= 1.2 \text{ m/s}^2 \quad \leftarrow 1 \text{ mark}$$

Substituting:

$$T = m_1 a + F_f$$

$$= 1.50 \cdot 1.2 + 0.35 \cdot 1.50 \cdot 9.8$$

$$= 6.9 \text{ N} \quad \leftarrow 2 \text{ marks}$$