Physics
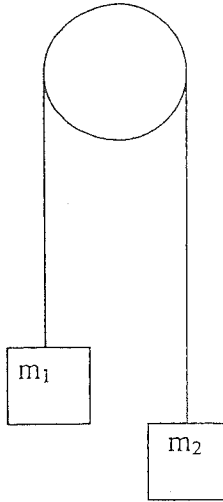
Name: _____

1.

$m_1 = 5.6$ kg
$m_2 = 3.8$ kg

   a)   Draw and label the free body diagram for each of the masses.
      b)   Calculate the magnitude and direction of acceleration of the system.
      c)   Calculate the tension in the cord.

2.   A truck 3000.0 kg rests on the slope of a hill. The coefficient of friction between the tires of the truck and the road is $\mu = 0.18$. What is the maximum angle of the slope if the truck is to remain stationary? What is the angle for a 4500.0 kg truck?

3.   A 55.0 kg man stands in a 1500.0 kg elevator.

a)   If the maximum tension that the cable can withstand without breaking is 2.8×10^4 N, what is the maximum acceleration of the elevator?

b)   If the acceleration of the elevator is 1.5 m/s^2 downwards, what would the apparent weight of the man be?

①
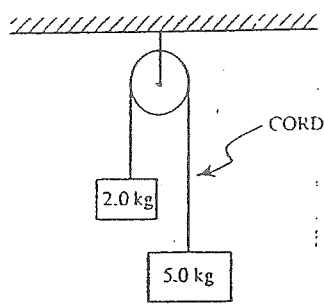
Two masses of 2.0 kg and 5.0 kg are suspended by a massless cord over a frictionless pulley as shown.
What are the magnitude and direction of acceleration for the 2.0 kg mass?

CORD

2.0 kg

5.0 kg

2. Two blocks are pulled across a frictionless surface by a 240 N force, as shown in the diagram below.

CORD

60.0 kg   20.0 kg ———→ 240 N
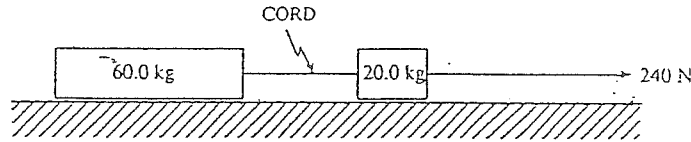
If the blocks are accelerating at 3.00 m/s², what is the tension in the cord between the two blocks?

A.   60.0 N
B.   120 N
C.   180 N
D.   240 N

3. The diagram below shows two force vectors $\vec{F_1}$ and $\vec{F_2}$ acting on an object at point P.

$\vec{F_1}$

P

$\vec{F_2}$

1 N
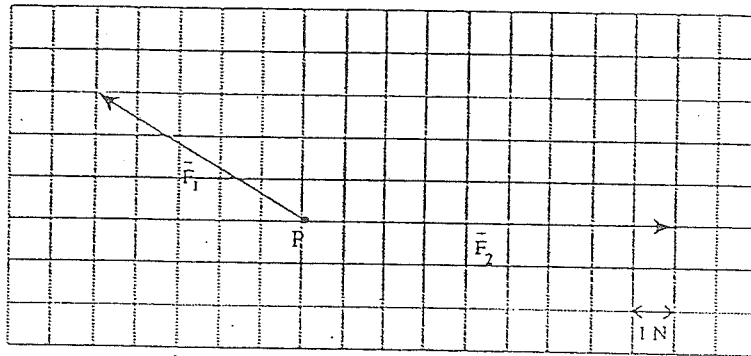
What is the magnitude of the resultant force?

A.   3.0 N
B.   5.0 N
C.   7.0 N
D.   14.3 N

4. An 84 kg sled slides down an icy slope inclined at 28° to the horizontal. If the force of friction between the sled and the ice is 180 N, what is the coefficient of friction?
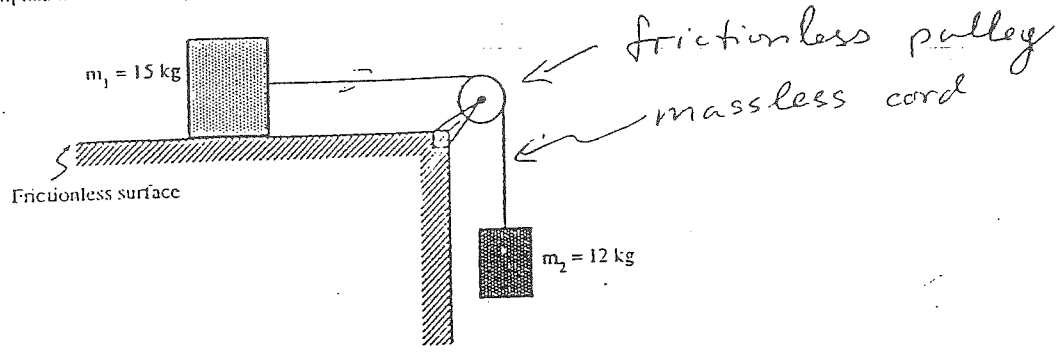
A.   0.22
B.   0.25
C.   0.47
D.   0.53

6. A gun can fire 500 bullets in 60 seconds. Each bullet has a mass of 0.020 kg and leaves the gun at 400 m/s. What average recoil force is exerted on the gun?

A.   5.0 N
B.   67 N
C.   6.0 × 10⁵ N
D.   2.4 × 10⁵ N

3

1. Object m_1 has a mass of 15 kg and the hanging object m_2 has a mass of 12 kg.

①

$m_1 = 15$ kg

frictionless pulley
massless cord

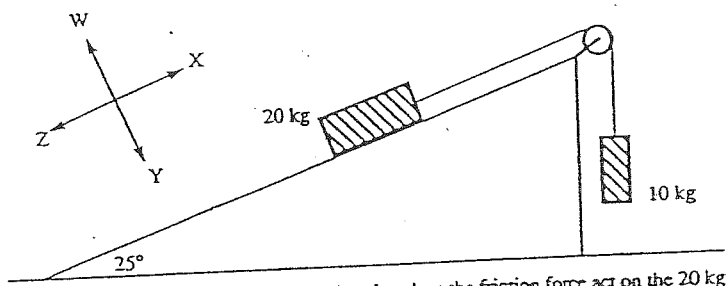Frictionless surface

$m_2 = 12$ kg

a) What is the magnitude of the acceleration of the object m_1?   (5 marks)

1. b) What is the tension in the connecting string?   (2 marks)

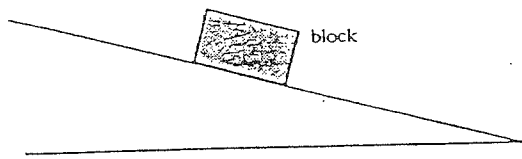② Two blocks are connected by a string over a frictionless pulley as shown in the diagram below.

W

X

20 kg

Z

Y

10 kg

25°

If this system of masses is at rest, in what direction does the friction force act on the 20 kg block?
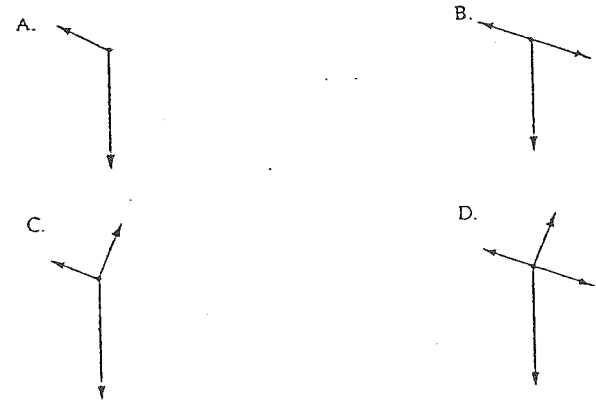
A.   W
B.   X
C.   Y
D.   Z

③ As shown in the diagram below, a block on an inclined plane is at rest due to friction.

block

Which one of the following best shows the forces on the block?

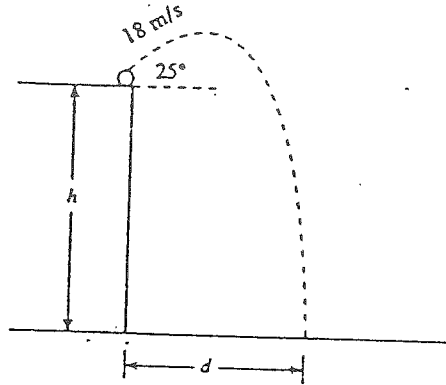DIAGRAMS NOT DRAWN TO SCALE

A.

B.

C.

D.

④ A steel ball is falling through oil at a constant speed. The ball weighs 2.0 N. Using the laws of motion, explain why the speed is constant.   (4 marks)

④

1. A rock is thrown from a clifftop at 18 m/s, 25° above the horizontal. It lands on the beach 4.2 s later.

18 m/s

25°

h

d

a) What is the height h of the cliff?

(4 marks)

b) How far from the base of the cliff d did the rock land?

(3 marks)

8. What is the minimum power output of a small electric motor that lifts a 0.050 kg mass through 2.0 m in 30 s?

A. 0.0017 W

B. 0.017 W

C. 0.033 W

D. 15 W

OMIT

9. A net force of 20 N acts for 1.5 s on a 4.0 kg object initially at rest. What is the final kinetic energy of the object?
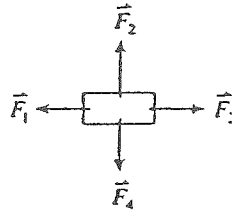
A. 30 J

B. 110 J

C. 230 J

D. 440 J

OMT.

OVER

1. The free body diagram shown below represents a crate being dragged towards the left over a rough surface.

$$\vec{F}_2 \uparrow$$

$$\vec{F}_1 \leftarrow \boxed{} \rightarrow \vec{F}_3$$

$$\vec{F}_4 \downarrow$$

Which of the vectors represent the normal force and the friction force acting on the crate?

	NORMAL FORCE	FRICTION FORCE
A.	$\vec{F}_1$	$\vec{F}_2$
B.	$\vec{F}_2$	$\vec{F}_3$
C.	$\vec{F}_3$	$\vec{F}_4$
D.	$\vec{F}_4$	$\vec{F}_1$

2. The graph shown below displays velocity v versus time t for a moving object.
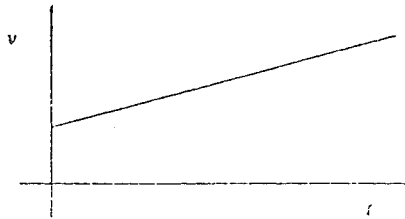
The slope of this graph represents the object's

A. mass.
B. momentum.
C. acceleration.
D. displacement.

3. The gravitational field strength on planet X is 5.0 N/kg. An astronaut of mass 60 kg leaves Earth to visit planet X. What will her mass and weight be when she is on the surface of planet X?

	MASS	WEIGHT
A.	60 kg	300 N
B.	60 kg	590 N
C.	120 kg	300 N
D.	120 kg	590 N

4. A girl applies a 140 N force to a 35 kg bale of hay at an angle of 28° above horizontal. The friction force acting on the bale is 55 N. What will be the horizontal acceleration of the bale?
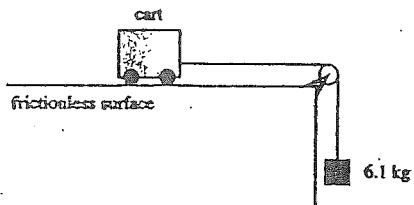

F = 140 N

28°
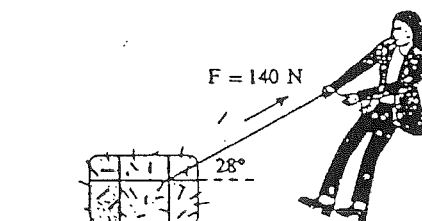
A. 0.31 m/s²
B. 2.0 m/s²
C. 2.4 m/s²
D. 2.6 m/s²

1. In the diagram shown, the tension in the cord connecting the hanging mass and cart is 43 N.

cart

frictionless surface

6.1 kg

a) Draw and label a free body diagram for the cart and the hanging mass. (2 marks)

b) Determine the mass of the cart. (5 marks)

6 kg

μ = 0.20

4 kg.

30°
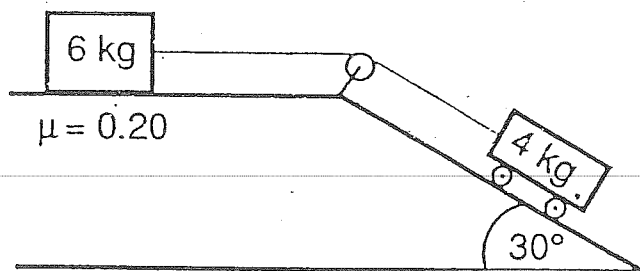
2. The above diagram shows a 6.0 kg mass on a horizontal surface connected by thread over a pulley to a 4.0 kg cart on a ramp inclined at 30°. The coefficient of friction between the horizontal surface and the 6.0 kg mass is 0.20 and the friction between the 4 kg cart and the ramp is not significant. What is the tension in the thread when the masses are accelerating? (10 marks)

3. The 4.0 kg block shown accelerates across a frictionless horizontal table at 1.5 m/s².
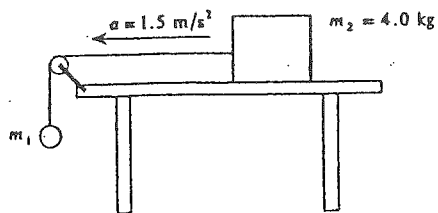
Find the mass of object m_1.

A. 0.61 kg
B. 0.72 kg
C. 6.0 kg
D. 26 kg

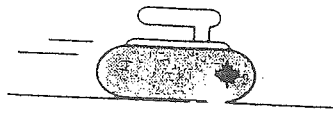4. Three blocks have masses 1.0 kg, 7.0 kg and 5.0 kg as shown. The horizontal surface is frictionless.
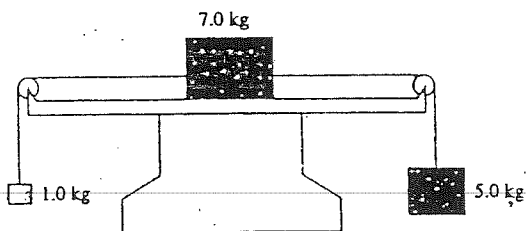
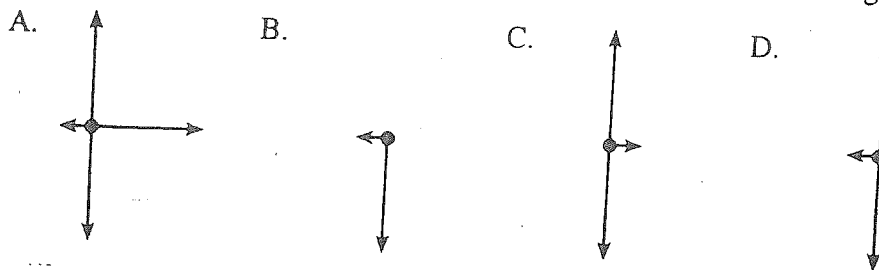
What is the magnitude of the acceleration of the system?

A. 3.0 m/s²
B. 3.8 m/s²
C. 6.5 m/s²
D. 7.8 m/s²

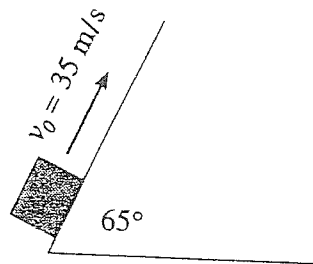1. 🌢 A curling rock is travelling to the right across the ice as shown in the diagram.

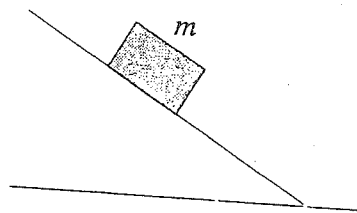Which of the following best represents the forces acting on the curling rock?

A.

B.

C.

D.

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

$v_0 = 35$ m/s

65°

If the initial velocity is 35 m/s, how long does the object take to return to the starting point?
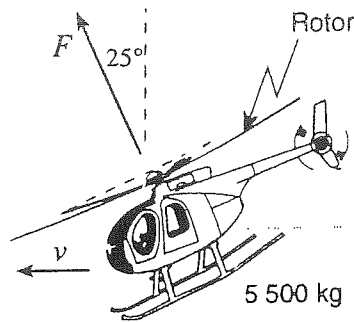
A.   3.6 s
B.   3.9 s
C.   7.9 s
D.   17 s

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

m

The force acting up the ramp on this block

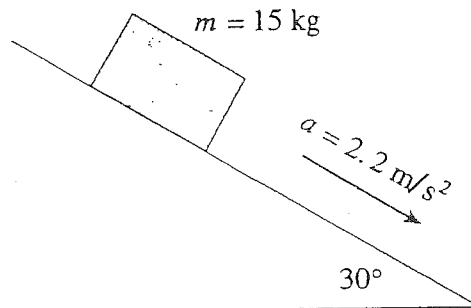A.   0.
B. mg.
C.   less than mg.
D.   more than mg.

(#)(9)

4. A 5 500 kg helicopter is travelling at constant speed in level flight.

Rotor

F 25°

v

5 500 kg

What is the force F provided by the rotor?

A. 4.9×10^4 N

B. 5.4×10^4 N

C. 5.9×10^4 N

D. 1.2×10^5 N

5. A 15 kg block has a constant acceleration of 2.2 m/s² down a 30° incline.

$m = 15$ kg

$a = 2.2 \, m/s^2$

30°

What is the magnitude of the friction force on the block?

A. 33 N
B. 41 N
C. 74 N
D. 130 N

6. Force F gives mass m_1 an acceleration of 4.0 m/s². The same force F gives mass m_2 an acceleration of 2.0 m/s². What acceleration would force F give to the two masses m_1 and m_2 if they were glued together?

A. 1.0 m/s²
B. 1.3 m/s²
C. 3.0 m/s²
D. 6.0 m/s²

10

1. A 75 kg Olympic skier takes 20 s to reach a speed of 25 m/s from rest while descending a uniform 16° slope.

16°
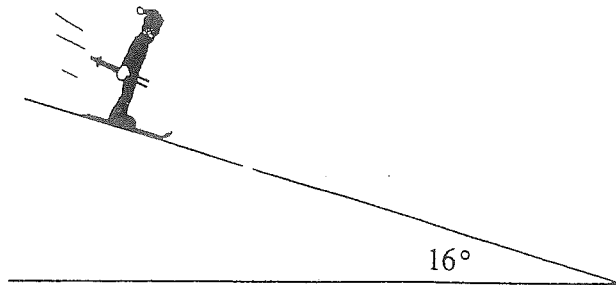
What is the coefficient of friction between the skis and the slope surface?   (7 marks)

2. 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.
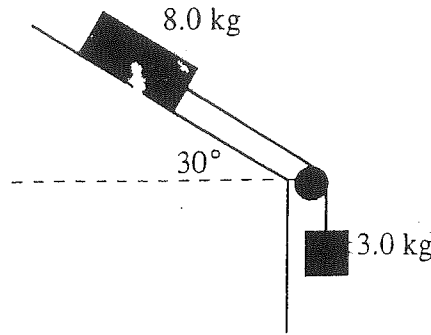

$m_1 = 2.0$ kg

$\mu = 0.27$

$m_2 = 4.0$ kg
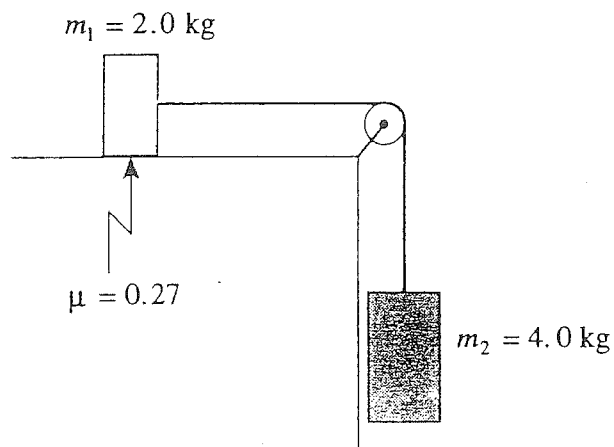
a) Draw and label a free body diagram showing the forces acting on mass m_1.   (2 marks)

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

3. A hanging 3.0 kg mass is attached to an 8.0 kg block on a ramp inclined at 30° to the horizontal. The coefficient of friction between the 8.0 kg block and the ramp is 0.26 and the pulley is frictionless.

8.0 kg

30°

3.0 kg

What is the acceleration of the 8.0 kg block down this ramp?   **(10 marks)**

4. A 12.5 kg block is pushed at a constant speed up a frictionless 28° incline by a horizontally applied force F.

F

28°
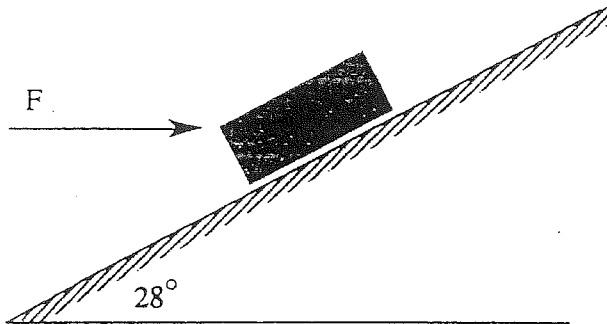
a)   Draw a free body diagram for the block in the space below and label the forces.

(3 marks)

b)   What horizontal force F is required in order to maintain the block at constant speed?

(4 marks)

c)   What is the normal force exerted by the ramp on the block?   **(3 marks)**

12

1. (a) Calvin and Hobbes lost control of their frictionless sled while sliding down a frictionless hill. At the bottom of the hill they were moving at 12.5 m/s. Luckily, the hill slopes up again at an angle of 25° to the horizontal, but the up slope ends 17.0 m later at a sheer cliff. Prove that Calvin and Hobbes will definitely fall into the icy waters below the cliff.

(b) What is the minimum coefficient of friction necessary to save Calvin and Hobbes from the icy plunge?

(c) With the coefficient of friction from (b), how far up the slope are Calvin and Hobbes after:

(i)	0.5 s
(ii)	1.5 s
(iii)	2.5 s
(iv)	3.0 s
(v)	5.0 s