Big Test Name ____________

Forces and Newtons 1st 2 Laws

(1) An airplane is moving with a constant velocity in level flight. Compare the magnitude of the forward force provided by the engines to the magnitude of the backward frictional drag force. [1]

---

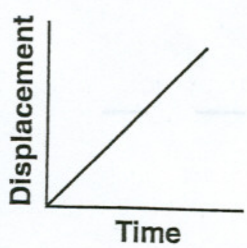
(2) What is an essential characteristic of an object in equilibrium?

(1) zero velocity
(2) zero acceleration
(3) zero potential energy
(4) zero kinetic energy

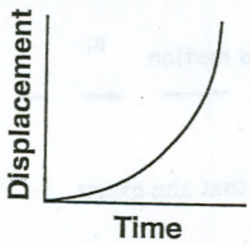
(Equilibrium means all forces are balanced, OR total combined $F_{net}$ = zero)

---

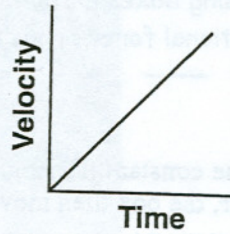
(3) Which graph best represents the motion of an object in equilibrium?



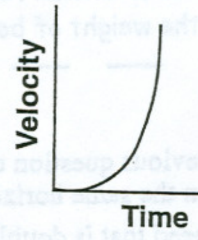
(1)



(2)



(3)



(4)

---

(4) The SI unit for **Newtons of Force can be broken into -** *(SI means metric system)*

(1) $\frac{kg \bullet m^2}{s^2}$

(2) $\frac{kg \bullet m^2}{s}$

(3) $\frac{kg \bullet m}{s}$

(4) $\frac{kg \bullet m}{s^2}$

The data table below lists the mass and speed of four different objects.

**Data Table**

| Object | Mass (kg) | Speed (m/s) |
|---|---|---|
| A | 4.0 | 6.0 |
| B | 6.0 | 5.0 |
| C | 8.0 | 3.0 |
| D | 16.0 | 1.5 |

Which object has the greatest inertia?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

---

to 8

. woman exerts a constant horizontal force on a large box. As a result, the box moves :ross a horizontal floor at a constant speed "$v_0$".

he constant horizontal force applied by the woman:


l) Has same size as weight of box
2) Is greater than weight of box
3) Has same size as frictional force opposing boxes motion
4) Is greater than the frictional force opposing boxes motion
5) Is greater than the weight of box or frictional force opposing boxes motion n.

---

f the woman in the previous question doubles the constant horizontal force that she exerts ›n the box to push it on the same horizontal floor, the box then moves:

(A) with a constant speed that is double the speed "$v_0$" in the previous question.

(B) with a constant speed that is greater than the speed "$v_0$" in the previous question, but not necessarily twice as great.

(C) for a while with a speed that is constant and greater than the speed "$v_0$" in the previous question, then with a speed that increases thereafter.

(D) for a while with an increasing speed, then with a constant speed thereafter.

(E) with a continuously increasing speed.

---

If the woman in question 6 suddenly stops applying a horizontal force to the block, then the block will:

(A) immediately come to a stop.

(B) continue moving at a constant speed for a while and then slow to a stop.

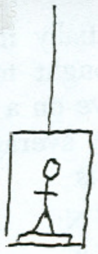
(C) immediately start slowing to a stop.

(D) continue at a constant speed.

(E) increase its speed for a while and then start slowing to a stop.

(9) A person is standing on a bathroom scale in an elevator car. If the scale reads a value greater than the weight of the person at rest, the elevator car could be moving

(1) downward at constant speed
(2) upward at constant speed
(3) downward at increasing speed
(4) upward at increasing speed



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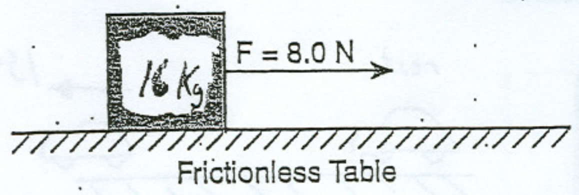
(10) The diagram below shows a horizontal 8.0-newton force applied to a 16-kilogram block on a frictionless table.




What is the magnitude of the block's acceleration?

(1) 0.50 m/s²
(2) 2.0 m/s²
(3) 9.8 m/s²
(4) 32 m/s²

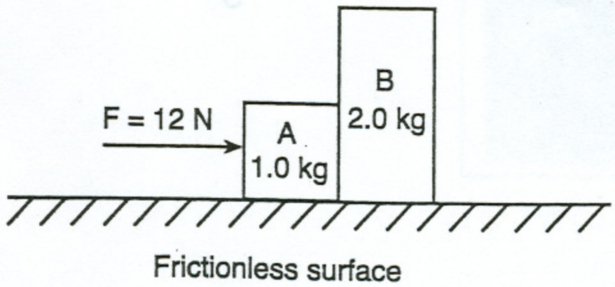
---

(11) A net force of 25 newtons is applied horizontally to a 10.-kilogram block resting on a table. What is the magnitude of the acceleration of the block?

(1) 0.0 m/s²
(2) 0.26 m/s²
(3) 0.40 m/s²
(4) 2.5 m/s²

---

(12) The diagram below shows a horizontal 12-newton force being applied to two blocks, *A* and *B*, initially at rest on a horizontal, frictionless surface. Block *A* has a mass of 1.0 kilogram and block *B* has a mass of 2.0 kilograms.




The magnitude of the acceleration of block *B* is

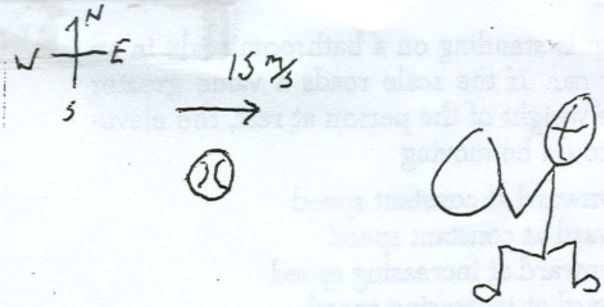
(1) 6.0 m/s²
(2) 2.0 m/s²
(3) 3.0 m/s²
(4) 4.0 m/s²

130141

(3)

4 A 0.149-kilogram baseball, initially moving at 15 meters per second, is brought to rest in 0.040 second by a baseball glove on a catcher's hand. The magnitude of the average force exerted on the ball by the glove is

(1) 2.2 N
(2) 2.9 N
(3) 17 N
(4) 56 N

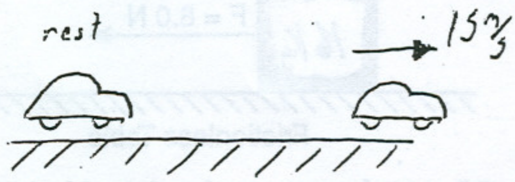



1) The direction of the balls acceleration is ________

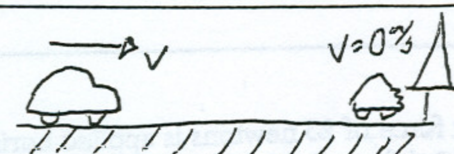
(15)

What is the magnitude of the net force acting on a $2.0 \times 10^3$-kilogram car as it accelerates from rest to a speed of 15 meters per second in 5.0 seconds?

(1) $6.0 \times 10^3$ N
(2) $2.0 \times 10^4$ N
(3) $3.0 \times 10^4$ N
(4) $6.0 \times 10^4$ N




16 + 17




A $2.0 \times 10^3$-kilogram car collides with a tree and is brought to rest in 0.50 second by an average force of $6.0 \times 10^4$ newtons.

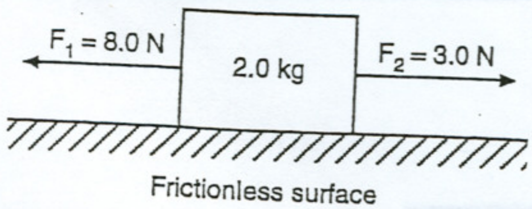
(16) What is the cars acceleration from this force?

1) $2 \times 10^4$ m/s²  2) $2 \times 10^3$ m/s²  3) $3 \times 10^1$ m/s²  4) $3 \times 10^0$ m/s²

(17) What was the cars velocity before the collision?

1) 40 m/s  2) 20 m/s  3) 15 m/s  4) 10 m/s

18) Two forces are applied to a 2.0-kilogram block on a frictionless horizontal surface, as shown in the diagram below.



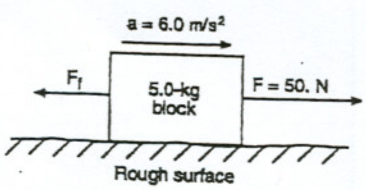

The acceleration of the block is

(1) 1.5 m/s² to the right
(2) 2.5 m/s² to the left
(3) 2.5 m/s² to the right
(4) 4.0 m/s² to the left

---

19) The diagram below shows a 5.0-kilogram block accelerating at 6.0 meters per second² along a rough horizontal surface by the application of a horizontal force, *F*, of 50. newtons.

Fill In




$f_F$ = ______

What is the magnitude in newtons of the force of friction, $F_f$, acting on the block?

---

20)

One Newton of weight or force is about how many pounds -

1) 0.25 pounds 2) 2.25 pounds 3) 4 pounds 4) 10 pounds

---

21)

On Earth 1 kilogram of mass has about what weight in pounds -

1) 0.25 pounds 2) 2.25 pounds 3) 4 pounds 4) 10 pounds

22. The weight of a typical high school physics student is closest to

(1) 1500 N
(2) 600 N
(3) 120 N
(4) 60 N

---

23. An apple weighing 1 newton on the surface of Earth has a mass of approximately

(1) $1 \times 10^{-1}$ kg
(2) $1 \times 10^{0}$ kg
(3) $1 \times 10^{1}$ kg
(4) $1 \times 10^{2}$ kg

---

24. On the surface of Earth, a spacecraft has a mass of $2.00 \times 10^4$ kilograms. What is the mass of the spacecraft on the moon?

(1) $5.00 \times 10^3$ kg
(2) $2.00 \times 10^4$ kg
(3) $4.90 \times 10^4$ kg
(4) $1.96 \times 10^5$ kg

---

25. A 60.-kilogram astronaut weighs 96 newtons on the surface of the Moon. The acceleration due to gravity on the Moon is

1) $0.0\ m/s^2$
2) $1.6\ m/s^2$
3) $4.9\ m/s^2$
4) $9.8\ m/s^2$

---

26. A person weighing 785 newtons on the surface of Earth would weigh 298 newtons on the surface of Mars. What is the magnitude of the gravitational acceleration on the surface of Mars?

(1) $2.63\ m/s^2$
(2) $3.72\ m/s^2$
(3) $6.09\ m/s^2$
(4) $9.81\ m/s^2$

Test Day 2 Name ____________

(27) Sand is often placed on an icy road because the sand

1 decreases the coefficient of friction between the tires of a car and the road
2 increases the coefficient of friction between the tires of a car and the road
3 decreases the gravitational force on a car
4 increases the normal force of a car on the road

---

(28) The table below lists the coefficients of kinetic friction for four materials sliding over steel.

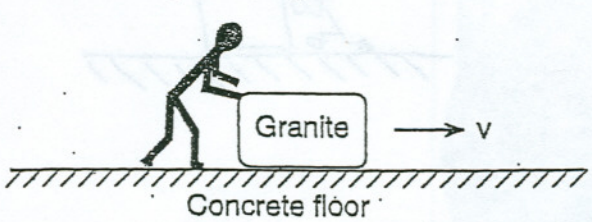
| Material | Coefficient of Kinetic Friction |
|---|---|
| aluminum | 0.47 |
| brass | 0.44 |
| copper | 0.36 |
| steel | 0.57 |

A 10.-kilogram block of each of these materials is pulled horizontally across a steel floor at constant velocity. Which block requires the *smallest* applied force to keep it moving at constant velocity?

(1) aluminum
(2) brass
(3) copper
(4) steel

---

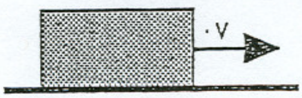
(29) The diagram below shows a granite block being slid at constant speed across a horizontal concrete floor by a force parallel to the floor.

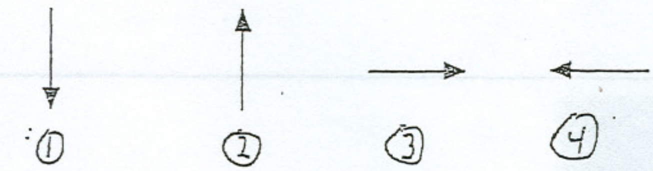



Which pair of quantities could be used to determine the coefficient of friction for the granite on the concrete?

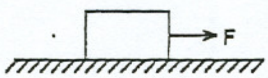
(1) mass and speed of the block
(2) mass and normal force on the block
(3) frictional force and speed of the block
(4) frictional force and normal force on the block

30 A box decelerates as it moves to the right along a horizontal surface, as shown in the diagram at the right. Which vector best represents the force of friction on the box?



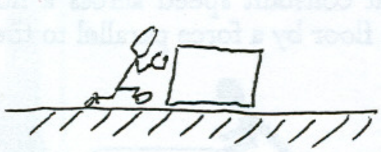

31 A box initially at rest on a level floor is being acted upon by a variable horizontal force, as shown in the diagram at the right. Compared to the force required to start the box moving, the force required to keep it moving at constant speed is




1 less
2 greater
3 the same

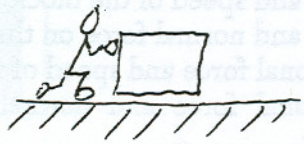
32 A 50.-newton horizontal force is needed to keep an object weighing 500. newtons moving at a constant velocity of 2.0 meters per second across a horizontal surface. The magnitude of the frictional force acting on the object is

(1) 500. N
(2) 450. N
(3) 50. N
(4) 0 N



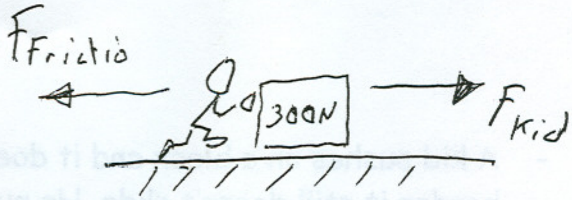
33 A wooden block is at rest on a horizontal steel surface. If a 10.-newton force applied parallel to the surface is required to set the block in motion, how much force is required to keep the block moving at constant velocity?

(1) less than 10. N
(2) greater than 10. N
(3) 10. N



34. According to your reference table, *Approximate Coefficents of Friction,* what is the minimum horizontal force needed to start a 300. N steel block on a steel table in motion?

(1) 0.57 N
(2) 074 N
(3) 171 N
(4) 222 N

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35. Jill is pulling a 200. newton sled through the snow at constant velocity using a horizontal force of 10. newtons. What is the kinetic coefficient of friction of the sled on the snow?

(1) 0.02
(2) 0.05
(3) 0.20
(4) 20


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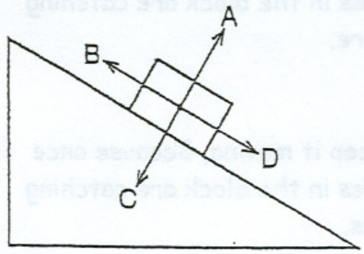
36 to 38. The diagram below represents a block sliding down an incline.




36. Which vector best represents the frictional force acting on the block?

(1) *A*
(2) *B*
(3) *C*
(4) *D*

37. The component of the weight that acts parallel to the incline points in the direction of -

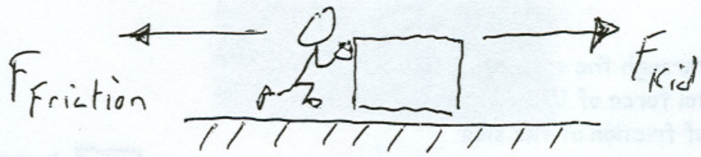
1) A 2) B 3) C 4) D

38. The component of the weight that acts perpendiculear to the incline points in the direction of -

1) A 2) B 3) C 4) D

39

- A kid pushes on a block and it doesn't slide, He pushes a little harder it still doesn't slide, He pushes a little harder and the block finally breaks free & begins to slide. Throughout the time he pushes on it the kid notices -




1) Once the block begins sliding its harder to keep it moving, Because once it is moving all the little surface irregularities in the block are catching on the surface irregularities in the floor more.

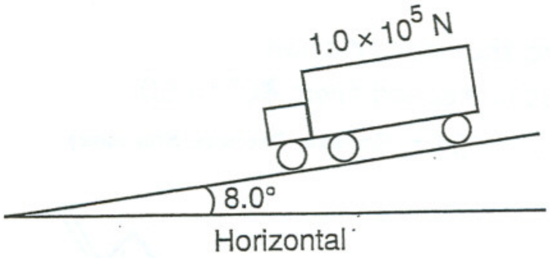
2) Once the block begins sliding its easier to keep it moving, Because once it is moving all the little surface irregularities in the block are catching on the surface irregularities in the floor more.

3) Once the block begins sliding its easier to keep it moving, Because once it is moving all the little surface irregularities in the block are catching on the surface irregularities in the floor less.

4) He notices it is equally hard to start the blocks motion as it is to keep The block moving forwards at steady speed *(constant velocity)*

40

The diagram below shows a $1.0 \times 10^5$-newton truck at rest on a hill that makes an angle of 8.0° with the horizontal.



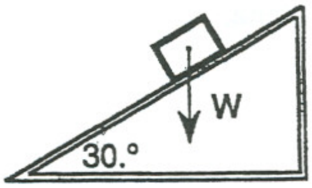

What is the component of the truck's weight parallel to the hill?

(1) $1.4 \times 10^3$ N
(2) $1.0 \times 10^4$ N
(3) $1.4 \times 10^4$ N
(4) $9.9 \times 10^4$ N

---

41

In the diagram below, the weight of a box on a plane inclined at 30.° is represented by the vector *W*.



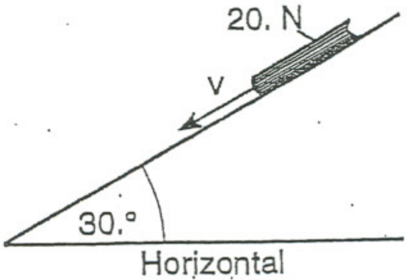

What is the magnitude of the component of the weight (*W*) that acts parallel to the incline?

(1) *W*
(2) 0.50 *W*
(3) 0.87 *W*
(4) 1.5 *W*

---

42

A book weighing 20. newtons slides at constant velocity down a ramp inclined 30.° to the horizontal as shown in the diagram below.

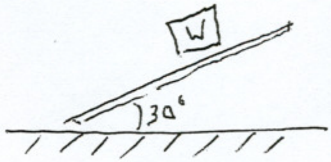


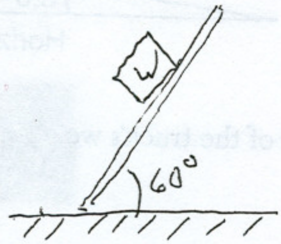

What is the force of friction between the book and the ramp?

(1) 10. N up the ramp
(2) 17 N up the ramp
(3) 10. N down the ramp
(4) 17 N down the ramp

43 to 45

A block is placed on an incline that has friction
The angle of tilt of the inline is increased from 30° to 60°.
What happens to the following things - (Increase, Decrease, Stay same)




(43) - The weight of the block

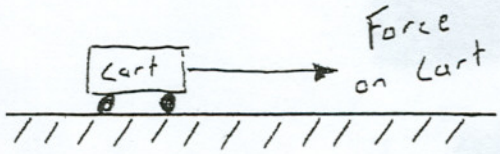
(44) - The part of the weight that acts parallel to plane.
(Or the part that makes it want to slide down plane)

(45) - The part of the weight that acts perpendicular to plane.
(Or the part that drives block into surface of plane)

(problems 40%) Name ______________________

**PROBLEM 1**

Two different (frictionless) Lab carts are placed on a track. Forces ranging from 2 Newtons to 20 Newtons are applied to the carts as indicated in the table below. Using a stopwatch and calculations the acceleration of the carts is measured and recorded in the table as indicated.




| Force on Car | Accel of car A | Accel. of Car B |
|---|---|---|
| 2N | 0.4 $m/s^2$ | 1.5 $m/s^2$ |
| 4N | 1.1 $m/s^2$ | 3.2 $m/s^2$ |
| 6N | 1.3 $m/s^2$ | 4.3 $m/s^2$ |
| 8N | 1.9 $m/s^2$ | 5.9 $m/s^2$ |
| 10N | 2.7 $m/s^2$ | 7.3 $m/s^2$ |
| 12N | 3.0 $m/s^2$ | 9.0 $m/s^2$ |
| 14N | 3.4 $m/s^2$ | 11 $m/s^2$ |
| 16N | 4.1 $m/s^2$ | 11.5 $m/s^2$ |
| 18N | 4.7 $m/s^2$ | 13.2 $m/s^2$ |
| 20N | 5.2 $m/s^2$ | 14.7 $m/s^2$ |

A - Plot the data points for each car. [1] (Next page)

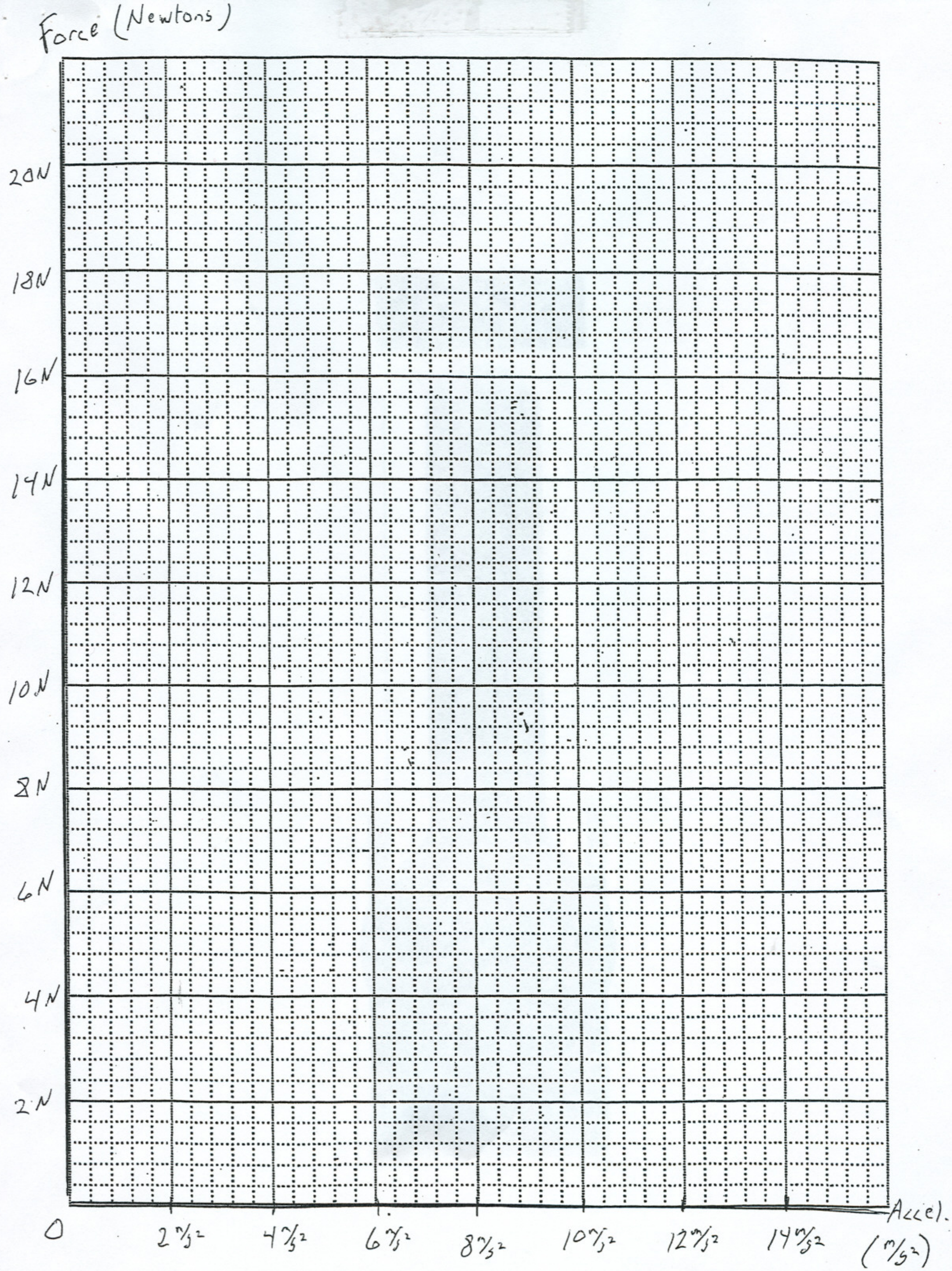
B - Draw the best fit line for each cars [1] data points.

(u can do on graph) C - For each cars data calculate slope of the graph. (show equation and units) [3]

Car A

Car B

D - What is the Physical significance of the graphs slope ? [1]

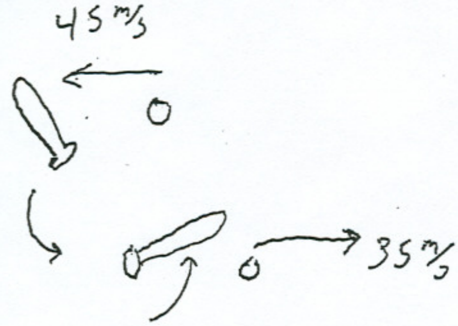


Force (Newtons)
20N
18N
16N
14N
12N
10N
8N
6N
4N
2N
0
2 m/s²
4 m/s²
6 m/s²
8 m/s²
10 m/s²
12 m/s²
14 m/s²
Accel. (m/s²)

problem 2

Base your answers to questions __ and    on the information below.

The instant before a batter hits a 0.14-kilogram baseball, the velocity of the ball is 45 meters per second west. The instant after the batter hits the ball, the ball's velocity is 35 meters per second east. The bat and ball are in contact for $1.0 \times 10^{-2}$ second.




1) What is the change in velocity of the ball $\Delta V$ [1]

$\Delta V =$ ______ m/s

2) Determine the magnitude and direction of the average acceleration of the baseball while it is in contact with the bat.

(Show equation with sub. & units) [3]

Direction = ____________

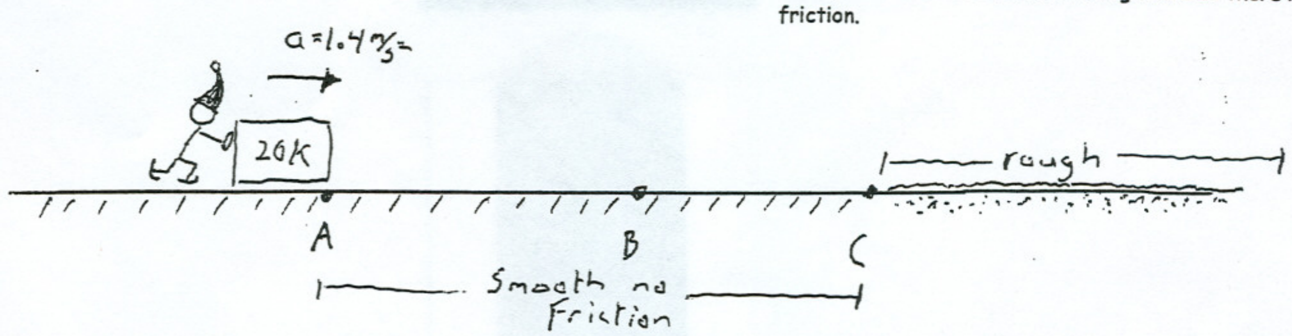
3) Calculate the magnitude of the average force the bat exerts on the ball while they are in contact. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 65 through 68 on the information below.

problem 3

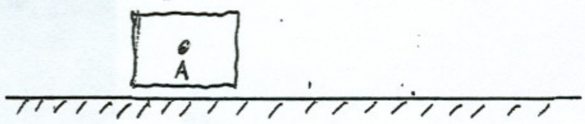
An ice skater applies a horizontal force to a 20.-kilogram block on frictionless, level ice, causing the block to accelerate uniformly at 1.4 meters per second$^2$ to the right. After the skater stops pushing the block, it slides onto a region of ice that is covered with a thin layer of sand. The coefficient of kinetic friction between the block and the sand-covered ice is 0.28.

So kid pushes block from point A to B & accelerates it. He then lets go at B and block glides to point C. From point C on the block is on rough sand so there is friction.




65 Calculate the magnitude of the force applied to the block by the skater. [Show all work, including the equation and substitution with units.] [2]

66 On the diagram *in your answer booklet*, starting at point A, draw a vector to represent the force applied to the block by the skater. Begin the vector at point A and use a scale of 1.0 centimeter = 5.0 newtons. [1]




67 Determine the magnitude of the normal force acting on the block. [1]

68 Calculate the magnitude of the force of friction acting on the block as it slides over the sand-covered ice. [Show all work, including the equation and substitution with units.] [2]

65)

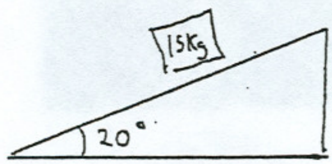
66) On Diagram

67) $F_{Norm}$ = ______ N

68)

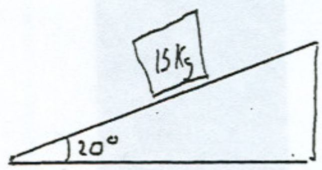
PROBLEM 4

A 15 kg wooden crate is placed on top of a 20 degree wooden incline plane.

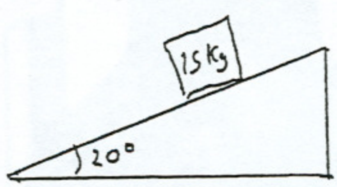



A - Find the weight of the crate, and label the weight vector on the digram below. (show Equation with sub & unit, and draw weight vector)

[2]




B - Break the weight vector into the part that acts parallel to the plane, and the part that acts perpendicular to the plane, and draw these two parts on the diagram below. ( we sometimes called these parts - The part that goes down the ramp, and the part that drives the box into the ramp) [3]




$F_{g_{parallel}}$ = ______________

$F_{g_{perpendicular}}$ = ______________

C - Does this block slide down the incline or not ? Why is this so ? [1]

Force Test Answers

1 - Same
2 - 2
3 - 1
4 - 4
5 - 4
6 - 3
7 - E
8 - C

9 - 4
10 - 1
11 - 4
12 - 4
13 - 4
14 - west
15 - 1
16 - 3
17 - 3

18 - 2
19 - 20N
20 - 1
21 - 2
22 - 2
23 - 1
24 - 2
25 - 2
26 - 2

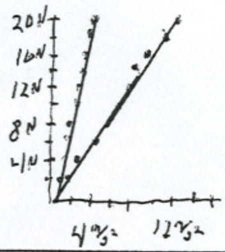
27 - 2
28 - 3
29 - 4
30 - 4
31 - 1
32 - 3
33 - 1

34 - 4
35 - 2
36 - 2
37 - 4
38 - 3
39 - 3
40 - 3
41 - 2
42 - 1

43 - Same
44 - Increase
45 - Decrease

---

Prob 1




C - Slope = $\frac{F_2 - F_1}{a_2 - a_1}$

Car A ≃ 3.75 $\frac{N}{m/s^2}$

Car B ≃ 1.36 $\frac{N}{m/s^2}$

D - Slope is mass

---

Prob 2 $\Delta V = 80\,m/s$

$a = \frac{\Delta V}{t} = \frac{80\,m/s}{.01\,sec} = 8000\,m/s^2$

East

$F = ma$

$= .14K(8000\,m/s^2) = 1152N$

---

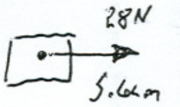
prob 3 65 -

$F = ma$

$= 20K(1.4\,m/s^2)$

$= 28N$

66)




67) $F_{Norm}$ = Weight

= 200N

68) $F_{Fric} = \mu F_N$

$= .28(200N) = 56N$

---

prob 4 A) - $F_g = mg$

$= 15K(10\,m/s^2)$

$= 150N$



= Wparall

150N cos 20

≃ 141N = Wperpen

$F_{Fric}$ static wall $= \mu F_N = .42(141N) = 59N$

No 50N down

can't break

---

Multiple Choice

Scale

| # right | crdeits |
|---|---|
| 45 | 60.00 |
| 44 | 58.67 |
| 43 | 57.33 |
| 42 | 56.00 |
| 41 | 54.67 |
| 40 | 53.33 |
| 39 | 52.00 |
| 38 | 50.67 |
| 37 | 49.33 |
| 36 | 48.00 |
| 35 | 46.67 |
| 34 | 45.33 |
| 33 | 44.00 |
| 32 | 42.67 |
| 31 | 41.33 |
| 30 | 40.00 |
| 29 | 38.67 |
| 28 | 37.33 |
| 27 | 36.00 |
| 26 | 34.67 |
| 25 | 33.33 |
| 24 | 32.00 |
| 23 | 30.67 |
| 22 | 29.33 |

| | |
|---|---|
| 21 | 28.00 |
| 20 | 26.67 |
| 19 | 25.33 |
| 18 | 24.00 |
| 17 | 22.67 |
| 16 | 21.33 |
| 15 | 20.00 |
| 14 | 18.67 |
| 13 | 17.33 |

part 2 Long

prob scale

| Of 24 | points of 40 |
|---|---|
| 24 | 40.00 |
| 23 | 38.33 |
| 22 | 36.67 |
| 21 | 35.00 |
| 20 | 33.33 |
| 19 | 31.67 |
| 18 | 30.00 |
| 17 | 28.33 |
| 16 | 26.67 |
| 15 | 25.00 |
| 14 | 23.33 |
| 13 | 21.67 |
| 12 | 20.00 |
| 11 | 18.33 |
| 10 | 16.67 |
| 9 | 15.00 |
| 8 | 13.33 |
| 7 | 11.67 |
| 6 | 10.00 |