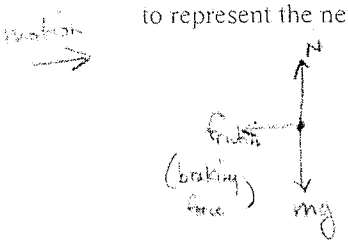
State Exam Review
Standard 2

Key

1. Draw a force diagram of a car slowing down (braking) on a flat surface. Also draw a single vector to represent the net force.

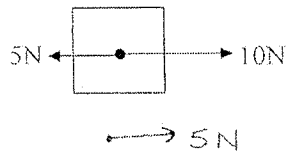


$\Sigma F \longleftarrow$ ΣF is the braking force because it is slowing down

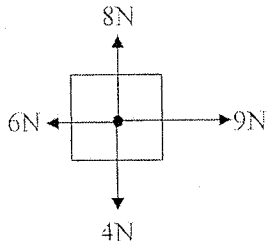
2. Name some devices that can be used to measure force.

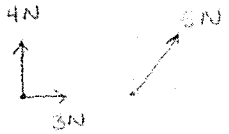
spring scale, bathroom scale, electronic scale, Balance

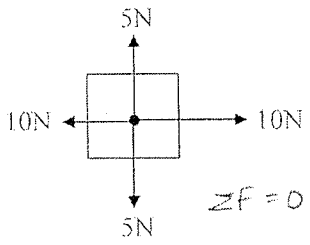
3. Determine the net force.



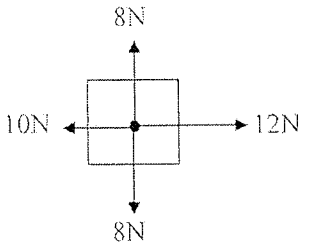
$\longrightarrow$ 5 N







$\Sigma F = 0$



4. A 2.0×10^6 kg submarine has a 1.94×10^7 N buoyant force acting on it. Is it sinking or not? How do you know. What is its acceleration (if zero say so)?

$F_b = 1.94 \times 10^7$ N

$\Sigma F = ma \Rightarrow a = \frac{\Sigma F}{m} = \frac{0.2 \times 10^7 \text{ N}}{2 \times 10^6 \text{ kg}} = 0.1 \text{ m/s}^2$

$\Sigma F = 0.02 \times 10^7$ N } sinking because the ΣF is down

$mg = (2 \times 10^6 \text{ kg})(9.8 \text{ m/s}^2) = 1.96 \times 10^7$ N

5. A 70kg person has a weight of 687 N on Earth. $(70\text{ kg})(9.8\ \frac{N}{kg}) = 687\text{ N}$

6. What will happen to an object when the forces acting on it are not balanced?

it will accelerate

7. What net force acts on a 10kg object with an acceleration of 5m/s^2

$\Sigma F = ma = (10\text{kg})(5\ \text{m/s}^2) = 50\text{ N}$

8. Use Newton's 2nd Law (F = ma) to explain why objects fall at the same rate of acceleration regardless of their mass. acceleration of the force and mass so if there is a massive object then the weight also large but the ratio will be 9.8

$\frac{F}{M} = g = \frac{f}{m}$

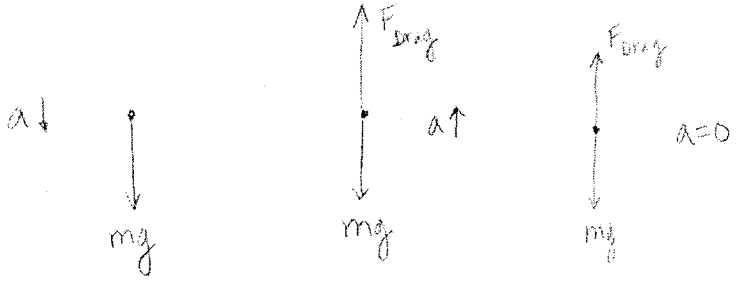
9. What is the mass of a 100kg person on Earth?

100 kg

10. Explain the difference between mass and weight.

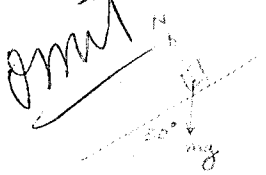
mass is the amount of matter in an object and weight is gravity pulling on the mass.

11. Draw a force diagram of a skydiver and indicate the direction of the acceleration
- Before opening the parachute
- Immediately after opening the parachute
- At terminal velocity



12. An object sliding down a ramp of 30 degrees should have an acceleration equal to ½ g. However, you find in an experiment that the acceleration is equal to ⅓ g. Draw a force diagram of the object sliding down the ramp and use it to explain why the acceleration is not ½ g.

omit



FBD for the object when the acceleration is ⅓ g.

FBD for the object when the acceleration is ½ g

using Newton's 2nd Law $\Sigma F = ma$: if the acceleration is lower than the ΣF must be lower so there is a friction force in the opposite direction of the force down the ramp

13. Explain what will happen to each charge. Which pair will have the greatest attraction? Which will have the least? Coulombs law says $F \propto q_A q_B$ and likes repell and unlikes attract

least attraction →

+10C -10C

$q_A q_B$ = 100 C (attract)

+10C +10C

$q_A q_B$ = 100 C (repell)

+20C +20C

$q_A q_B$ = 400 C (repell)

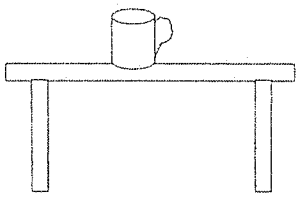
+20C -40C ← greatest attraction

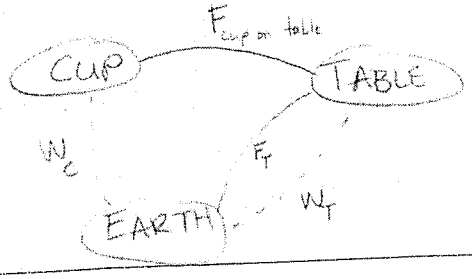
$q_A q_B$ = 800 C (attract)

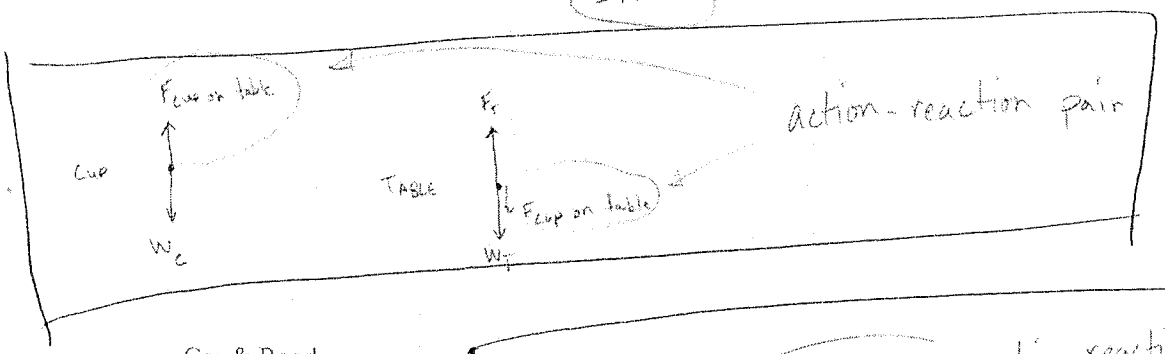
14. Draw force diagrams for each object. Clearly indicate force pairs using Newton's 3rd Law.

and System

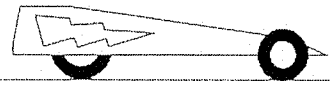
Cup & Table

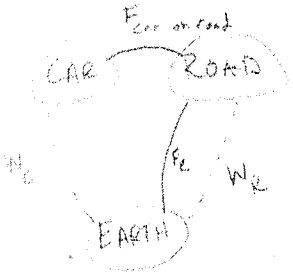


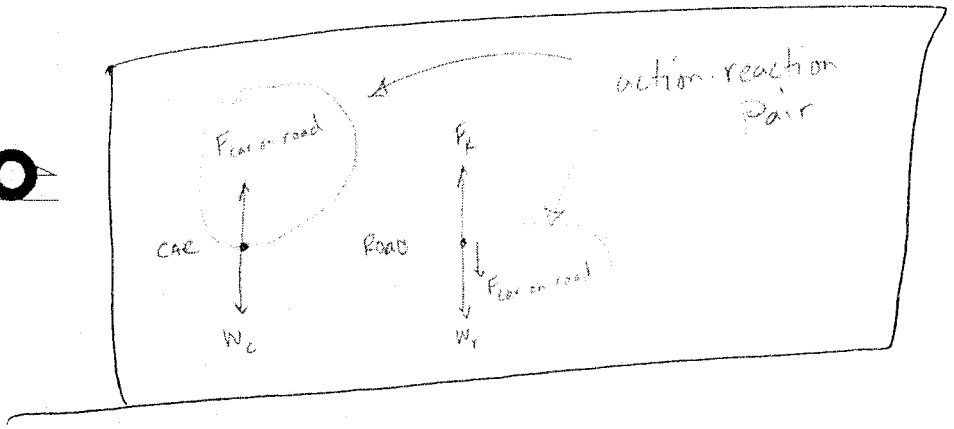




Car & Road







CRT Review: Standard 2

Name: Answer Key Date:_____ Per:_____

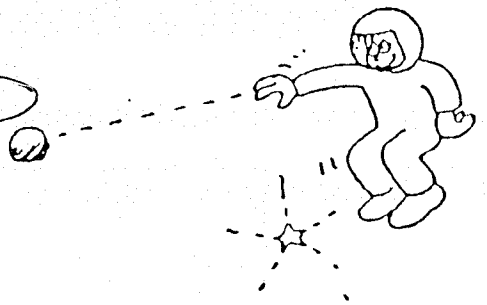
Year End Review

FORCES & NEWTON'S LAWS

1. (*Circle the correct answer.*) An astronaut in outer space away from gravitational or frictional forces throws a rock. The rock will

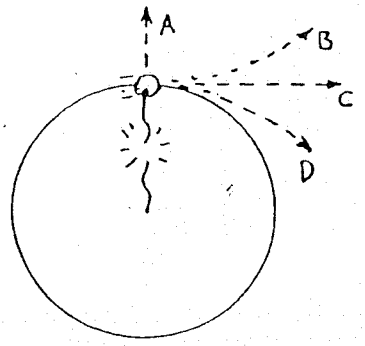
(gradually slow to a stop)

(continue moving in a straight line at constant speed)



The rock's tendency to do this is called

(inertia) (weight) (acceleration)

2. 

The sketch shows a top view of a rock being whirled at the end of a string (clockwise). If the string breaks, the path of the rock is

(A) (B) (C) (D)

↳ straight line will be tangent to circle.

3. Use the words *mass*, *weight*, and *volume*, to complete the table.

The force due to gravity on an object	Weight
The quantity of matter in an object	mass
The amount of space an object occupies	Volume

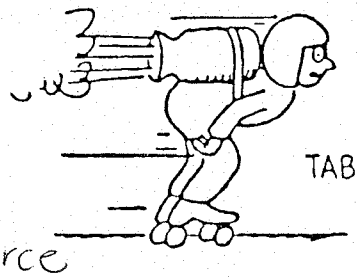
4. Skelly the skater, total mass 25 kg, is propelled by rocket power.

a. Complete Table I (neglect resistance)

F = ma

TABLE I

FORCE	ACCELERATION
100 N	4 m/s^2
200 N	8 m/s^2
250N	10 m/s^2



b. Complete Table II for a constant 50-N resistance.

opposing force means "subtract it" from the total force

TABLE II

FORCE	ACCELERATION
50 N	0 m/s^2
100 N	2 m/s^2
200 N	6 m/s^2

PER: _____

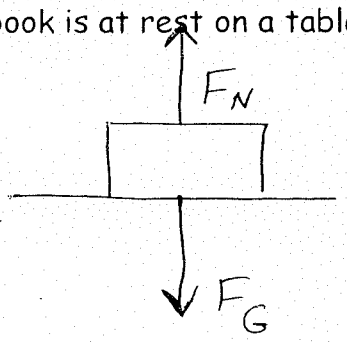
Name: _____

Date: _____

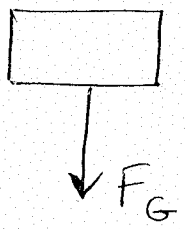
Practice Drawing FREE-BODY Diagrams

Instructions: Draw free-body diagrams for the various situations described below.

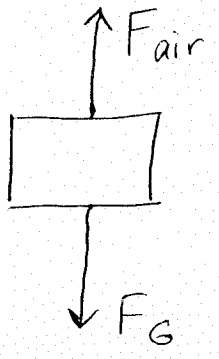
1) A book is at rest on a table top



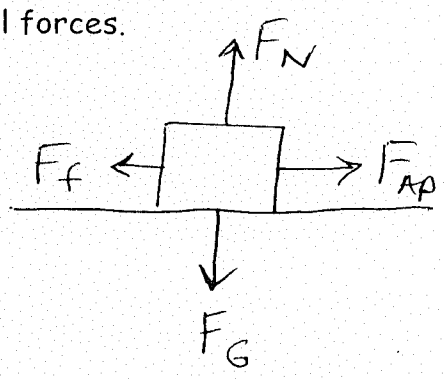
2) An egg is falling from a nest in a tree. Do not consider air resistance.



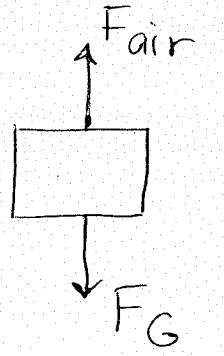
3) A flying squirrel is gliding from a tree to the ground. Consider air resistance.



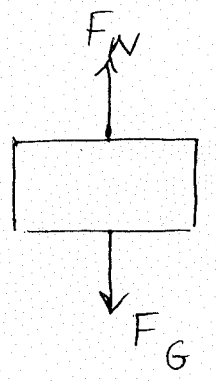
4) A rightward force is applied to a book in order to move it across a desk. Consider frictional forces.



5) A skydiver is descending with a constant speed. Consider air resistance.



6) A soccer ball is sitting on the ground.



Practice Multiple Choice

D 7. If a person threw a ball against a wall and it bounced back at him, how would Sir Isaac Newton explain what happened?

A. The acceleration of an object is equal to force times mass.
B. An object will remain in motion if it is acted upon by an outside force.
C. The acceleration of an object is equal to the force divided by the mass.
(D.) An object's velocity will only change due to an external net force.
E. The force of the object is proportional to the product of the mass of the wall and the ball.

8-10. Use this information to answer questions 8 through 10.

Experiment 1: The student placed a 100 g melting ice cube on a flat, horizontal surface and gave it a push. She watched it move for a distance of 1 meter.
Experiment 2: The student placed a 100 g round metal ball on a flat, horizontal surface and gave it a push. She watched it move for a distance of 1 meter.
Experiment 3: The student placed a 100 g glider on a horizontal air track and gave it a push. She watched it move for a distance of 1 meter.

A 8. Which statement **best** describes what the student would have observed during these experiments? The objects moved

(A.) in straight lines, and they moved at nearly constant speeds.
B. in straight lines, but the glider slowed down dramatically.
C. at constant speeds, and the ice cube moved in a circular path.
D. at constant speeds, and they all moved in curved paths.
E. in curved paths, and they all slowed down dramatically.

B 9. Once the objects started moving, what type of energy had they gained from the push?

A. Elastic potential energy
(B.) Kinetic energy
C. Chemical energy
D. Thermal energy
E. Gravitational potential energy

mat 10. If this were a graduate student in material science, which of the following **best** describes what she was trying to observe? The effect of

A. mass on motion
B. surface type on motion
C. force on motion
D. object shape on mass
E. force on mass

11-12. Use this information to answer questions 11 and 12.

A group of students used two-liter pop bottles to build rockets. Their objective was to build a rocket that would fly to the greatest height. The rockets all had identical aerodynamic cones and fins. Their experiments and the results are described below.

Experiment 1–The students varied the amount of water in the rockets.

Test #	Mass in Cone	Water in Rocket	Pressure in Rocket	Height of Flight
1	75 gm	0 liters	60 psi	5 meters
2	75 gm	.25 liters	60 psi	20 meters
3	75 gm	.5 liters	60 psi	36 meters
4	75 gm	.75 liters	60 psi	56 meters
5	75 gm	1 liter	60 psi	50 meters

Experiment 2–The students varied the amount of air pressure in the rockets.

Test #	Mass in Cone	Water in Rocket	Pressure in Rocket	Height of Flight
6	75 gm	.75 liters	60 psi	55 meters
7	75 gm	.75 liters	70 psi	68 meters
8	75 gm	.75 liters	80 psi	95 meters
9	75 gm	.75 liters	90 psi	120 meters
10	75 gm	.75 liters	100 psi	bottle explodes

omit 1X. Which variable(s) tested for Newton's second law of motion?

A. Mass in the cone
B. Amount of water in the bottle
C. The pressure in the bottle
D. Velocity of the cone and pressure in the bottle
E. Amount of water and pressure in the bottle

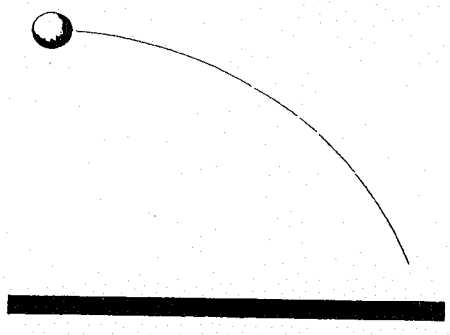
B 12. If the rocket in test #10 had not exploded, how high would you estimate it to have gone?

A. About 125 meters
(B.) About 150 meters
C. About 200 meters
D. About 250 meters
E. About 300 meters

B 13. Aristotle's theory of motion explained that, for a body to stay in motion, a force had to keep it in motion. This concept was widely accepted by the educated community for almost 1500 years. Galilei Galilei proposed that a body will remain in motion once it has been affected by a force and does not need a constant force to keep it moving. What was the main reason for this change in thinking?

A. Aristotle's theory was too old to be accepted by the teachers of the day, so they were looking for any replacement they could find.
B. Galileo's theory was based on experimental evidence that was reproducible and predicted results better than the old model.
C. Galileo's theory was based on mental models that needed no direct evidence.
D. Galileo had a better sense of intuition than did Aristotle.
E. Aristotle's theory was written in Latin, whereas Galileo wrote his in Italian so everyone could read it.

G 14. A ball with a mass of m is thrown into the air, as shown in the figure below. What is the force exerted on Earth by the ball?



F. $m_{ball}g$, directed down
G. $m_{ball}g$, directed up
H. $m_{Earth}g$, directed down
J. $m_{Earth}g$, directed up

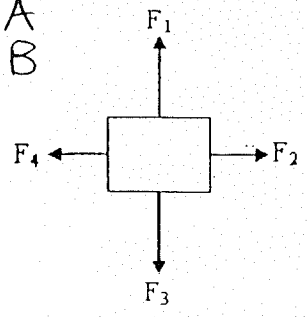
5 Which is an example of Newton's third law affecting human life?

A. Human bodies are naturally buoyant in water.
B. Helmets protect peoples' heads from collision forces in an accident.
C. The moon's gravity creates high and low tides which aids ocean shipping.
D. Rock climbers buy special shoes with rubberized soles to increase friction.

16) C A parachutist in free fall first reaches terminal velocity

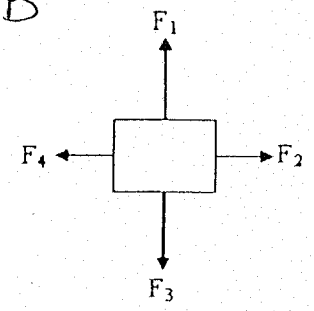
A. at the time of collision with the earth
B. when the force of gravity is greater than the air resistance
C. when the force of gravity is just balanced by the air resistance
D. after the parachute is opened

17) A B The diagram shows various forces acting on a box. As a result of the forces, the box does NOT accelerate. Which of the equations below best expresses the relationship between forces?



A. F1 = F3 and F2 = F4
B. F1 = F3 = F2 = F4
C. F1 = F3 only
D. F2 = F4 only

18) B The diagram shows various forces acting on a box. You know that F1 = F3 and that F2 = F4. Which equation below best describes the motion of the box?



A. Velocity = 0 m/s
B. Acceleration = 0 m/s2
C. Velocity = 0 m/s and Acceleration = 0 m/s2
D. The forces are not balanced.

19) C Based on his observations, Aristotle taught that objects stopped moving because it was 'natural' for them to do so. Many hundreds of years later, Newton made other observations and explained motion in terms of forces acting on objects. Which statement best explains how modern scientists view Aristotle's and Newton's ideas?

A. Aristotle was correct because almost everything that moves stops without any help from outside forces.
B. Newton was correct because he had better ways to make measurements to explain what he observed happening.
C. Newton is more correct because scientific knowledge builds on past knowledge as new information is learned.
D. Neither is correct by today's standards because we now have access to technology to make very precise measurements.

20) A Swimmers rely on science and technology more and more to advance in their sport. Newton's 3rd Law of Motion effectively describes how the force applied by a swimmer on the water is equaled by the force of the water on the swimmer. How can this knowledge be found?

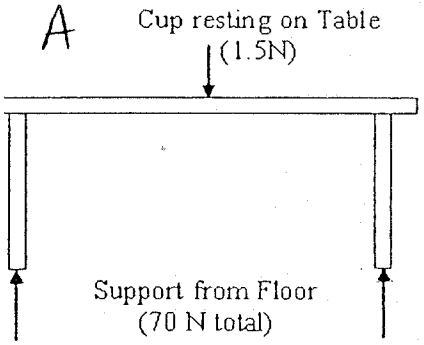
A. Observations by physicists as well as swimmers give the evidence that swim coaches use.
B. Observations by physicists give the evidence, otherwise swim coaches would not know this.
C. This knowledge is intuitive to anyone who goes near the water.
D. Swimmers can learn this through watching tapes of themselves.

Throughout history people have developed elaborate explanations to describe observations of the physical world. Newton proposed simpler explanations to describe the motions of objects, subject to a few basic rules. Why have Newton's laws achieved such importance in our current understanding of the world?

. Before Newton, people were uneducated and superstitious. We have come to understand that their knowledge was therefore limited. We can discredit the old explanations for this reason.
B. Newton was a rich nobleman who had more time to ponder his own ideas and then had the money and prestige needed to publish his work and see that it was given importance over the old ideas.
C. We have come to understand that new ideas are generally superior to old ideas, even if it sometimes takes a long time for the new one to be accepted by everyone. Soon Einstein will be more important than Newton.
D. New ideas are accepted only after being tested and tried against observations. Newton was no exception. His ideas have stood the test of time and better alternatives have not come along yet.

The diagram shows the forces acting on a table.
What force from the table acts on the cup?

A

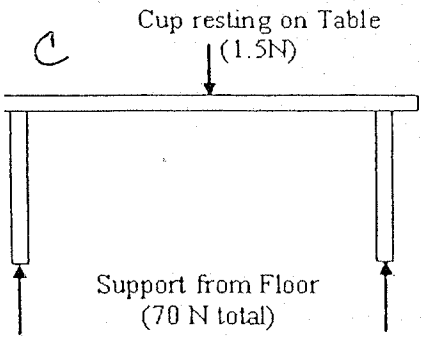


A. 1.5 N
B. 70 N
C. 71.5 N
D. 68.5 N

23

diagram shows the forces acting on a table.
at force from the table acts on the floor?

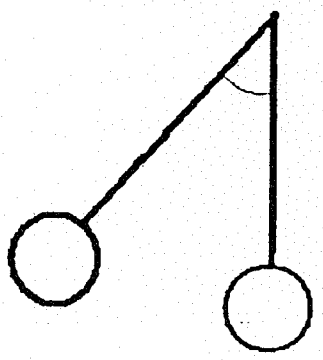
C



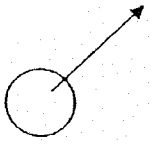
A. 1.5 N
B. 70 N
C. 71.5 N
D. 68.5 N

24) A Pendulum is swinging back and forth. When the pendulum reaches the top of the swing we could draw the forces acting on the pendulum. Which of the following diagrams would show the forces acting on the pendulum?

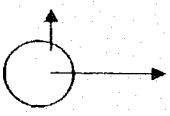
omit



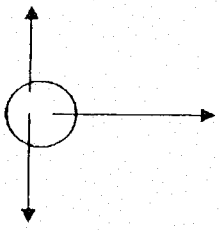
A.



B.



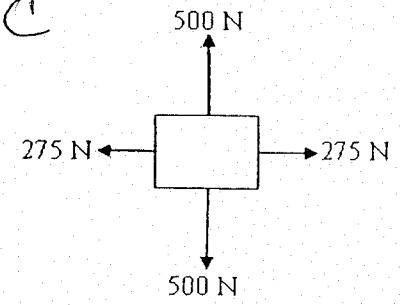
C.



D.

25) The diagram shows various forces acting on a box. How could the motion of the box be described from this information?

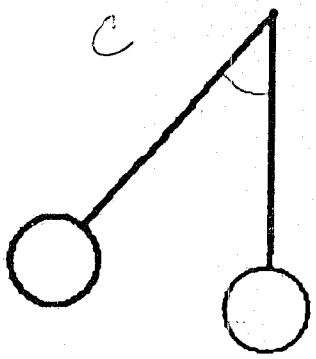
C



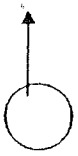
A. The box is accelerating.
B. The box is absolutely motionless.
C. The box has zero acceleration, but may or may not be moving.
D. The box moves in some way that can't be exactly determined.

26) A Pendulum is swinging back and forth. When the pendulum reaches the bottom of the swing we can draw the forces acting on the pendulum. Which of the following diagrams would show that the pendulum is NOT accelerating?

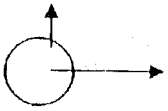
C



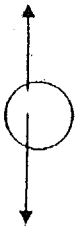
A.



B.



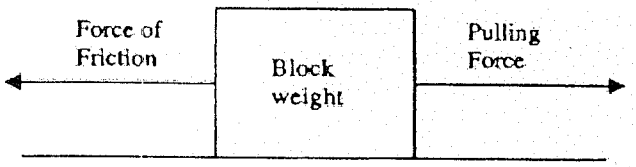
C.



D.

27) A steel block is pulled along a steel surface. An experiment is conducted that compares the forces needed to overcome friction when the weight is changed.

B



	Block weights		
	5kg	10kg	15kg
Smooth steel surface	0.75kg	1.5kg	2.25kg

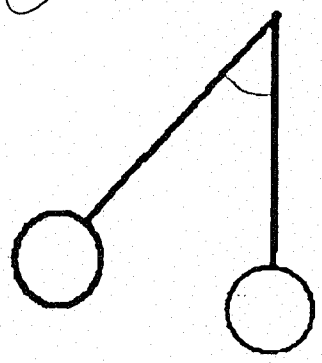
What happens to the frictional force as the weight of the block increases?

A. The frictional force stays the same
B. The frictional force increases

(10)

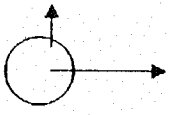
28) A Pendulum is swinging back and forth. When the pendulum reaches the bottom of the swing we could draw the forces acting on the pendulum. Which of the following diagrams would show the forces acting on the pendulum?

C

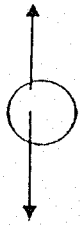


A.

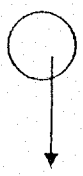
B.



C.



D.



29) Which of the following is an example of Newton's 3rd law?

C

A. An elevator pulls on a cable and a person pushes on the elevator.
B. An elevator pushing on a person and gravity pulling on the elevator.
C. An elevator pulls on the cable and the cable pulls the elevator.
D. An elevator pushes on a person and the elevator pulls on a cable.

30) As you ride an elevator from the 1st floor to the 3rd floor, what forces do you experience?

B

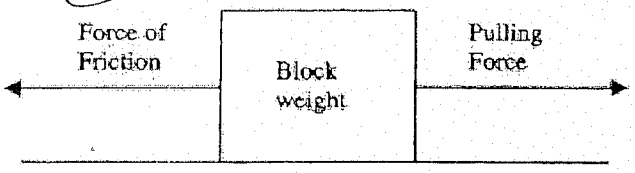
A. Gravity is the only force you experience.
B. Gravity and the force of the elevator accelerating and decelerating.
C. No forces because you move at a constant speed.
D. Only the force of the elevator accelerating.

31) Which is an example of Newton's first law applied to human life?

A. The cruise control on a car maintains a constant velocity.
B. A car's brakes bring it to an emergency stop in an accident.
C. One tug-of-war team slowly overpowers the other team.
D. Astronauts notice that objects in the capsule with them seem weightless and float when released.

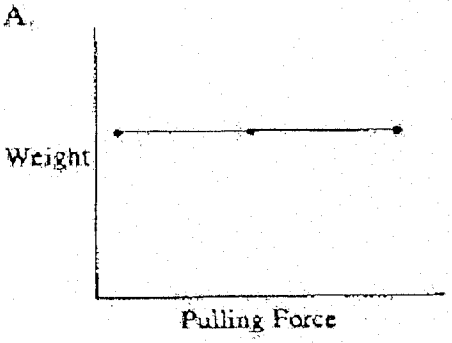
32) A steel block is pulled along a steel surface. An experiment is conducted that compares the forces needed to overcome friction when the weight is changed. Which graph depicts the change in frictional force of the smooth steel surface?

C

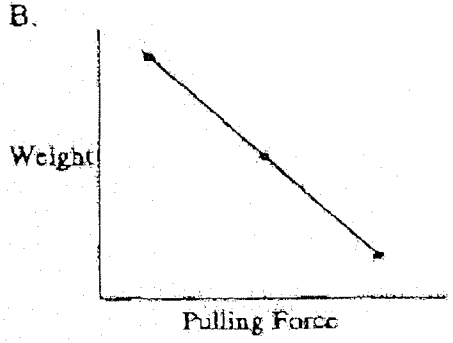


	Block weights		
	5kg	10kg	15kg
Smooth steel surface	0.75kg	1.5kg	2.25kg

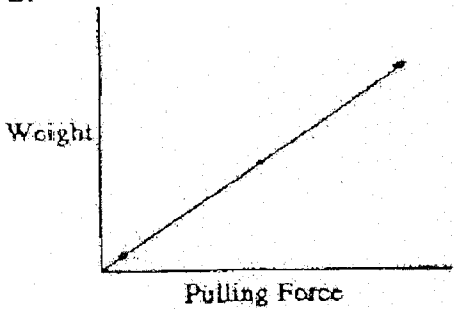
A. A.



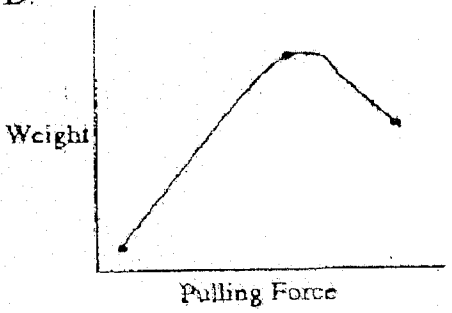
B. B.



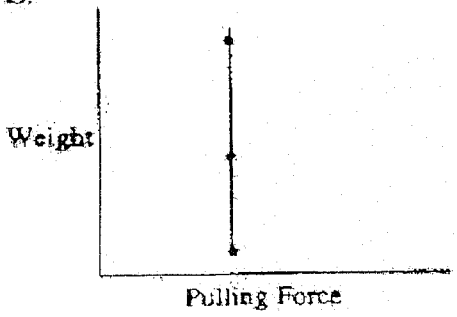
C. C.



D. D.



E. E.



(12)