1. A student is riding a bike and applies the brakes. Which most helps the bike to stop?
   A. friction  B. gravity  C. heat  D. momentum

2. Chang jumps rope. No matter how high he jumps, he still returns to the ground. What force pulls him back to the ground?
   A. Inertia  B. Gravity  C. Friction  D. Pressure

3. Alex rides his bicycle to work every day. One day he noticed the chain on his bicycle was making a lot of noise, so he sprayed the chain with a lubricant. What effect did this have on the chain?
   A. The lubricant reduced the friction of the chain.
   B. The lubricant increased the friction of the chain.
   C. The lubricant reduced the surface area of the chain.
   D. The lubricant increased the surface area of the chain.

4. Jeannie put her soccer ball on the ground on the side of a hill. Which force acted on the soccer ball to make it roll down the hill?
   A. gravity  B. electricity  C. friction  D. magnetism

5. You and a friend are moving a box in your classroom.

   According to the diagram, how will the box react to the forces acting on it?
   A. The box will fall over  B. The box will stay in place.
   C. The box will move toward Person A.  D. The box will move toward Person B.

6. The moon has a smaller mass than the Earth. If you were able to travel to the moon your weight would
   A. increase.  B. decrease.
   C. remain the same.  D. vary from day to night.
7. The diagram below shows two students pushing a heavy crate across a floor.

One student pushes with a force of 40 N and the other student pushes with a force of 100 N. What is the resulting force from the two students pushing the crate?

A. 60 N  
B. 100 N 
C. 140 N  
D. 4000 N

8. What effect does gravity have on a person living on Earth?

A. It causes a person to have mass. 
B. It causes a person to have weight. 
C. It causes a heavy person to fall faster than a light person. 
D. It causes a heavy person to fall slower than a light person.

9. A student studies gravity, using objects that have the same mass. Which two objects have the greatest gravitational force acting between them?

A.  
B.  
C.  
D.  

10. When workers spread sand over icy bridges and roads in the winter, how does this help people drive on the roads?

A. The sand increases friction between the road and the tires of a car. 
B. The sand increases the inertia of a car. 
C. The sand increases the speed of a car. 
D. The sand increases the momentum of a car.
11. A boy on a skateboard is rolling along a flat paved walk. His skateboard hits a patch of gravel and slows down. Which phrase best explains what causes the skateboard to slow down?

A. mass of the gravel  
B. mass of the skateboard  
C. friction from the gravel  
D. gravity on the skateboard

12. Two forces act on the 2 kg box shown below.

A 4 N force acts to the right and a 6 N force acts to the left. What is the net force acting on the box?

A. 10 N to the right  
B. 10 N to the left  
C. 2 N to the right  
D. 2 N to the left

13. Two equal forces act at the same time on the same stationary object but in opposite directions. Which statement describes the object’s motion?

A. It remains stationary.  
B. It moves at a constant speed.  
C. It accelerates.  
D. It decelerates.

14. The moon has less gravity than Earth because

A. the moon is farther from the sun.  
B. the moon has no atmosphere.  
C. the moon has less mass than Earth.  
D. the moon is made of volcanic rock.

15. What forces are equal in size but opposite in direction?

A. balanced  
B. frictional  
C. gravitational  
D. unbalanced

16. A student sets a block at the top of a wooden ramp. The student pushes the block. As the block slides down the ramp, it slows down and then comes to a stop. What force causes the block to slow down?

A. the force of gravity  
B. the force of friction  
C. the force of magnetism  
D. the force of the student’s push
17. Four different spring scales show the forces needed to pull objects with different masses across different surfaces at a constant speed.

Which scale is being used to pull the object with the smallest mass across the smoothest surface (the surface with the least friction)?

A.  
B.  
C.  
D.  

18. A boat is sailing to the south at a speed of 10 miles per hour. A water current, which is acting on the boat, is moving to the north at a speed of 1 mile per hour.

Which statement describes the effect the current will have on the position and motion of the boat if all other conditions are the same?

A. The boat would move to the east at a higher speed.  
B. The boat would move to the south at a lower speed.  
C. The boat would move to the north at a lower speed.  
D. The boat would move to the west at the same speed.

19. The force of gravity on the surface of the moon is about one-sixth the force of gravity on the surface of Earth. Which describes the relationship of mass and weight of an object on the moon compared to that on Earth?

A. Both mass and weight are greater on the moon.  
B. Both mass and weight are less on the moon.  
C. Mass is the same, but weight is less on the moon.  
D. Weight is the same, but mass is less on the moon.
20. Which of the following statements best explains why it is usually easier to keep a sliding object moving than it is to start the object moving?

A. Kinetic friction is typically equal to static friction.
B. Kinetic friction is typically less than static friction.
C. Kinetic friction is a force that resists attempts to start an object moving.
D. Kinetic friction is a force that opposes the sliding of two objects over each other.

21. Two teams are playing tug-of-war with a rope that has a knot in the middle, as shown below.

When they pull with equal but opposite force, the knot is at rest. However, if the blue team pulls with a force of 2200 N and the green team pulls with a force of 2500 N, what is the magnitude and direction of the net (unbalanced) force?

A. 300 N to the left  B. 300 N to the right  C. 4700 N to the left  D. 4700 N to the right

22. Which type of force requires contact between two objects for one to push or pull the other?

A. frictional forces slowing down a rolling soccer ball
B. the magnetic force pulling paper clips to a powerful electromagnet
C. the magnetic force pushing two magnets apart
D. the force of gravity acting on raindrops that fall to Earth

23. A 10-newton force and a 15-newton force are acting from a single point in opposite directions. What additional force must be added to produce equilibrium?

A. 5 N acting in the same direction as the 10-N force  B. 5 N acting in the same direction as the 15-N force
C. 10 N acting in the same direction as the 10-N force  D. 25 N acting in the same direction as the 15-N force

24. Amanda tested toy car tires to see which would go down a ramp the most slowly. She found that the tire that caused the most friction moved down the ramp the most slowly.

Which properties did the tires that moved the most slowly have?

A. Round shape and a smooth material  B. Round shape and a rough material
C. Oval shape and a smooth material  D. Oval shape and a rough material
25. If each horse is pulling with the same force, in which direction will the rock move?

A. north  B. east  C. south  D. west

26. Four students push on a block of wood with the forces shown in the diagram below. Assume friction is negligible.

![Diagram of forces on a block](image)

The block slides horizontally. What is the net force acting on the block of wood?

A. 3 N to the left  B. 8 N to the left  C. 11 N to the right  D. 25 N to the right

27. Which of the following will definitely cause a change in the velocity of a parked car?

A. The car experiences an unbalanced force.

B. All forces acting on the car increase by 1 N.

C. All forces acting on the car decrease by 1 N.

D. The forces acting on the car are equal and balanced.
28. The diagram below shows the forces acting on a rock.

![Diagram of forces acting on a rock](image)

The weight of the rock is 76 N. An upward force of 106 N is exerted on the rock. What is the net force acting on the rock?

A. 30 N upward  
B. 76 N downward  
C. 106 N upward  
D. 182 N downward

29. A heavy box is at rest on an inclined plane. The box begins to slide down the inclined plane when a small force is applied to the box. The force is removed as soon as the box begins to slide. The speed of the box increases as the box slides down the inclined plane.

Which of the following is the most likely cause of this increasing speed?

A. The force of gravity on the box is less when the box is not moving than when the box is moving.
B. The force of gravity on the box is greater when the box is not moving than when the box is moving.
C. The force of friction on the box is less when the box is not moving than when the box is moving.
D. The force of friction on the box is greater when the box is not moving than when the box is moving.

30. This diagram shows three horizontal forces acting on an object.

![Diagram of forces acting on an object](image)

Neglecting friction, what is the magnitude of force, F, if the object remains at rest?

A. 6 N  
B. 8 N  
C. 14 N  
D. 22 N
31. A toy car rolls at a constant speed down a straight inclined track. When the car reaches the flat surface at the base of the inclined track, the speed of the car decreases.

Which statement best explains why the speed of the car decreases when it reaches the flat surface?

A. The force of gravity acting on the car increases. B. The force of gravity acting on the car decreases.
C. The forces influencing the car are not balanced. D. The forces influencing the car are balanced.

32. A force is any push or pull exerted on matter. An arrow (→) is the standard symbol used to diagram a force. Three arrows, each representing a different force, are shown below.

Arrow X describes a pulling force of 5 newtons to the south. Arrow Y describes a pushing force of 20 newtons to the east. Arrow Z describes a pulling force of 90 newtons to the northwest.

What is the relationship between a force and its arrow diagram?

A. A short arrow describes a pulling force. B. The longer the arrow, the stronger the force.
C. A long arrow describes a force pulling toward the north. D. The shorter the arrow, the stronger the force.

33. A spring scale is pulled downward and readings are recorded.

<table>
<thead>
<tr>
<th>Distance Pulled</th>
<th>Spring Scale Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 cm</td>
<td>4 N</td>
</tr>
<tr>
<td>1.5 cm</td>
<td>6 N</td>
</tr>
<tr>
<td>2.0 cm</td>
<td>8 N</td>
</tr>
<tr>
<td>2.5 cm</td>
<td>10 N</td>
</tr>
</tbody>
</table>

If the spring is pulled 3.5 cm, the spring scale should read

A. 12 N. B. 13 N. C. 14 N. D. 15 N.
34. How would the measurable properties of a golf ball change if it were moved from Earth to the Moon?

A. It would have the same mass, but a different weight.
B. It would have the same weight, but a different mass.
C. It would have the same density, but a different mass.
D. It would have the same mass, but a different density.

35. Dominick attached a metal ball to the end of a string and swung it over his head in a circular motion at a constant speed. After several swings, the string broke. The metal ball moved outward and eventually fell to the ground. Which of these made the metal ball fall to the ground?

A. Mass  B. Gravity  C. Friction  D. Magnetism

36. A probe traveling through outer space is moving at a constant velocity. Which statement applies to the motion of this probe?

A. An unbalanced force is acting on the probe, causing it to accelerate.
B. The probe will undergo constant acceleration until a force acts on it.
C. The probe will continue on its current path until an unbalanced force acts on it.
D. The force that makes the probe move through space is equal to its mass divided by its velocity.

37. Which of the following statements best describes the force of Earth's gravity on a rocket moving upward?

A. The gravitational force is constant for all altitudes.
B. The gravitational force is weaker when the rocket is higher.
C. The gravitational force is stronger when the rocket is higher.
D. The gravitational force is zero when the altitude is greater than 10,000 miles.

38. An object is moving at a constant speed. If a balanced force is applied in the opposite direction the object is moving, what will most likely happen?

A. The object will speed up.
B. The object will change direction.
C. The object will continue moving at a constant speed.
D. The object will slow down and eventually stop moving.
39. A mass is being pushed to the right at a constant velocity.

Which vector best represents the frictional force?

A. I  B. II  C. III  D. IV

40. A student places a ball on the ground and kicks it. The ball moves along the ground. Why does the ball move?

A. The kick decreases the weight of the ball.
B. The kick applies a contact force to the ball.
C. The kick decreases the force of gravity acting on the ball.
D. The kick removes friction between the ball and the ground.

41. When you are driving a car, why is braking less effective on a wet road than on a dry road?

A. The water reduces friction.  B. Kinetic energy is increased by water.
C. Friction increases when the brakes are wet.  D. Reaction time is reduced during a rainstorm.

42. The distance of the star Vega from Earth is 1.6 million times greater than the distance of the Sun from Earth. Which of the following best describes the gravitational influence of Vega on Earth?

A. It is roughly equal to that of the Sun.  B. Its influence is greater than that of the Sun.
C. Its influence is small because of its distance.  D. It influences the magnitude of Earth’s mass.
43. The diagrams below show a ball in the center of a table. The two solid arrows show the directions of equal forces pushing on the ball.

In which diagram does the dotted arrow correctly show the direction the ball will travel as a result of the two forces pushing on the ball?

A. diagram 1  
B. diagram 2  
C. diagram 3  
D. diagram 4

44. The picture below shows the four major forces acting on an airplane in flight.

What causes the force indicated by the X?

A. gravity  
B. air friction  
C. magnetic force  
D. force exerted by the engine
1. Answer: A
2. Answer: B
3. Answer: A
4. Answer: A
5. Answer: B
6. 
7. Answer: C
8. Answer: B
9. Answer: A
10. Answer: A
11. Answer: C
12. Answer: D
13. Answer: A
14. Answer: C
15. Answer: A
16. Answer: B
17. Answer: A
18. Answer: B
19. Answer: C
20. Answer: B
21. Answer: B
22. Answer: A
23. Answer: A
24. Answer: D
25. Answer: C
26. Answer: C
27. 
28. Answer: A
29. Answer: D
30. Answer: D
31. Answer: C
32. Answer: B
33. Answer: C
34. Answer: A
35. Answer: B
36. Answer: C
37. Answer: B
38. Answer: D
39. Answer: A
40. Answer: B
41. Answer: A
42. Answer: C
43. Answer: D
44. Answer: A