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# Newton's Laws Unit Practice Exam

____ 1. A 30-N force and a 50-N force act on an object in opposite directions. What is the net force on the object?


50N - 30N = 20N

____ 2. What is the maximum resultant possible when adding a 2-N force to a 12-N force?


Add 12N + 2N = 14N

____ 3. Equilibrium occurs when

$\Sigma F = 0$

____ 4. The weight of a person can be represented by a vector that acts

downward

____ 5. You are helping your aunt move a piano on wheels from one room to another. When you push the piano horizontally, it moves at constant speed. What can you say about the piano?

It is at constant speed, therefore it is in equilibrium and sum of forces equals zero.

____ 6. Friction is a force that always acts

opposite the direction of motion.

____ 7. The law of inertia states that an object

- at rest stays at rest
- in motion stays in motion
- unless acted on by net external force

____ 8. After a cannonball is fired into frictionless space, the amount of force needed to keep it going equals

zero (no friction)

____ 9. A sheet of paper can be withdrawn from under a container of milk without toppling it if the paper is jerked quickly. The reason this can be done is that the container of milk has inertia.

____ 10. An object following a straight-line path at constant speed
a. has no forces acting on it. = NO NET FORCES!
b. has a net force acting on it in the direction of motion.
c. has zero acceleration.
d. must be moving in a vacuum.
e. none of the above

____ 11. One object has twice as much mass as another object. The first object also has twice as much inertia

____ 12. Compared to its weight on Earth, a 10-kg object on the moon will weigh $\frac{1}{6}$ its weight on earth or 16.7 N

____ 13. Compared to its mass on Earth, the mass of a 10-kg object on the moon is 10kg; mass stays the same

____ 14. You would have the largest mass of gold if your chunk of gold weighed 1 N on (and why?)
a. Earth.
b. Jupiter.
c. the moon.
1 N on moon is largest mass.
On earth, largest mass is largest weight, 10.

____ 15. How much does a 3.0-kg bag of bolts weigh on earth?

$$W = mg$$
$$= 3.0\,kg \cdot 10\,m/s^2$$
$$= 30\,N$$

____ 16. Accelerations are produced by Net forces

____ 17. How does acceleration of an object change in relation to its mass? It is
a. directly proportional.
b. Acceleration doesn't depend on mass at all.
c. inversely proportional.

$F = ma$
$a = \frac{F}{m}$ inverse

____ 18. The acceleration produced by a net force on an object is
a. inversely proportional to the mass of the object.
b. directly proportional to the magnitude of the net force.
c. in the same direction as the net force.
d. all of the above
e. none of the above

____ 19. When an object reaches terminal velocity its acceleration is
zero (at equilibrium)

____ 20. Suppose the force of friction on a sliding object is 25 N. The force needed to maintain a constant velocity is
25 N (must counter-act 25 N friction)

____ 21. A bowling ball weighs 20 N. When held at rest in your hands, the net force on the bowling ball is
At rest means equilibrium. Therefore, net force equals zero.

____ 22. A girl pulls on a 9-kg wagon with a constant force of 27 N. What is the wagon's acceleration?

9 kg → 27 N

$F = ma$
$a = \frac{F}{m}$
$a = \frac{27\ N}{9\ kg}$
$a = 3\ m/s^2$

____ 23. An object has a constant mass. A constant force on the object produces constant [acceleration]

$a = \frac{F}{m}$

____ 24. A push on a 5-kilogram brick accelerates the brick. Neglecting friction, to equally accelerate a 10-kilogram brick, one would have to push with 2x Force

$a = \frac{F}{m}$
$a_1 = \frac{F}{5\ kg}$
$a_1 = \frac{2F}{10\ kg}$

____ 25. A block is dragged without acceleration in a straight-line path across a level surface by a force of 11 N. What is the frictional force between the block and the surface?

11 N → (ugh!)
← Friction

$v = const$
so $\Sigma F = 0$
$\therefore$ [11 N]

____ 26. Which of the following would exert the most pressure on the ground and why?
a. A woman standing in running shoes
b. A woman standing on skis
c. A woman standing in high-heel shoes

Assuming mg = weight

$P = \frac{Force}{Area} = \frac{W}{A}$

High heels = smallest A.

____ 27. If you pull horizontally on a box with a force of 150 N and the box doesn't move, the friction force must be 150 N. Now if you pull with 270 N so the box slides at constant velocity, the friction force is 270 N

∂ constant v; ΣF = 0. ∴ $F_{fric} = 270N$

____ 28. Suppose a cart is being moved by a force. If suddenly a load is dumped into the cart so that the cart's mass doubles, what happens to the cart's acceleration?

$a = \frac{F}{m}$ $a' = \frac{F}{2m}$

$\therefore a = \frac{1}{2}$

____ 29. You are on a frozen pond, and the ice starts to crack. If you lie down on the ice and begin to crawl, this will (and why?)
a. increase the pressure on the ice.
b. decrease the pressure on the ice.
c. increase the total force on the ice.
d. decrease the total force on the ice.

And be closer to praying :)

____ 30. A 11-N falling object encounters 7 N of air resistance. The magnitude of the net force on the object is


F = 7N − 11N

= −4N or 4N ↓

____ 31. A car has a mass of 2000 kg and accelerates at 3 meters per second squared. What is the magnitude of the force acting on the car?

F = ma

$F = 2000\ kg \cdot 3\ m/s^2$

F = 6000 N

____ 32. A tow truck exerts a force of 4000 N on a car, accelerating it at 4 m/s/s. What is the mass of the car?

F = ma

$\frac{F}{a} = m$

$\frac{4000N}{4\ m/s^2} = 1000\ kg$

___ 33. A jet has a mass of 30,000 kg. The thrust for each of four engines is 15,000 N. What is the jet's acceleration when taking off?

$F_{tot} = 4 \times 15{,}000N$

$= 60{,}000N$

$a = \frac{F}{m}$ $\quad a = \frac{60{,}000N}{30{,}000\ kg} = \boxed{2\ m/s^2}$

___ 34. You pull horizontally on a 50-kg crate with a force of 350 N and the friction force on the crate is 50 N. The acceleration of the crate is

$F_{NET} = 350N - 50N$

$= 300N$

$a = \frac{F}{m}$ $\quad a = \frac{300N}{50kg}$

$\boxed{a = 6\ m/s^2}$

___ 35. How much force is needed to accelerate a 2.0-kg physics book to an acceleration of 5.0 $m/s^2$?

$F = ma$

$= (2.0\ kg)(5.0\ m/s^2)$

$\boxed{F = 10N}$

___ 36. A 9-N falling object encounters 9 N of air resistance. The magnitude of the net force on the object is

$9N - 9N = \boxed{0\ N}$

___ 37. An archer shoots an arrow. Consider the action force to be the bowstring against the arrow. The reaction to this force is the arrow to the bowstring.

___ 38. A player hits a ball with a bat. The action force is the impact of the bat against the ball. What is the reaction to this force? the ball against the bat.

___ 39. A large truck and a small car traveling at the same speed have a head-on collision. The vehicle to undergo the greater change in velocity will be same Force, ∴ acceleration

$a = \frac{F}{M}$ (truck) $\quad a = \frac{F}{m}$ (mini)

$\boxed{\text{small car}}$

___ 40. You drive past a farm, and you see a cow pulling a plow to till a field. You have just learned about Newton's third law, and you wonder how the cow is able to move forward if the plow is exerting an equal and opposite force on the cow. Which of the following explains the movement of the cow and plow?

Really cow pushes on earth. Earth pushes on cow. So, cow can accelerate (m vs Earth)