**N Laws Study Guide**

Directions: Answer questions in complete sentences in your notebook on page 84-86

Equations:

Fnet = ma Fg = mg v = $\frac{d}{t}$ slope = $\frac{y\_{2}-y\_{1}}{x\_{2}- x\_{1}}= \frac{rise}{run}$

Constants:

g = 9.8 m/s2

Hints

* **If there is more than one force, find the net force first.**
* **Use free body diagrams to determine net force.**
* **Weight is a *force*… objects with a certain mass exert a downward weight force of ten times the mass.**
1. An astronaut working on the exterior of the International Space Station throws his 0.6kg wrench out into space. If he throws it with a force of 12N, what is its acceleration? Draw two free-body diagrams for: (a) the instant he throws it, and (b) a few seconds after he throws it.

|  |  |
| --- | --- |
| As he throws it | After he throws it |

1. A force F is applied to an object of mass m. If its mass is increased, how will its acceleration change (increase / decrease / remain constant) ?
2. A force F is applied to an object of mass m. If the force is tripled, how will its acceleration change? (increase / decrease / remain constant) ?
3. A Mars rover has a mass of 125kg on Earth. If the acceleration due to gravity on Mars is 3.4 m/s2, what is the rover’s *mass* on Mars?
4. A Mars rover has a mass of 125kg on Earth. If the acceleration due to gravity on Mars is 3.4 m/s2, what is the rover’s *weight* on Mars?
5. Describe how Newton’s first law explains the difficulty in pushing a full shopping cart (from rest) versus an empty shopping cart (from rest).
6. The net force on an object is 0N. What could the object be doing? (There is more than one answer)
7. What is it called when an object is at rest? What is it called when an object is moving at a constant speed?
8. If a hammer and a paper are dropped from the same height, describe what happens to them (assuming no air resistance, like on the moon).
9. If a hammer and a paper are dropped from the same height on Earth (there is air resistance), draw FBDs for the hammer and paper.
10. A ball is rolling across a frictionless surface (Ffrict = 0N), when it reaches a new surface applying a frictional force of 5N (Ffrict = 5N). What happens the moment it encounters the new surface?
11. An archer shoots an arrow at a target. The arrow impacts the target with a force of 750N. What is the reaction force?
12. State each of Newton’s Laws of motion.
13. A NASA space probe is accelerated to a speed of 15,000 mi/hr in space. The engines are turned off. What happens to the velocity of the space probe?
14. A football place kicker kicks a football. What is the reaction force?
15. Sammy swings at a 0.15kg baseball and accelerates it at a rate of 4300 m/s2. How much force does he exert on the ball?
16. Tommy stubs his toe on the coffee table with a force of 110 N. What is the acceleration of Tommy’s 1.80kg foot? What is the acceleration of the table if it has a mass of 15.0 kg (ignoring friction)?
17. On the moon, the gravity is 1/6 that of Earth (gmoon = 1.67 m/s2; gearth = 9.8 m/s2). While on the moon, astronaut Buzz Aldrin carried on his back a backpack that would weigh over 1760N on Earth. What is the backpack’s mass in kilograms?
18. A 10 kg rocket is accelerating forward with a force of 300N. Air resistance is pushing against the rocket with a force of 50N. What is the acceleration of the rocket?
19. True or False: Newton’s Third Law tells us that the Earth and moon exert forces on each other, however the force that Earth exerts on the moon is greater than the force that the moon exerts on the Earth because the Earth has more mass.
20. A 0.2 kg bird crashes into a 500kg car with a force of 0.5N. What is the force applied by the car to the bird? What is the acceleration of the bird? What is the acceleration of the car?
21. A helicopter hovering in place drops an object whose mass is 12kg and the air supplies a force of 45 N. Draw a free-body diagram and calculate the net force and acceleration of the object.

1) a = 20 m/s2 2) decrease 3) increase 4) 125 kg 5) 425N 7) The object is in equilibrium, which means it is not accelerating. 11) The object will slow down (negative acceleration) as a new external force is applied. 12) The target applies a 750N reaction force to the arrow. 14) The space probe will continue to move in kinetic equilibrium at 15,000 mi/hr. 15) The football applies a force to the kicker. 16) F = 645N 17) The acceleration on the foot is 61 m/s2. The acceleration on the table is 7.3 m/s2. 18) The backpack has a mass of 176 kg. 19) a = 25 m/s2  21) The force of the car to the bird is 0.5N. The acceleration of the bird is 2.5 m/s2. The acceleration of the car is 0.001 m/s2. 22) a = 6.05 m/s2