

Force and Motion Review

Force:

Answer the following questions involving force. Show work and include units when necessary.

1. What is a force?

a push or pull, or any action that involves the interaction of objects and has the ability to change motion.

2. What is the unit for force? N

3. What is the force of gravity on planet earth? 9.8 N/kg

4. What is the difference between mass and weight?

Weight is a force & depends on mass & gravity
mass-amount of space an object takes up

5. $W = m \cdot g$

6. Will your mass change if you are on different planets? Why/why not?

NO, mass will never change but your weight will because weight is dependent on mass & gravity

7. What is the mass of a person on Earth who weighs 500 N?

$$W = m \times g \quad 500\text{N} = W \quad m = ?$$

$$9.8\text{N/kg} = g$$

$$\frac{500\text{N}}{9.8} = \frac{m \times 9.8}{9.8}$$

$$\boxed{51\text{ kg} = m}$$

8. A physical science test book has a mass of 2.2 kg

a. What is the weight on the Earth?

$$W = ? \quad W = mg \quad W = 2.2 \times 9.8$$

$$m = 2.2\text{ kg} \quad g = 9.8\text{ N/kg}$$

$$\boxed{W = 21.56\text{ N}}$$

b. What is the weight on Mars ($g = 3.7\text{ m/s}^2$)

$$W = ? \quad W = 2.2 \times 3.7$$

$$m = 2.2\text{ kg} \quad g = 3.7\text{ N/kg}$$

$$\boxed{W = 8.14\text{ N}}$$

c. If the textbook weighs 19.6 Newtons on Venus, What is the strength of gravity on Venus?

$$W = 19.6\text{ N} \quad W = mg \quad 19.6 = 2.2 \times g$$

$$m = 2.2\text{ kg} \quad \boxed{8.91\text{ N/kg} = g}$$

a - ?

Friction:

Answer the following questions involving friction.

9. Define friction.

Friction is a force that resists motion.

10. For the following situations, identify if the friction is being increased or decreased.

a. Oil is applied to the chain of a bike. decreasing

b. The tires of NASCAR racecars are smooth without any treads. decreasing

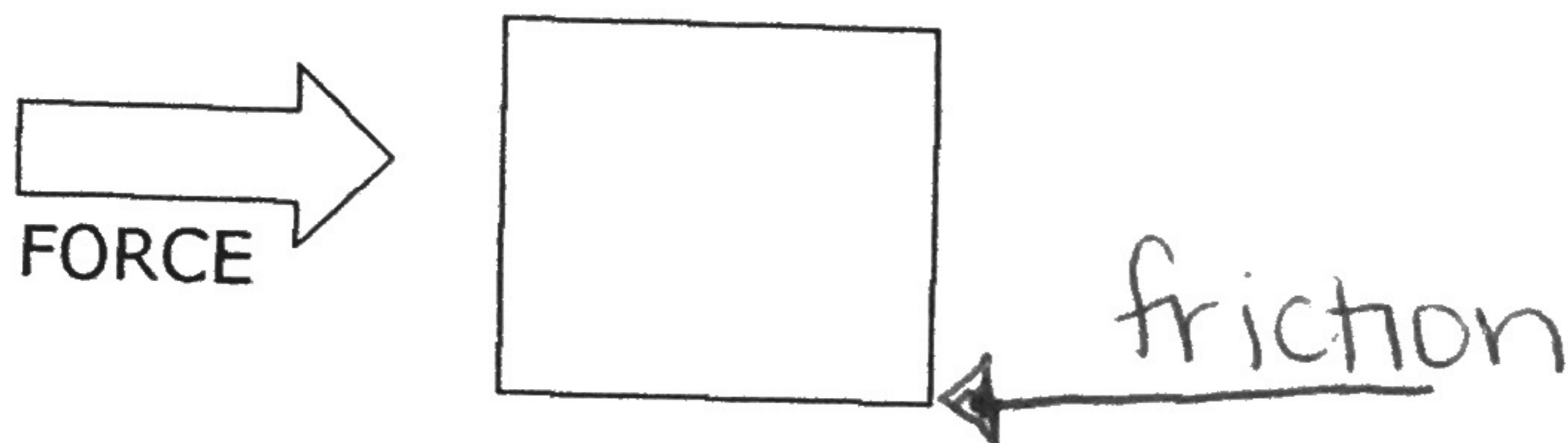
c. Shoes used for baseball have cleats sticking out on the bottom. increasing

d. Wax is applied to the bottom of a snowboard. decreasing

e. Baseball players put sticky pine tar on the handles of bats. increasing

f. Sand is put on snowy roads. increasing

11. Use an arrow to show the direction of friction.



Forces and Equilibrium:

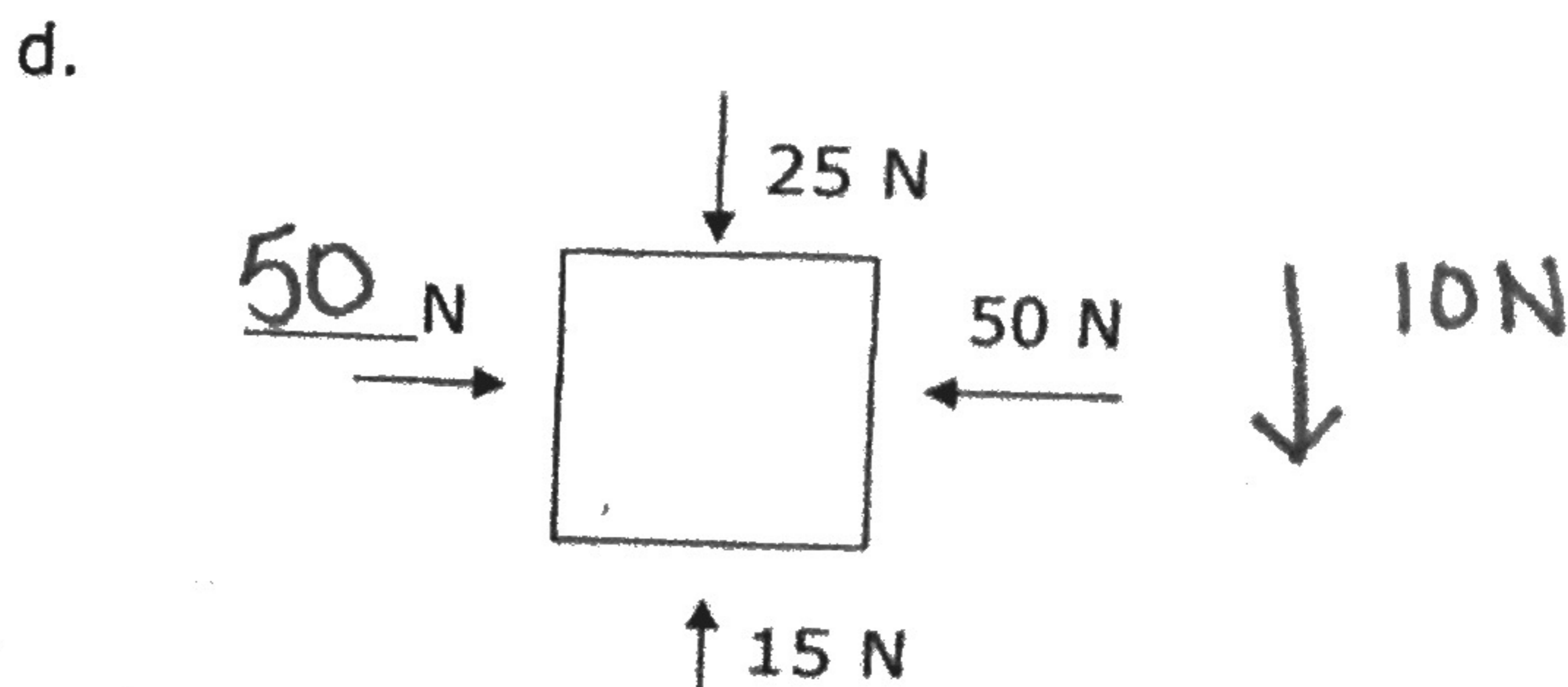
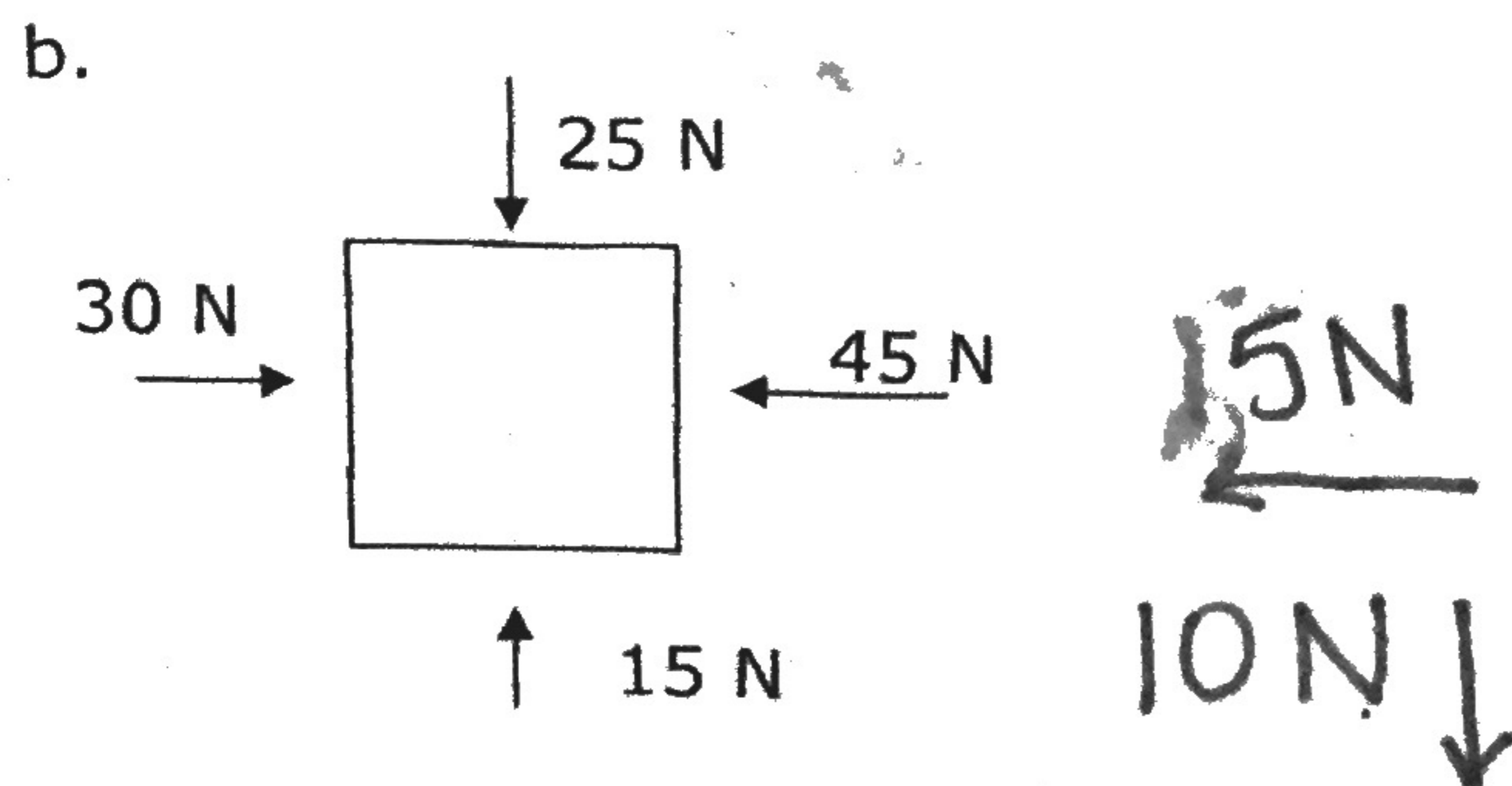
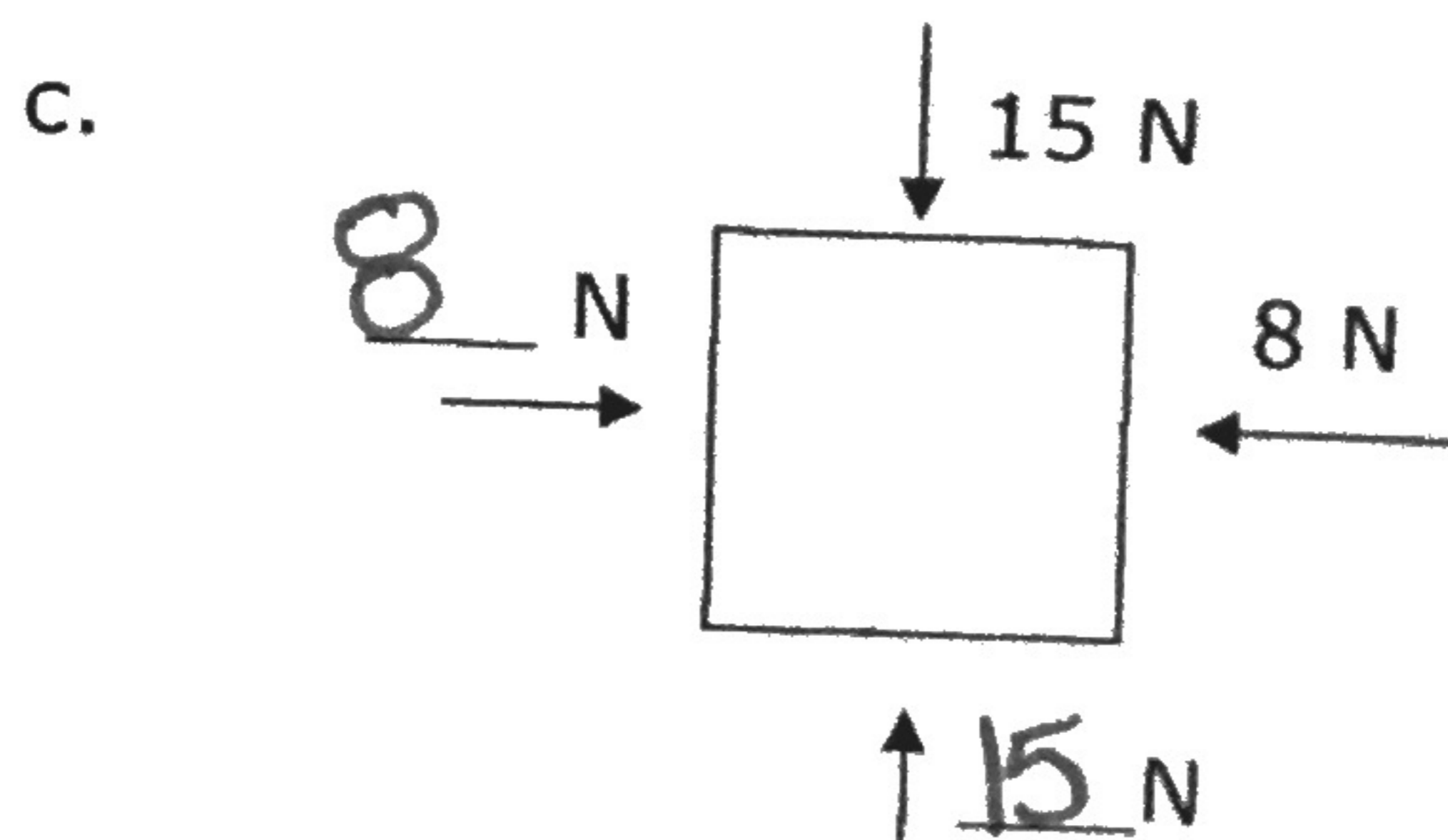
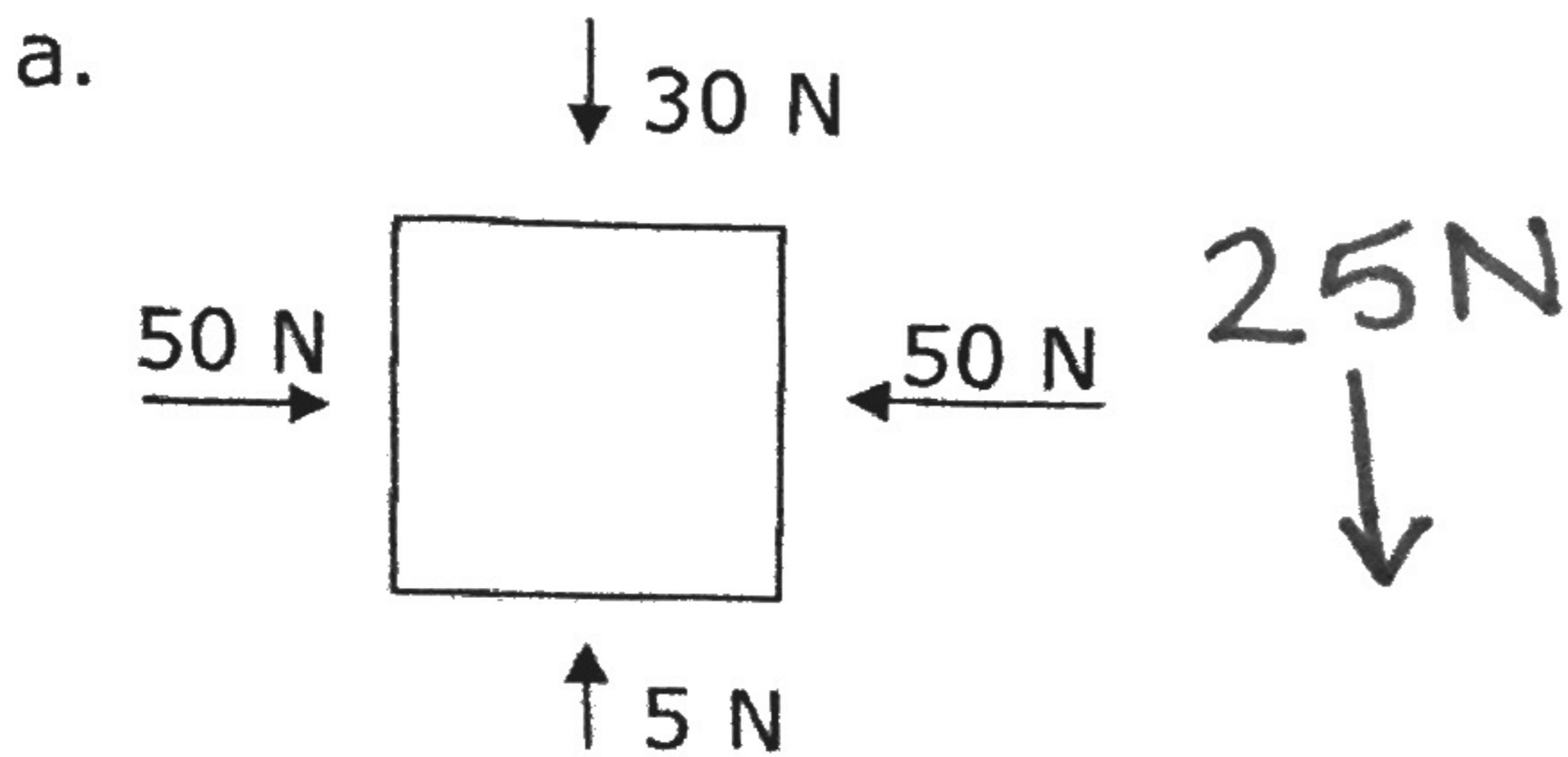
12. What is net force?

Net Force is the sum of all forces acting on an object.

13. When the net force of an object is zero, what do you know about the movement of that object?

When the net force of an object is zero, it has balanced forces and will move at a constant rate.

14. Identify the net force on the following objects or fill in the blank to make the net force equal zero:



Newton's 1st Law:

Answer the following questions involving Newton's 1st Law.

15. Define Newton's First Law.

An object at rest will stay at rest and an object in motion will stay in motion unless acted on by an unbalanced force

16. What is another name for Newton's first law? Law of Inertia

Newton's 2nd Law:

Answer the following questions involving Newton's second law.

17. Define Newton's Second Law.

Acceleration is equal to force divided by mass ($A = \frac{F}{m}$)

18. What is the equation that is connected to Newton's second law?

$$F = m \times a$$

19. When mass increases, acceleration decreases.

20. When the force increases, acceleration increases.

21. What net force is required to accelerate a car at a rate of 2 m/s^2 if the car has a mass of $3,000 \text{ kg}$? (SHOW YOUR WORK AND INCLUDE UNITS!)

$$F = m \times a$$
$$F = ? \quad a = 2 \text{ m/s}^2$$
$$m = 3,000 \text{ kg}$$

$$F = (3,000)(2)$$

$$\boxed{F = 6,000 \text{ N}}$$

22. What is the mass of a falling rock if it produces a force of 147 N ? (SHOW YOUR WORK AND INCLUDE UNITS!) assume Earth so $a = 9.8 \text{ m/s}^2$

$$F = m \times a$$
$$F = 147 \text{ N} \quad a = 9.8 \text{ m/s}^2$$
$$m = ?$$

$$147 \text{ N} = m \times 9.8$$

$$\boxed{15 \text{ kg} = m}$$

23. What is the acceleration of softball if it has a mass of 0.5 kg and hits the catcher's glove with a force of 25 N ?

$$F = m \times a$$

$$F = 25 \text{ N}$$

$$m = .5 \text{ kg}$$

$$a = ?$$

$$25 \text{ N} = .5 \times a$$

$$\boxed{50 \text{ m/s}^2 = a}$$

Newton's 3rd Law:

Answer the following questions involving Newton's Third Law.

24. Define Newton's Third Law.

For every action, there is an equal but opposite reaction

25. Complete the sentence - Forces always come in Pairs.

Applying the Laws:

Determine which law best describes each situation.

26. A magician pulls a tablecloth out from under dishes and glasses on a table without disturbing them. 1st

27. A person's body is thrown outward as a car rounds the curve on a highway. 1st

28. Rockets are launched into space using jet propulsion where exhaust accelerates out from the rocket and the rocket accelerates in the opposite direction. 3rd

29. A picture is hanging on a wall and does not move. 1st

30. A person not wearing a seatbelt flies through a car window when someone slams on the breaks because the person's body wants to remain in continuous motion even when the car stops. 1st

Momentum:

Answer the following questions using the momentum equation.

31. $P = m \times v$

32. If a 40 Kg object has a momentum of 400Kg*m/s, how fast is it traveling? (SHOW YOUR WORK AND INCLUDE UNITS!)

$p = 400 \text{ kg} \cdot \text{m/s}$

$m = 40 \text{ kg}$

$v = ?$

$\frac{p}{m} = v$

$\frac{400 \text{ kg} \cdot \text{m/s}}{40 \text{ kg}} = \boxed{10 \text{ m/s}}$

33. If an object traveling at 20 m/s (about 44 miles per hour) has a momentum of 800Kg*m/s, what is the object's mass? (SHOW YOUR WORK AND INCLUDE UNITS!)

$m = ?$

$v = 20 \text{ m/s}$

$p = 800 \text{ kg} \cdot \text{m/s}$

$\frac{p}{v} = m$

$\frac{800 \text{ kg} \cdot \text{m/s}}{20 \text{ m/s}} = \boxed{40 \text{ kg}}$

34. An US Olympic Ski Team member was going 88 miles per hour (39 m/s) in the downhill ski race when lost his balance and fell. He has a mass of 65Kg. What was his momentum?

$m = 65 \text{ kg}$

$v = 39 \text{ m/s}$

$m \times v = p$

$65 \text{ kg} \times 39 \text{ m/s} = \boxed{2535 \text{ kg} \cdot \text{m/s}}$

$p = ?$