

Newton's Laws Test Review (Ch. 4)

Formulas you'll be given:

Average speed: $v = \frac{d}{t}$

Acceleration is the rate of change of velocity: $a = \frac{v_f - v_i}{\Delta t}$

Average velocity: $v = \frac{\Delta x}{\Delta t}$

How fast while accelerating: $v_f = v_i + a \cdot \Delta t$

How far while accelerating: $\Delta x = v_i \cdot \Delta t + \frac{1}{2} \cdot a \cdot (\Delta t)^2$

Newton's 2nd Law: $F_{\text{net}} = m \cdot a$

Weight: $w = m \cdot g$ (g is 9.81 m/s²)

Directions: *On a separate sheet of paper, answer each item in the list below and do each practice problem on the back. To save time, you may abbreviate where appropriate.*

1. Distinguish between vectors and scalars. Identify whether each of the following quantities is a vector or a scalar:

a. distance	f. acceleration
b. time	g. force
c. speed	h. weight
d. displacement	i. mass
e. velocity	

2. Distinguish between mass and weight.

Calculate the weight of the following masses:	Calculate the mass of the following weights:
a. 5.0 kg	e. 50.0 N
b. 25.0 kg	f. 100. N
c. 75 kg	g. 500. N
d. 150 g	h. 2500 N

3. What is inertia? What determines how much inertia an object has?
4. What causes acceleration? What else affects acceleration and how?
5. Distinguish between *directly proportional* and *inversely proportional*. Suppose the acceleration of an object is 2 m/s². What would the acceleration be if:

a. net force doubles?	c. mass doubles?
b. net force quarters?	d. mass quarters?

6. What is a force? Draw a free-body force diagram showing the forces acting on:

a. a package dropped from a helicopter	d. an automobile braking
b. an automobile traveling at a constant speed	e. an airplane cruising at a constant velocity
c. an automobile speeding up	

7. Why do all objects in freefall accelerate at 9.81 m/s²?
8. What is terminal velocity and why does it happen?
9. According to Newton's Third Law:
 - a. Do action/reaction forces cancel each other? Why or why not?
 - b. If a child and an adult sitting in office chairs facing each other push off, who experiences a greater force? How do you know?
 - c. A bus driving down the road hits a bug. Which experiences more force? Which experiences more acceleration? Why?

Practice Problems: You do not need to show your work on all of these, but you for sure need to know how to solve them. You must show your answers to get credit.

10. Calculate the net force required to accelerate a 1590 kg car at a rate of 0.28 m/s^2 .
11. Three people push on a broken down car. They can each push with a force of 112 N. Given that the car's mass is 956 kg and there is 143 N of friction resisting, how much will the car accelerate? Draw a free-body force diagram to show the forces on the car.
12. The Cessna T-37 airplane has a weight of 6580 lbs. and two engines that can each produce 1025 lbs. of thrust force. Calculate how fast it can accelerate, in m/s^2 , in the absence of friction. Hint: Use dimensional analysis to find the mass in kilograms and the thrust in newtons.. (1 kg = 2.205 lb, 1 lb = 4.448 N)
13. What is the mass of a giant piece of floating dry ice if it takes 2 people each pushing with 38.2 N of force to accelerate it 2.59 m/s^2 ?
14. A person in a wheelchair is accelerated 0.536 m/s^2 when their friend pushes them with 27 N of net force. How much is the total mass of the wheelchair plus person?
15. If a monkey hangs on a spring scale and the scale reads 84.76 N, then how much is his mass?
16. How much engine force is required to keep a car going with constant velocity if the total friction resistance on the car is 430 N?
17. Use Newton's Second Law to complete the following table:

Pulling Force (N)	Friction Force (N)	Mass (kg)	Acceleration (m/s^2)
160	120	10.	
250.		50.0	1.50
	150	5.0	6.0
550	430		2.0
	275	45	0
15,000		1200	3.5

18. Your friend has a mass of 58.0 kg and your dog pulls him on a skateboard having mass 2.5 kg. If the dog pulls with 300. N of tension force but there is 50. N of friction:
 - a) What will be the acceleration of your friend?
 - b) At this rate of acceleration, how much time will it take them to reach a speed of 15.0 m/s?
 - c) How far will they travel before reaching this speed?
 - d) How fast is 15.0 m/s in miles/hour? (use dimensional analysis)
 - e) How much is the weight of your friend?
 - f) Draw a free-body diagram of your friend on the skateboard when being pulled. Be sure to include the following forces: pulling tension in the leash, friction, weight, normal force.
 - g) Are the weight and normal forces equal and opposite? Are they an action-reaction pair? Explain.
 - h) Suppose they hit a bumpy section of road, causing the acceleration to decrease to 3.50 m/s^2 . How much net force now acts on your friend? If friction is 100. N, how much is the tension force in the leash.

From the book: p. 150 Multiple Choice #1,4

Answers to practice problems (not in order, there will be some left over)

0.202 0.25 3.0 3.63 4.0 4.13 8.64 18 27.2 29.5 33.6 50.
60. 65.1 175 180 212 275 312 289 430 450 490 569 10,800

Answers to MC in book
p. 150 I.C.4.G