

Student #: _____

Student Name: _____

Physics 11 Homework Unit 3: Newton's Laws of Motion

PART A: Short Answer Questions

1. Are the normal force and the force of gravity on an object on a surface always equal in magnitude? Explain, or give an example.
2. Friction can be your best friend or your worst enemy. Describe a situation where friction is helpful in your daily life and a situation where friction is not helpful.
3. A man is suing the bus company for a physical injury he received while riding on the bus. He claims that the bus driver accelerated forward so quickly that a suitcase came flying from the back of the bus hitting him in the head. Use your vast knowledge of Newton's Laws to explain why this man does or does not have a case.

PART B: Problem Solving

4. An 11 kg block is being pushed forward on a flat surface with a force of magnitude 45 N. The coefficient of static friction on the block is 0.15 and the coefficient of kinetic friction on the block is 0.12 (only one of these needs to be used).
 - (a) Draw a free body diagram of the block.
 - (b) What is the net force acting on the block?
 - (c) What is the acceleration of the block?

5. Find the weight of a 2.3 kg bowling ball on Earth.
6. You have a weight of 652.58 N [down] while standing on a spring scale on Earth near the equator.
- (a) Calculate your mass.
 - (b) Determine your weight on Earth near the North Pole
 - (c) Determine your weight on the International Space Station.
- (Hint: consult the values of g from class notes.)
7. A student pushes a 2100 g textbook along a lab bench at constant velocity with 3.50 N of force.
- (a) Draw a free body diagram of the book.
 - (b) Determine the normal force supporting the textbook.
 - (c) Calculate the force of friction and the coefficient of friction between the book and the bench.
 - (d) Which coefficient of friction have you found, static max or kinetic?
8. A swimmer is propelled directly north by a force of 35.0 N. Moving water exerts a second force of 20 N [E]. Determine the net force acting on the swimmer.

9. At 560 metric tons, the Airbus A380 is the world's largest airliner. What is the lift (upward force) generated by the wings when the plane is:
- (a) flying at constant altitude?
 - (b) accelerating upwards at 1.1m/s^2 to avoid some bad weather?
- (1 metric ton = 1000kg)

PART C: Multiple Choice Questions

10. When an object undergoes an acceleration (either positive or negative),
- (a) its mass always increases.
 - (b) its speed always increases.
 - (c) it always falls toward the Earth.
 - (d) a net force always acts upon it.
11. A force acts on an object that is free to move. If we know the net unbalanced force and the mass of the object, Newton's Second Law of motion enables us to determine the object's:
- (a) weight
 - (b) position
 - (c) speed
 - (d) acceleration
12. An automobile is towing a trailer at a constant speed. The force that the automobile exerts on the trailer is
- (a) equal to the force the trailer exerts on the automobile.
 - (b) greater than the force the trailer exerts on the automobile.
 - (c) equal to the force the trailer exerts on the road.
 - (d) greater than the force friction exerts on the trailer.
13. When a horse pulls a wagon, the force that causes the horse to move forward is the force
- (a) he exerts on the wagon.
 - (b) the wagon exerts on him.
 - (c) he exerts on the ground.
 - (d) the ground exerts on him.
14. The frictional force between two surfaces in contact depends on
- (a) the normal force pressing one against the other.
 - (b) the types of materials.
 - (c) whether a lubricant is used or not.
 - (d) all of the previous choices.

15. When a 1 N force acts on a 1 kg object that is able to move freely, the object receives
- (a) a speed of 1 m/s.
 - (b) an acceleration of 0.102 m/s^2 .
 - (c) an acceleration of 1 m/s^2 .
 - (d) an acceleration of 9.8 m/s^2 .
16. The weight of 600 g of salami is:
- (a) 0.061 N
 - (b) 5.9 N
 - (c) 61 N
 - (d) 5880 N
17. A 2400 kg car accelerates from 10 m/s to 30 m/s in 10 s. The average net force acting on the car is:
- (a) 816 N
 - (b) 8000 N
 - (c) 12 000 N
 - (d) 4800 N
18. The coefficient of static friction between two wooden surfaces is:
- (a) 0.5
 - (b) 0.5 N
 - (c) 0.5 kg/N
 - (d) 0.5 N/kg
19. A minimum force of 40 N is needed to set a 10 kg steel box moving across a wooden floor. The coefficient of static friction is:
- (a) 0.08
 - (b) 0.25
 - (c) 0.4
 - (d) 2.5
20. The coefficient of static friction for steel on ice is 0.10. The force needed to set a 70 kg skater in motion is approximately:
- (a) 0.1 N
 - (b) 0.7 N
 - (c) 7 N
 - (d) 70 N
21. The Moon's mass is much smaller than Earth's mass. Compared to the gravitational force Earth exerts on the Moon, the gravitational force the Moon exerts on Earth
- (a) is smaller
 - (b) is the same
 - (c) is greater
 - (d) is zero

22. A woman whose mass is 60 kg on the Earth's surface is in a spacecraft at a height of one Earth's radius above the surface, where $g = 2.45 \text{ m/s}^2$. Her mass is:
- (a) 15 kg
 - (b) 30 kg
 - (c) 60 kg
 - (d) 147 kg
23. A man whose weight is 800 N on the Earth's surface is also in a spacecraft at a height of one Earth's radius above the earth, where $g = 2.45 \text{ m/s}^2$. His weight there is:
- (a) 200 N
 - (b) 400 N
 - (c) 800 N
 - (d) 0 N
24. Astronauts feel a sensation of "weightlessness" even in orbits close to the Earth due to
- (a) $g = 0 \text{ m/s}^2$ at that radius
 - (b) the pull of the moon pulling in the opposite direction
 - (c) nausea
 - (d) the "free fall" of both the spacecraft and its contents
25. A 1000 kg car accelerates from 25 m/s to 35 m/s under a net force of 500 N. The distance that it travelled is:
- (a) 150 m
 - (b) 150 km
 - (c) 375 m
 - (d) 600 m
26. An automobile that is towing a trailer is accelerating on level road. The force that the automobile exerts on the trailer is
- (a) equal to the force the trailer exerts on the automobile.
 - (b) greater than the force the trailer exerts on the automobile.
 - (c) equal to the force the trailer exerts on the road.
 - (d) equal to the force the road exerts on the trailer.
27. The action and reaction forces referred to in Newton's third Law
- (a) act upon the same object.
 - (b) act upon different objects.
 - (c) need not to be equal in magnitude but need to have the same line of action.
 - (d) must be equal in magnitude but need not to have the same line of action.
28. A horizontal force of 150 N is applied to a 51 kg carton (initially at rest) on a level floor. The coefficient of static friction is 0.50. The frictional force acting on the carton if the carton does not move is:
- (a) 150 N
 - (b) 200 N
 - (c) 250 N
 - (d) 500 N

29. The coefficients of static and sliding (kinetic) friction for wood on wood are respectively 0.50 and 0.30. If a 100 N wooden box is continually pushed across a horizontal wooden floor with just enough force to overcome the force of static friction, the moving box's acceleration is:
- (a) 0.2 m/s^2
 - (b) 0.5 m/s^2
 - (c) 2.0 m/s^2
 - (d) 5.0 m/s^2
30. A toboggan reaches the foot of a hill at a speed of 4.0 m/s and coasts on level snow for 15 m before coming to a stop. The coefficient of sliding friction is:
- (a) 0.004
 - (b) 0.05
 - (c) 0.16
 - (d) 0.27
31. If Earth were 3 times farther from the sun than it is now, the gravitational force exerted on it by the sun would be
- (a) three times as large as it is now.
 - (b) nine times as large as it is now.
 - (c) one-third as large as it is now.
 - (d) one-ninth as large as it is now.
32. A shoe sits on a ramp without moving. As the angle of the ramp is increased, the shoe starts to move. This is because
- (a) the normal force has increased.
 - (b) the coefficient of static friction has decreased.
 - (c) the component of the normal force along the ramp has increased.
 - (d) the component of gravity acting along the plane of the ramp has increased.

PART D: Analysis

34. Which of Newton's Laws is being exemplified in the following paragraph, where the sentences have been separated? Place the number of the law after each statement which describes the motion or event.
- (a) A car is travelling straight down the road at a constant speed. _____
 - (b) The driver turns the steering wheel but the slippery conditions result in the car failing to change direction. _____
 - (c) The car slides across the intersection without losing speed or changing direction. _____
 - (d) The car slams into a large snow bank and quickly comes to a stop. _____
 - (e) The driver (with no seatbelt or airbag) is "thrown" forward towards the windshield. _____
 - (f) The face of the driver slams into the windshield and stops rapidly. _____
 - (g) The windshield is broken and the driver's nose is also broken and very painful. _____

35. Draw a neat, properly labelled free-body diagram (FBDs) for each of the following objects. Indicate the size of forces with the lengths of the arrows. (i.e. if two forces are the same size, then draw the arrows the same length; if they are different sizes, then draw the larger force longer.) Forces on the may or may not include weight F_g , normal force F_N , friction F_f , and applied force F_a .
- (a) A cart being pushed up along a ramp.
 - (b) The Space Shuttle accelerating vertically immediately after leaving the launch pad.
 - (c) A car going straight on the highway at 100 km/h.
 - (d) A baseball just after it leaves the pitcher's hand.
 - (e) A car has an accident when attempting to round a corner on a snowy/icy road.