

UNIT THREE * DYNAMICS

Name _____

I. Vocabulary: Define the following terms in your own words:

Mass	Balanced force	Weight
Friction	Air resistance	Terminal Velocity
Inertia	Strong nuclear force	Weak nuclear force
Normal Force	Electromagnetic Force	Dynamics
Gravitational Force	Unbalanced Force	

II. Problems and questions:

Problems A: Solve for the unknown asked for:

- The Titan II rocket exerts a net force of 3.84×10^{15} N on its mass of 3250 kg. At what rate does it accelerate?
- If Valerie shoves a large ball with 55.3 N of net force and it accelerates at 3.28 m/s^2 , what is its mass?
- How hard do you need to push Alberto's 623 kg car to get it to accelerate at 0.25 m/s^2 ?
- If a 861.5 kg car goes from rest to 35.8 m/s in 2.94 s, what is the acceleration on the car, and what net force is propelling it?
- If a 3.8 kg ball is pushed horizontally across a frictionless surface from rest with a force of 65.8 N until it attains a speed of 15.8 m/s, how far did you push it?
- A 1206 kg car is rolling toward Adrian at 3.25 m/s. He pushes against the hood for 7.36 s, until the car stops moving. With what net force did he push?
- Explain Newton's three EWSHs, giving examples of each.
- Name the four (?) forces and give examples of each.
- If you drop a rock, the earth's gravity accelerates it down. According to Newton #3, what happens to the earth? Does it really?
- If you're traveling on the interstate at constant speed, why does your engine have to keep pushing? Doesn't this violate Newton #1? Why are cars made aerodynamic?
- Describe the motion of your cassettes as they fly out your window when you turn a sharp corner. Why does this happen?
- The USS Enterprise goes from zero to warp speed in 1 second. What kind of force would that take? What happened to everyone on board?

(1) $1.18 \times 10^{12} \text{ m/s}^2$ (2) 16.9 kg
 (3) 160 N (4) 12.2 m/s^2 ; 10 500 N
 (5) 7.2 m (6) -533 N

Problems B:

- Calculate the weight of all the masses listed in problem section A.
- Cris pushes a 50.3 kg box across the floor at constant speed. If the coefficient of friction is 0.35, how much frictional force is he fighting?
- Igor overcomes a frictional force of 359.47 N while dragging a corpse around the lab. If the body weighs 1250 N, what is the coefficient of friction between the body and the floor?
- You can convert your weight in lbs to kg by dividing by 2.2. How much does a 162 lb person weigh in newtons? What is the mass of a 71.3 N bowling ball?
- Cindy sits on a sled with a coefficient of friction of 0.12 which is being pushed across a field at a constant speed by a 98.7 N force. If the sled has a mass of 4.35 kg, how much does Cindy weigh? What is her mass?
- A truck driver slams on the brakes and skids to a stop through a displacement of 25m.
 - If the truck had double the mass, find the truck's skidding distance. (Hint: Increasing the mass increases the normal force.)
 - If the initial velocity of the truck were halved, what would be the truck's skidding distance?
- What is the difference between weight and mass? Which is more important?
- Why is the direction of a force important? What direction does weight push?
- Why is weight equal to the normal force in friction?
- What are the three types of friction? Give examples of each.
- Two blocks with masses of 45.0 kg and 23.5 kg are stacked on a table with the heavier block on top. The coefficient of friction is 0.60 between the two blocks and 0.44 between the bottom block and the table. A horizontal force is slowly applied to the top block until one of the blocks moves. Where does slippage occur first, between the two blocks or between the bottom block and the table?

(1) -31 900 N, -166 N, -6110 N, -8450 N, -37 N, -11800 N
 (2) 170 N (3) .288 (4) -722 N, 7.27 kg (5) -780 N, 79 kg

Problems C:

1. If a rock has a mass of 5.2 kg and it gets thrown into the air with a force of 142 N, how quickly is it accelerated into the air?
2. A force of 154 N is used to accelerate a 15.4 kg box across the floor at a rate of 3.25 m/s^2 . What is the coefficient of friction between the box and floor?
3. How much force is needed to throw a 42 kg child into the air at 1.45 m/s^2 ?
4. A 25.3 kg crate falls off the back of Antony's truck traveling at 32.8 m/s. If the coefficient of friction between the crate and the ground is .897, how far along the ground will the crate slide?
5. Your mom has a mass of 46.3 kg and is thrown upward by a 789 N force. What is her acceleration?
6. Jessica's car is traveling at 50.0 km/h on a flat highway. If the coefficient of friction between the road and the tires on a rainy day is 0.100, what is the minimum distance needed for the car to stop?
7. A 5.0 kg bucket of water is raised from a well by a rope. If the upward acceleration of the bucket is 3.0 m/s^2 , find the force exerted by the rope on the bucket of water.
8. Josh shoves a box of books weighing 319 N across the floor with a force of 485 N. If the coefficient of friction between the box and the floor is 0.57, how long does it take to move the box 4.00 m, starting from rest?
9. Mike pushes a 925 N crate across a level floor by a force of 325 N. The coefficient of kinetic friction between the crate and floor is 0.25. Find the acceleration of the crate.
10. A 35 kg box rests on the back of Paola's truck. The coefficient of friction between the box and the truck bed is 0.300. Find the maximum acceleration the truck can have before the box slides backward.

11. What applied force is required to give a 25 kg suitcase an acceleration of 2.2 m/s^2 upward?
12. Kiara moves a box of cans down an aisle by pulling on a strap attached to the box with a force of 185.0 N. The box has a mass of 35.0 kg, and the coefficient of friction between box and floor is 0.450. Find the acceleration of the box.
13. A 13.5 kg block is on a table with a coefficient of friction of .357. If a 29.5 kg mass is allowed to pull the block across the table, what is the acceleration of the block?



- Pbs C
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|---------------------------|--------------------------|---------------------------|
| (13) 5.62 m/s^2 | (11) 300 N | (12) $.871 \text{ m/s}^2$ |
| (10) 2.9 m/s^2 | (8) .90 s | (9) $.99 \text{ m/s}^2$ |
| (7) 64 N | (5) 7.23 m/s^2 | (6) 98.5 m |
| (4) 61.1 m | (2) .688 | (3) 470 N |

Pbs D

1. Why is the concept of net force important?
2. What is the net force formula for horizontal motion? For vertical?
3. When an object freefalls, it ___ until it reaches its ___, then it moves with ___ until it hits something.
4. If you skydive and you have reached your terminal velocity, what will happen to your body in terms of force, velocity and displacement when your parachute opens?

