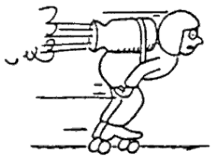
Domain 3: Physics Energy, Force , and Motion

1. Suppose the skater shown below has a mass of 25 kg and is moving at a speed of 8 m/sec along a level surface.
How much KE would he possess?

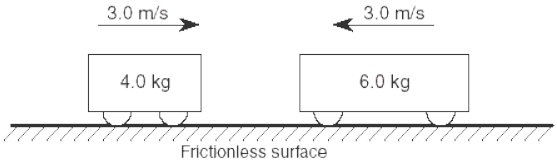
How would his KE change if his speed doubled?

How would the kinetic energy of a second skater having twice as much mass but still moving at 8 m/sec compare with the kinetic energy of our original skater?

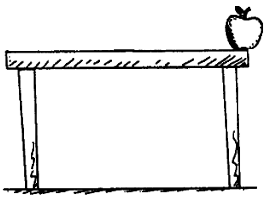


2. **If a poster is hanging on a wall, what type of potential energy does that poster have?**
   The elastic used In the waist bands of clothes have what type of potential energy?
   What kind of potential energy do batteries contain?
   What kind of potential energy does your food contain before you eat it?

3. **How do the kinetic energy of these 2 carts compare?**



4. **The table is 1 m tall and the apple has a mass of 100 grams.**

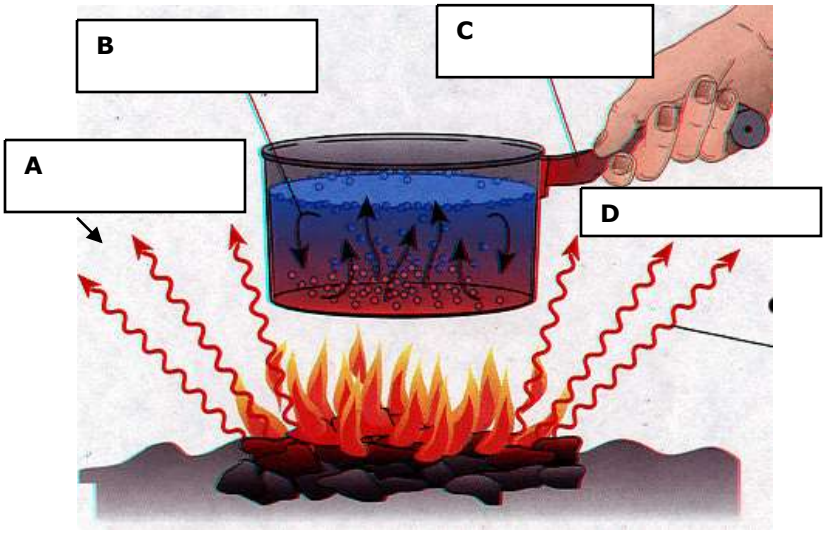


How much potential energy does the apple have?

4. **What impact would using photoelectric energy have on our environment?**

5. **How do nuclear power plants produce electricity? Is nuclear energy a "clean" energy? Please explain.**

6. **What kind of heat transfer is occurring at points A, B, C, and D?**



7. **What kind of heat transfer power hot air balloons?**
8. **What kind of heat transfer heats the Earth each day?**

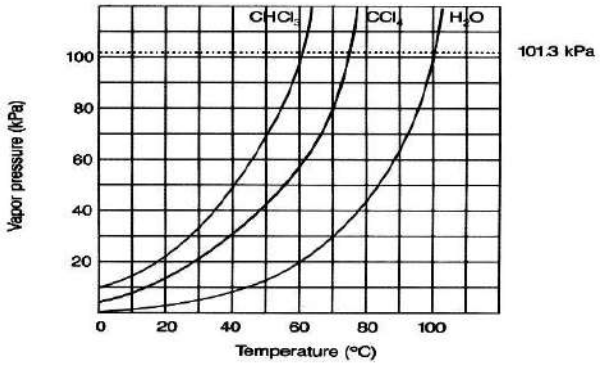
9. **Johnny wants to design a new cooler to keep his refreshments cold at the race. What materials would he use in order to reduce the transfer of thermal energy and keep his things nice and cold all day?**

10. **What material would be the worst insulator that Johnny could use?**

11. **In the above image, the water in the pot went from 22 degrees Celsius to 100 degrees Celsius. There were 500 grams of water. The specific heat of water is 4.18 J/g.C How many Jules of thermal energy were gained by the water?**

VAPOR PRESSURE GRAPHS **Use the graph below to answer the following questions.**

12. **What is the vapor pressure of $CHCl_3$ at 50°C?**
13. **What is the boiling point of H_2O when the external pressure is 30 kPa?**
14. **What is the normal boiling point of CCl_4?**
15. **Which substance has the weakest IMF?**



16. What is Newton's first law of motion? How do we know if forces acting on an object are unbalanced?
Newton's first law is sometimes called the law of _____

17. Identical twins are riding in identical wagons. A friend gives the first wagon a push of 5 N and gives the second wagon a push of 6 N. Which twin will experience the greater acceleration? Explain.

18. Two tugboats are moving a barge. Tugboat A exerts a force of 3000 newtons on the barge. Tugboat B exerts a force of 5000 newtons in the same direction.

a. Draw arrows showing the individual and combined forces of the tugboats in #1.

b. What is the combined force (net force) on the barge?
c. Are the forces balanced or unbalanced?

19. Now suppose that Tugboat A exerts a force of 2000 newtons on the barge and Tugboat B exerts a force of 4000 newtons in the opposite direction.

a. Draw arrows showing the individual and combined forces of the tugboats in #2.

b. What is the combined force (net force) on the barge?

c. Are the forces balanced or unbalanced?

20. A car was travelling due west (to the *left*), and after 40 minutes the car was 120 km from its starting location. What was the average velocity of the car during that particular trip? Hint… you need to convert minutes to hours first.

21. A plane travels at a constant speed across the Atlantic ocean from Asia to North America. It has a displacement of 100 km in a time of 3.9 hours. What was the planes velocity?

22. What is Newton's second law of motion?

A skater goes from a standstill to a speed of 6.7 m/s in 12 seconds. What is the acceleration of the skater?

23.

24. As a shuttle bus comes to a normal stop, it slows from 9.00m/s to 0.00m/s in 5.00s. Find the average acceleration of the bus.

25. A bicyclist accelerates at 0.89m\s^2 during a 5.0s interval. What is the change in the speed of the bicyclist and the bicycle?

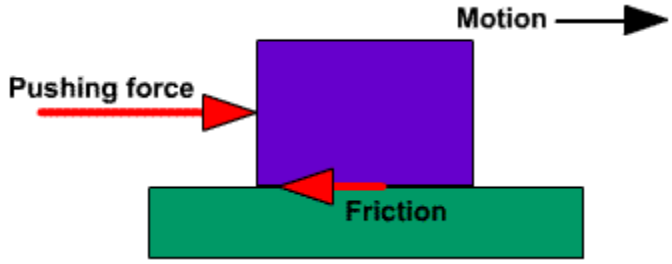
26. What is Newton's third law of motion?
27. Identify the action and reaction forces in the following situations:

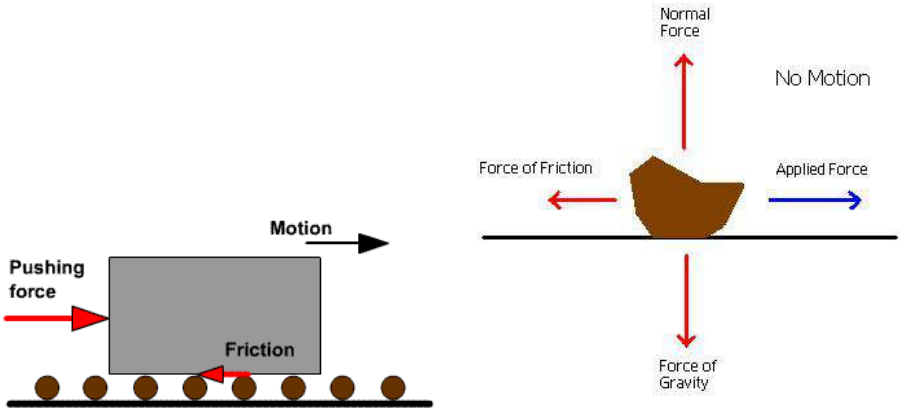
a. A book sitting on a table
b. The space shuttle taking off
c. A car hitting the rear end of another car

28. Two figure skaters push against each other and move in opposite directions across the ice. Describe the action-reaction pair in this situation. Draw a picture and label the action-reaction forces. Which of the two forces is greater? Which skater, the man or the woman, will probably accelerate faster? Explain

29. What force was applied to a ball that has a mass of 3 kg and accelerated at 22 m/s²?

30. Identify the types of friction in the following:





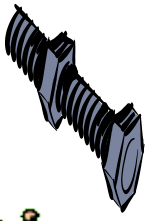
31. What type of force are all falling object demonstrating?

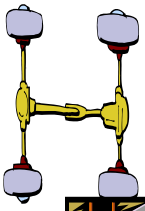
32. On the moon an astronaut that weights 150 lbs on Earth only weighs 25 lbs. Did his mass decrease? Why does he weigh so much less?

33. What kind of simple machines are these?



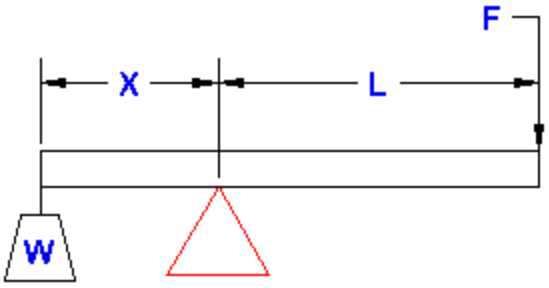




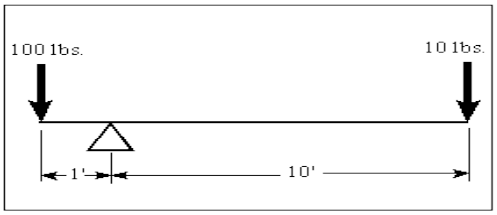



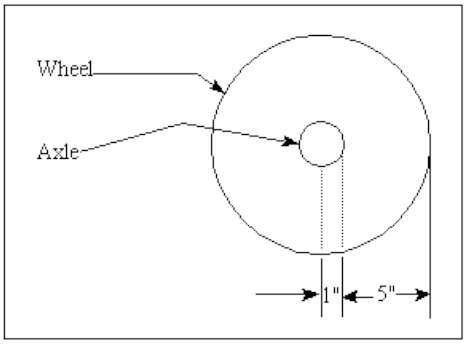

34. What is a compound machine?

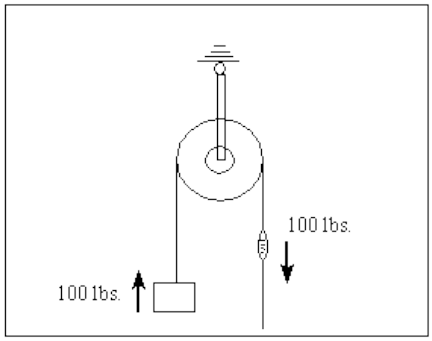
35. List and give an example of the different classes of levers. Label the following diagram.

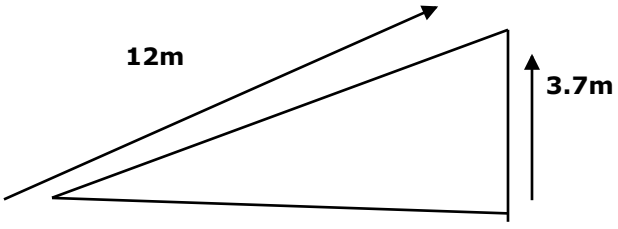


36. What is the mechanical advantage of the following machines?









37. Calculating Work

Calculate the amount of work done when moving a 567N crate a distance of 20 meters.

A fallen tree is lifted 2.75 meters. How much work is done?

If it took a bulldozer 567.6 joules of work to push a mound of dirt 30.5 meters, how much force did the bulldozer have to apply?

A frontend loader needed to apply 137 newtons of force to lift a rock. A total of 223 joules of work was done. How far was the rock lifted?

A young boy applied a force of 2,550 newtons on his St. Bernard dog who is sitting on the boy's tennis shoes. He was unable to move the dog. How much work did he do trying to push the dog?

38. Calculating Power

A set of pulleys lifts a piano and does 3,356 joulles of work. If the piano is lifted in 75 seconds, how much power is used?

What is the power of an electric toothbrush if it can do 755.8 joulles of work in 75 seconds?

Sara and Josh do the exact same amount of work. Sara does the work in 2.3 hours and Josh does it in 2.5 hours. Who is more powerful? Explain.

A dock worker lifts a 375N crate a distance of 0.5m over his head in 2.3 seconds. What is his power output?

- **Hint: You must do a calculation before you can begin to solve for *power*.**

An athlete is using the row machine in the gym. She does 3245 joulles of work on the oars in 72 seconds. What is her power output?

39. Calculating Efficiency

You do 222 J of work pushing a box up a ramp. If the ramp does 200 J of work, what is the efficiency of the ramp?

You do 15,000 J of work with a screw jack. If the screw jack does 14,500 J of work, what is the efficiency of the screw jack?

You do 1200 J of work with gears. If the gears do 1000 J of work, what is the efficiency of the gears?