FORCES CIRCUIT LAB DATA SHEET

Name _____

Date _____

Period _____

STATION 1: HOT WHEELIN' PHYSICS

1. Define Newton's First Law.

2. Describe the motion of the untaped washer when the car hits the pencils.

3. Describe the motion of the taped washer when the car hits the pencils.

4. Identify the force that caused the car to roll down the ramp.

5. What is the force called that tires exert on the road and the road exerts on the tires?

6. Using Newton's 1st Law, explain why the unattached washer didn't stay on the car.

7. Explain how the unattached washer demonstrates the importance of seatbelts.

STATION 2: CRASHING CARS

8.

9.

10.

11.

BONUS QUESTIONS

12.

13.

STATION 3: MARBLE TWISTER

14. Define potential energy.

15. Define kinetic energy.

16. Where on the marble twister does the marble have the most potential energy?

17. What is centripetal acceleration?

18. What happens to the marble when the diameter of the spiraling path begins to narrow?

19. How does a washing machine use centripetal force to clean your clothes?

20. Why doesn't the water in a washing machine experience centripetal force also?

21. 1st try ____ pts 2nd try ____ pts 3rd try ____ pts Total ____ pts

STATION 4: GROOVIN' GRAVITY

22.

23.

24.

25.

BONUS QUESTIONS

26.

27.

28.

STATION 5: NEWTON'S CRADLE

29. Define Newton's Third Law.

30. What happens when 1 moving marble crashes into the 5 motionless marbles?

31. What happens when 2 moving marbles crashes into the 5 motionless marbles?

32. Draw the 2 marbles crashing into the 5 marbles and label the action and reaction forces.

33. Give 3 examples of action and reaction force pairs in everyday life.

34. Define conservation of momentum.

STATION 6: THE NATURE OF FORCE – DO THE NATURE OF FORCE WORKSHEET

STATION 7: SCIENCE FRICTION

35. Define friction.

36. List the four kinds of friction and give an example of each.

37. Predict which type of friction is the largest force – static, sliding, or rolling.

38. Predict which type of friction is the smallest force – static, sliding, or rolling.

39. Which type of friction was the largest?

40. Which type of friction was the smallest?

41. Name two ways in which friction can be decreased.

STATION 8: MAKE YOUR JUMPSHOT

42.

43.

44.

45.

STATION 9: EQUILIBRIUM

	TRIAL 1	TRIAL 2	TRIAL 3
FORCE #1 (N)			
FORCE #2 (N)			
FORCE #3 (N)			

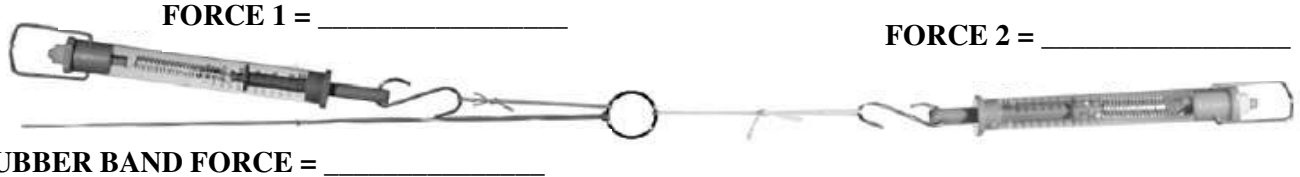
46. What do your observations tell you about the relationship between the 3 forces acting on the ring?

47. If an object is not moving, what do you know about the forces acting on the object?

48. Fill out the diagram from <u>part 2</u> of the instructions

FORCE 1 = _____

FORCE 2 = _____



RUBBER BAND FORCE = _____

STATION 10: WATCH IT SPIN

49.

50.

51.

52.

53.

54.

BONUS QUESTIONS

55.

56.

57.

STATION 11: WRONG WAY ROLLER

58. Define gravity.

59. Define Conservation of Energy.

60. Draw a picture of the set-up.

61. When you watched the center of the roller, what was happening to it?

62. What force caused the roller to go "uphill"?

63. What type of energy did the roller have before it moved?

64. What type of energy did it get converted into when it started moving?

STATION 12: PENDULUM PERIL

65. What did the ball do when you released it?

66. What kind of energy is present when the ball is in the starting position?

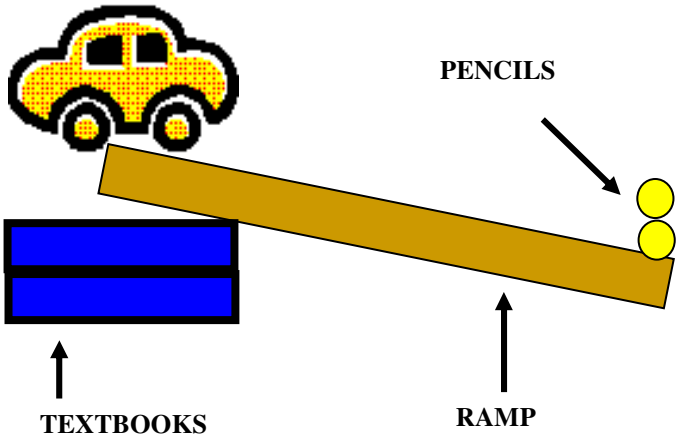
67. Fill out the table using your results.

	# of swings (50 cm)	**# of swings (25 cm)**
Pendulum with long string		
Pendulum with short string		

68. What affected the number of swings, the arc (how high it started) or the length of the string?

STATION 1

HOT WHEELIN' PHYSICS

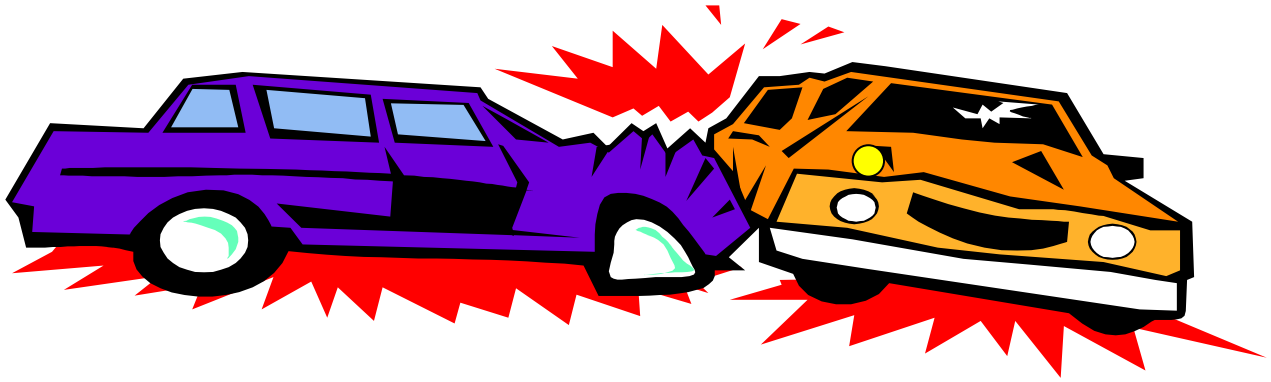


1. Tape 2 pencils to the end of the ramp (see above diagram).
2. Slowly lift the ramp and support it with two science textbooks.
3. Place the car on the ramp so the rear wheels are as close to the end of the ramp as possible (see above diagram).
4. Release the car.
5. Balance a washer on top of the car and release it from the top of the ramp again.
6. Using as little tape as possible, tape the washer to the roof of the car.

7. Release the car from the top of the ramp again.

STATION 2

CRASHING CARS



http://www.fearofphysics.com/

ANSWER THESE QUESTIONS ON YOUR DATA SHEET:

CLICK ON "COLLISIONS"

8. **What two things does a collision between two objects involve?**
9. **Click on your selections and then click on "GO" to determine the following: When a big red truck traveling at 30 m/s collides with a big red truck traveling at 30 m/s, what happens to the trucks after the collision?**
10. **Click "Back". When an SUV traveling at 30 m/s collides with a big red truck traveling at 10 m/s, what happens to each vehicle after the collision?**
11. **Click "Back". When a big red truck traveling at 0 m/s collides with a motorcycle traveling at 10 m/s, what happens to each vehicle?**

BONUS QUESTIONS

CLICK BACK TWICE AND THEN SELECT "WHAT IS FRICTION?"

12. **Click on the link at the bottom to do an experiment. Try to stop a big red truck going 50 mph on a dry road. What is the closest you can get without crashing?**
13. **Same scenario but a wet road. What is the closest you can get without crashing?**

STATION 3

MARBLE TWISTER

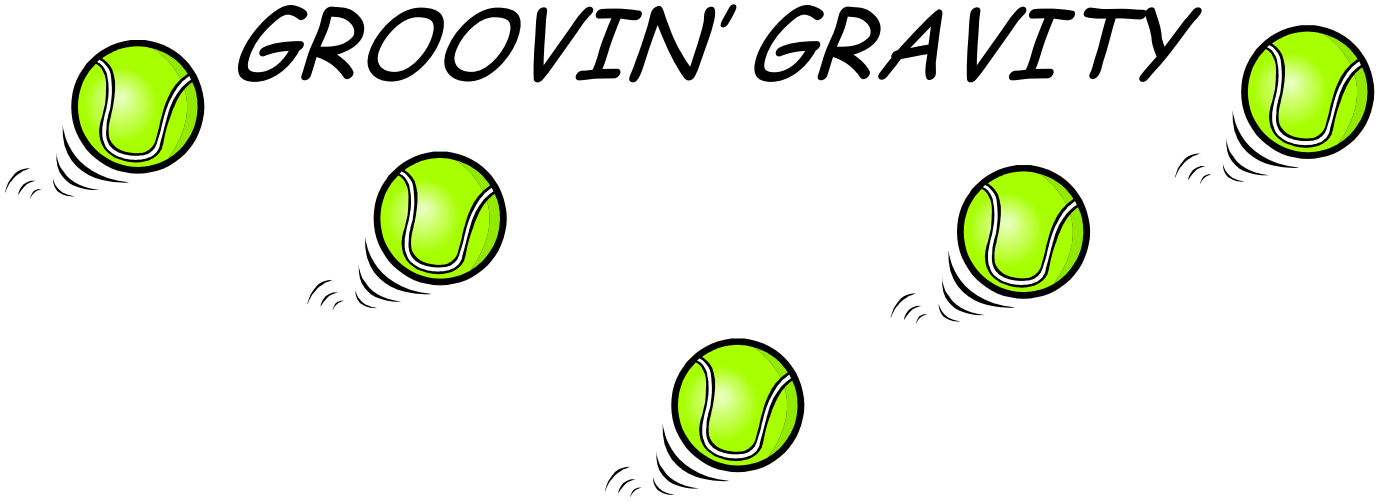
1. Place a marble near the top of the marble twister (you may have to give it a push to get it going).
2. Answer the questions on your data sheet.
3. For a quick competition, take turns sending the marble down the twister and tally your points.

THE CENTRIPETAL FORCE IN WASHING MACHINES

When the interior of the tub spins at high speeds, it forces the clothes against the walls. These walls produce a centripetal force against the outward-moving clothes, keeping them inside the barrel. However, the holes in the tub prevent the same force from being exerted upon the water. The water, propelled in a straight line away from the center of tub, escapes through the holes into the drain. The clothes, in effect, are being forced away from the water!

STATION 4

GROOVIN' GRAVITY



http://www.fearofphysics.com/

ANSWER THESE QUESTIONS ON YOUR DATA SHEET:

CLICK ON "WHY THINGS FALL"

22. Drop a ball from the top of the empire state building. How long did it take to hit the ground?
23. What is the rate that gravity accelerates objects towards the Earth?
24. Go back and time the ball from the 50% mark of the Empire State Building. How long did it take to hit the ground?
25. Compare the times from the top and the middle of the Empire State Building. Why doesn't it take half as long from the 50% mark?

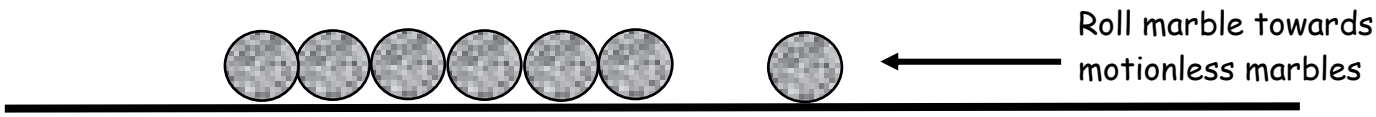
BONUS QUESTIONS

CLICK BACK 4 TIMES AND SELECT "ZERO G"

26. It is a scientific fact that the _____ gets weaker the higher you get.
27. Vote whether weak gravity lets astronauts float around and write it down.
28. Were you correct?

STATION 5

NEWTON'S CRADLE

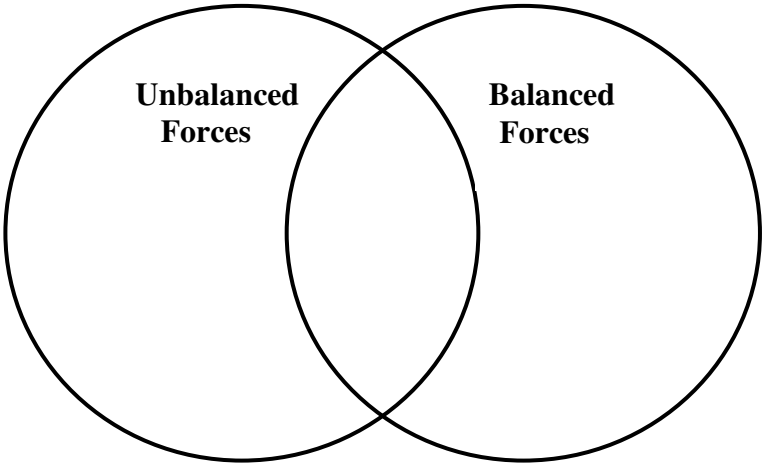


RULER

1. **Make sure that your ruler is securely taped to the table.**
2. **Place 5 marbles in a row in the center groove of the ruler. Place them together, touching each other.**
3. **Roll a sixth marble down the groove into the other marbles.**
4. **Repeat, but this time roll 2 marbles into the row of 5.**
5. **If time permits, try different marble combinations (1 from each side for example), and see what the outcome is.**

STATION 6

NATURE OF FORCE



1. Work on "The Nature of Force" worksheet silently at this table.
2. You may use the textbook to help you with the answers.

STATION 7

SCIENCE FRICTION

1. Answer questions #40-43 on your data sheet.
2. Practice the next 3 steps before you collect data.
3. To measure the static friction between the book and table, pull the spring scale slowly. Record the largest force on the scale ***before*** the book starts to move.
4. After the book begins to move, determine the sliding friction by reading the spring scale.
5. Place 3 rods under the book to act as rollers. Make sure rollers are evenly spaced. Place another roller in front of the book so the book will roll onto it. Pull the spring scale slowly to determine the rolling friction.
6. Answer the questions on your worksheet.

STATION 8

MAKE YOUR JUMPSHOT

http://www.fearofphysics.com/

ANSWER THESE QUESTIONS ON YOUR DATA SHEET:

CLICK ON "MAKE YOUR JUMPSHOT"

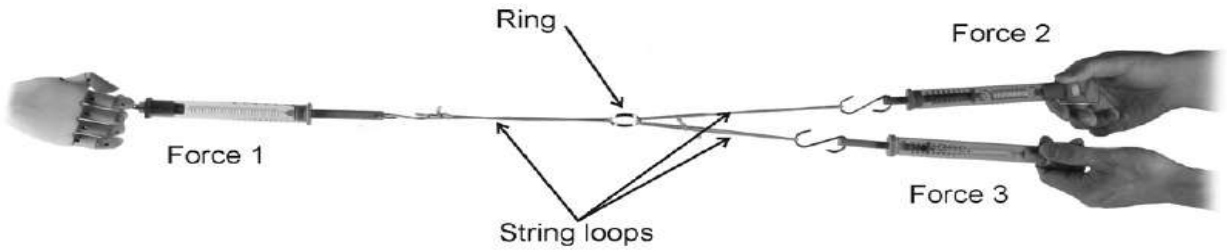
42. What 4 factors are involved for a jump shot set-up?
43. Distance yourself 15 meters from the basket. Select your height. What height did you choose?
44. Manipulate the speed and angle of the ball until you are told that you "Made It". What speed and angle worked for you?
45. Can you make it with nothing but net? (It will let you know if you did). Tell me the speed and angle at which you threw the ball to make that shot.

STATION 9

EQUILIBRIUM

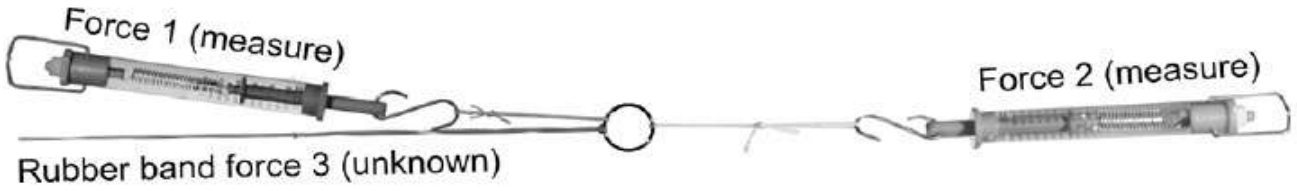
When nothing is moving it does not mean there are no forces acting. It means things are in equilibrium. In equilibrium the total (net) force is zero. You can have as many forces as you wish; they just have to be arranged so the total is zero. This investigation explores the concept of equilibrium using force scales.

PART 1



1. Hold each spring scale vertically and check that it is properly calibrated. If it needs to be adjusted, turn the nut at the top of the scale until it reads zero.
2. Attach three scales to the loops of string with the key ring in the middle.
3. Have three people each pull a scale, keeping the ring motionless with all the scales in a line.
4. Record the forces in the data table.
5. Repeat this 2 more times so you can record 3 trials on your data table.

PART 2



1. Set up the experiment with the key ring again using loops of string except this time replace one of the two loops with a rubber band.
2. Have two students pull on to spring scales opposite of each other. The third student should pull on the rubber band.
3. Record the 2 forces when the key ring is not moving. The force from the rubber band is the unknown force.

STATION 10

WATCH IT SPIN

http://www.fearofphysics.com/

ANSWER THESE QUESTIONS ON YOUR DATA SHEET:

CLICK ON "THE RACE"

49. What 3 objects are at the top of the ramp?
50. Make a prediction: what order they will arrive at the bottom of the ramp? Were you right or wrong?
51. If you were wrong, keep trying until you get it right. What is the actual order in which they will arrive at the bottom of the ramp?
52. Why does the fastest one win the race?

CLICK "BACK" 3 TIMES AND CLICK ON "THE WHEEL"

53. Read the scenario. What do you predict would happen to the wheel?
54. If you were wrong, select the correct answer. "This is physics, not _____!"

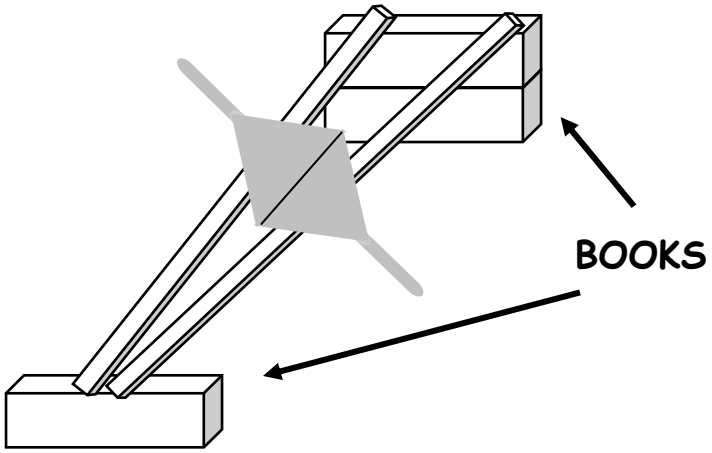
BONUS QUESTIONS

CLICK ON "BUT WHAT HAPPENS IF THE WHEEL IS SPINNING?"

55. What do you predict will happen to the wheel when the person lets go?
56. What does happen to the wheel when the person lets go?
57. What kind of momentum does the wheel have?

STATION 11

WRONG-WAY ROLLER



1. Adjust the metersticks so they are touching at the low end and separated at the high end (see above diagram).
2. Place the roller on the lower end of the 2 metersticks, so that the joined ends of the funnels are between them.
3. It should start to roll by itself, but if needed you can give the roller a slight tap to get it to roll.
4. Answer the next question on your data sheet.
5. Repeat steps 2 and 3, paying close attention to the center of the roller.
6. Answer the remaining questions on your data sheet.

STATION 12

PENDULUM PERIL

1. Pull one of the pumpkins up to your face (see diagram 1).
2. Release the pumpkin and wait for it to swing back.
3. Do not push the pumpkin or move.
4. Answer the data sheet questions.
5. Now pull the pumpkin on the longer string back to the red tape (50 cm line). See diagram 2.
6. Let the pumpkin start swinging and time for 15 seconds and count how many times it swings back and forth.
7. Write the number on the data table.
8. Now pull the same pumpkin on the longer string back to the blue tape (25 cm line).
9. Count the number of swings again during the 15 seconds and record on the data table.
10. Repeat steps 5-9 using the pumpkin on the shorter string.
11. Answer the rest of the questions.

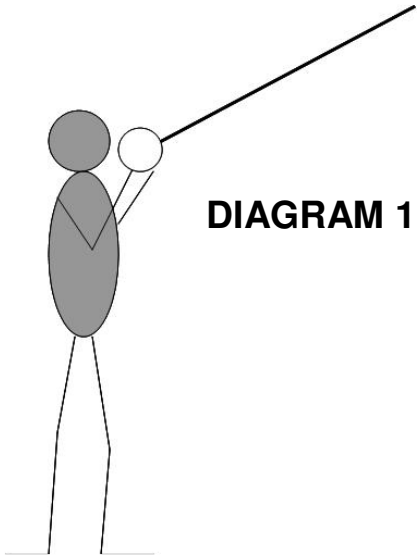


DIAGRAM 1

DIAGRAM 2