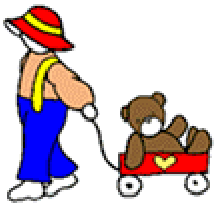
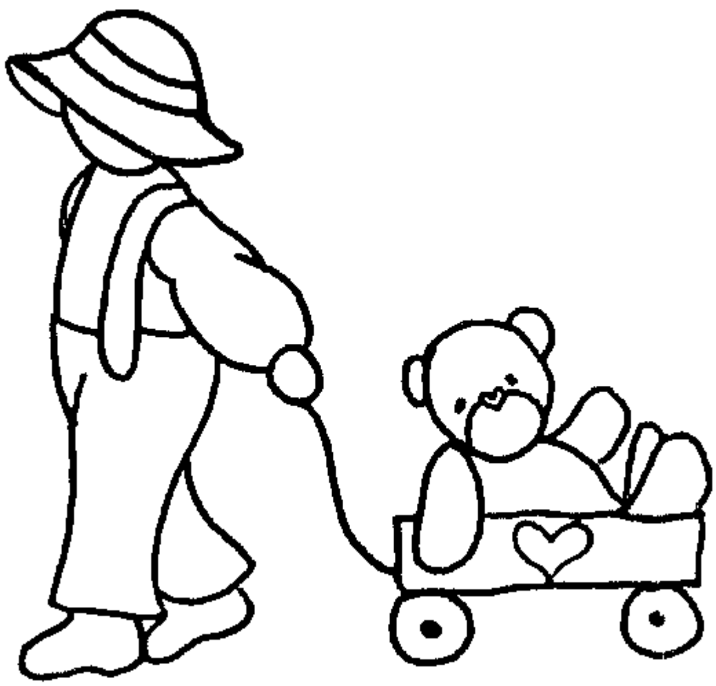


Applied Science

Our Technological World

SIXTH GRADE

WORKBOOK



students ______________________

WHAT IS THE SCIENTIFIC METHOD?

In the following situations, propose a possible question a scientist can answer to solve the problem. Be specific.

1. A scientist wants to establish how color effects plants. Design an experiment that will help the scientist find out.

____

____

____

____

____

2. A scientist wants to establish if two rocks are the same. What can that scientist do to find out if they are the same?

____

____

____

____

____

3. A scientist wants to establish if people who smoke cigarettes have more deaths due to lung cancer then people who do not smoke. How can that scientist find out?

____

____

____

____

____

____

APPLIED SCIENCE - SCIENCE AND MATH (6A)

PROBLEM: Can the length of a curved surface be determined?

PREDICTION:____

PROCEDURE:

MATERIALS: 1 tangle per student

EXERCISE 1. In the space below, make 3 shapes that are topologically related using 16 snaps from a Tangle. Trace the area inside. If you think you have a "neat" shape, show your teacher before you change the shape.

EXERCISE 2. See if you can make a knot from the closed curve of 16 segments. Draw the difference between a knot and a closed curve.

EXERCISE 3. Keeping the tangles closed, make a coil. Show your instructor and have them check this item to verify you completed this exercise. ________________________________

EXERCISE 4. Can you make a curved surface flat? You may unsnap one of the links on the tangle. Show your instructor to verify. ____

EXERCISE 5. How many complete circles can you make from the 16 curved snaps?_________ If the diameter of the circle (in cm) is multiplied by pi or 3.14, you can determine the circumference of the circle. Can you determine the outer length of the entire curved surface? Can you determine the inner length of the entire tangle? Use the space below and try to compute the length of a curved surface.

CONCLUSIONS:
____

APPLIED SCIENCE - SCIENCE AND MATH (6A) POST

Define each of the following branches of mathematics. From the definition, try to determine how that mathematical branch may be used in science. Give an example if you cannot think of a general name. Use the example.

DEFINE	HOW USED IN SCIENCE
1. Arithmetic - computation of figures	counting how many times something occurs in an experiment
2. Algebra	
3. Geometry	
4. Euclidean Geometry	
5. Riemannian Geometry	
6. Trigonometry	
7. Calculus	

FIBONACCI SEQUENCE

Can you figure out the next 5 numbers of the Fibonacci sequence?

A. 1, 1, 2, 2, 3, 5, 8, 13, ____, ____, ____, _____, _____

Here are some other sequences. Can you figure out the next 5 numbers in each sequence? Have fun!

B. 2, 4, 6, 8, 10, ____, ____, ____, _____, _____

C. 1, 3, 5, 7, 9, ____, ____, ____, _____, _____

D. 1, 2, 4, 7, ____, ____, ____, _____, _____

E. 1, 6, 11, 16, ____, ____, ____, _____, _____

F. 1, 4, 9, 16, ____, ____, ____, _____, _____

G. 1, 1/2, 1/4, ____, ____, ____, _____, _____

H. 100, 95, 90, ____, ____, ____, _____, _____

I. What's the difference between the first five sequences and the last 2 sequences?

____

____

APPLIED SCIENCE - SCIENCE AND MATH (6B)

PROBLEM: How is science and art related?

PREDICTION: ____

PROCEDURE:

MATERIALS: perler beads, templates

Draw a picture of your pattern and the design. Make sure you have used the correct amount of pegs that are on your pegboard. This helps determine how many beads you will need.

On the graph below, record how many beads you will need of each color. Then count out the number of perler beads and start your project. Your teacher will give you instructions.

COLOR	NUMBER OF BEADS

CONCLUSIONS: As you were designing your art work, did you see any relationship with science? Explain.

____
____
____
____
____

DESIGNING AN EXPERIMENT

ANSWER THE FOLLOWING QUESTIONS:

1. What subject do I want to learn more about? Are there any subjects that I have always wanted to know the answer?

____
____

2. How do I find information about the subject?

____

3. Where would I go to learn more information?

____
____
____

4. How can I design an experiment about this subject? Can I propose a hypothesis on the subject?

____

5. Can I compare and contrast this to other things? If so, what?

____

6. What is the goal of this project?

____

7. Where do I get materials for the experiment?

____

8. How do I record the data?

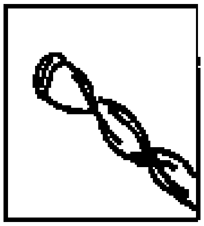
____

9. How do I present the data, so other people can understand what I did?

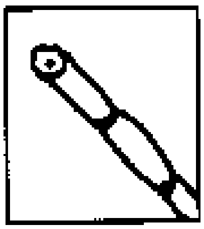
____

GUIDE TO FIBERS

PLANT FIBERS

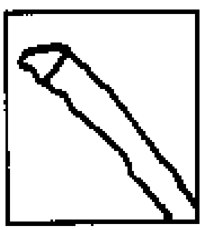


COTTON is derived from a cotton plant. The fibers appear as flat ribbons under the microscope that are slightly twisted. The fabric that cotton produces is soft, absorbs water, and wrinkles easily. Cotton is a fabric that is light and cool.

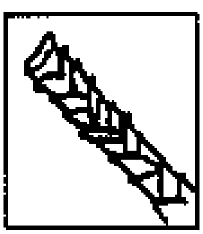


LINEN is derived from the stems of flax plants. Fibers are jointed, looks like a miniature bamboo. The fiber is shiny, strong, gets softer with use, absorbs water, and wrinkles easily. Linen gets softer with use and considered a cool fabric for warmer climate.

ANIMAL FIBERS

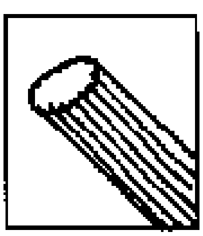


SILK is from the cocoons of silkworms. The fiber is double strands, smooth, and shiny. The fabric is lightweight but can keep its wearer warm.



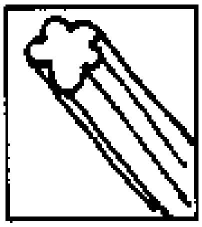
WOOL is from a sheep. Under the microscope it looks like scaly corkscrews. The fiber is stretchable, long lasting, doesn't wrinkle and springs back into shape. Wool easily absorbs water, and soft. Wool fabric is known for its ability to "breathe" keeping wearers warm in the winter and somewhat cool in warmer weather Wool picks up static electricity easily when rubbed.

SYNTHETIC FIBERS

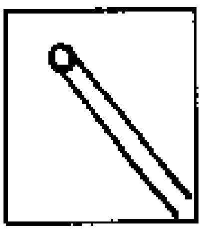


RAYON is made from wood. The fibers are smooth and glass-like rods, which is easily stretchable. Rayon doesn't wrinkle, is soft and absorbent.

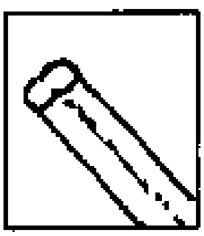
SYNTHETIC FIBERS



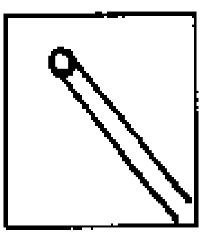
ACETATE is a created from wood. Under the microscope there are grooves that run the length of the fibers. Acetate is soft, smooth, and will melt under a hot iron. It does not absorb water. The fabric is cool.



NYLON is derived from coal. The fibers under the microscope are smooth and clear rods. Nylon is shiny, tough, stretchable and melts under a hot iron. The fibers are nonabsorbent, quick drying, and doesn't wrinkle. The fabric is cool but clammy.



ACRYLIC is made from petroleum. Under the microscope the fiber is dog-bone shaped with apparent cut ends. The fabric is lightweight, warm, and quick drying.



POLYESTER is derived from petroleum. Under the microscope the rod shaped fiber looks like nylon but is not clear. The fiber does not wrinkle, is silk-like, strong, and absorbent.

APPLIED SCIENCES-SCIENCE AND MATH (6C)

PROBLEM: Do different fabrics have different characteristics?

PREDICTION:____

PROCEDURE:

MATERIALS: pieces of different fabric; Guide to Fibers

Look at the different fabrics under the microscope and draw a single fiber.

FABRIC NAME	CLOTH WEAVE (DRAW OR DESCRIBE)	SINGLE FIBER (DRAW)

CONCLUSION: List some of the characteristics of fabrics.

____
____
____
____

APPLIED SCIENCE - PHYSICS (6A) PRE

In the following list of activities classify them with respect to which interaction would help explain the situation. Use the interactions of gravity, electromagnetic, weak nuclear, or strong nuclear.

1. an apple falling from a tree	
2. atomic bomb	
3. magnetism	
4. why rocks fall down and not up	
5. listening to the radio	
6. falling down from a bike	
7. Solar system motion	
8. radioactive decay of particles	
9. a balloon sticking to a wall after rubbing the balloon	
10. the Moon revolves around the Earth	
11. the motion of a comet	
12. weight	
13. friction	
14. protons and neutrons in a nucleus	
15. tidal action of the oceans	
16. x-rays	
17. television	
18. microwaves	
19. shape of galaxies	
20. light	

APPLIED SCIENCE - PHYSICS (6A)

PROBLEM: How many different types of motion are there?

PREDICTION:

____

____

PROCEDURE:

Go to the appropriate stations and answer the questions below. Be careful not to break any of the toys.

YO YO.
1. Can you make the yo-yo go up and down? ________________________________
2. Watch each student in your group and describe the motion of their yo-yo. You can give more than 1 chance. Record your information below.

NAME	DESCRIBE MOTION OF YO-YO

BALLOON. First, stretch out the balloon. Blow it up and hold onto the mouthpiece so no air escapes. Put a piece of thread through a one inch piece of straw. Then tape the straw to the balloon. Now tie one end of the string to a chair and hold the other end. Release the balloon and watch it move along the string. Try tilting the string upwards.
Describe the motion:

____

____

FORCE MACHINE. Pick up the amount of balls on the data chart and record what happens when you let the ball or balls go.

NUMBER OF BALLS	DESCRIPTION OF MOTION
1 ball	
2 balls	
3 balls	

BALL. Toss a ball at least 3 meters into the air. Describe the motion.

____

____

ORBITER. Place your fingers in the handles. Wind the string up by flipping wrists in a circular motion. Pull hands out rapidly. Alternate outward and inward. Describe the motion.

____

____

GYROSCOPE. Hold the frame firmly in your hand. Thread the cord through the small hole near the top of the spindle. Turning the wheel carefully let the cord wind around the spindle from hole to hub and back again. Now pull the cord away from the gyroscope with a quick, strong motion. Describe the motion.

____

____

CONCLUSION: Describe the different motions you observed?

____

____

____

____

____

____

APPLIED SCIENCE - PHYSICS (6B)

PROBLEM: How are fluids influenced by motion?

PREDICTION:

____

PROCEDURE: Go to each of the stations and follow your lab sheet.

TOUR OF BUBBLE. Flip the tube until bubbles start rising. Describe what you see. Take note of the bubble size, shape and speed.________________________________

____

SAND TIMER. Flip the tube until the timer moves upward. Describe what you see. What is causing the timer to move upwards?

____

____

DENSITY TIMER. Flip this 5 minute timer over and observe the motion. Make sure you flip it over when each chamber has just one colored liquid. Describe what happens to both liquids. Describe the speed and size of the drops as they fall.

____

____

TORNADO TUBE. Put the bottle with the water upwards and swirl the top bottle. A water funnel (vortex) will appear. Describe the motion. What is the reason for the vortex? ____

____

TORNADO IN A BOTTLE. Twirl the bottle in a circular motion very quickly. Describe the motion. What is the reason for the tornado? ______________________________

____

BIRD GLIDER. Secure the nose piece and throw the glider. Take the nose piece off and throw the glider. Describe the difference in motion. Why do you think this is occurring.

____

____

PUDDLE JUMPER - CAUTION: NEVER POINT THE PUDDLE JUMPER AT YOUR FACE OR ANY OTHER PERSON. Hold the puddle jumper firmly at the back of you left palm. Keep it pointed forward while you spin it so it flies forward when you let it go. Describe the motion. What makes the jumper fly?

____

____

TIMES UP Describe the motion. Why do the particles float to the top?
____
____

HANDBOILER - THIS IS GLASS, DO NOT SQUEEZE. Place the handboiler in the palm of your hand and gently hold. Describe what happens. Why does it look like it is boiling?____
____
____

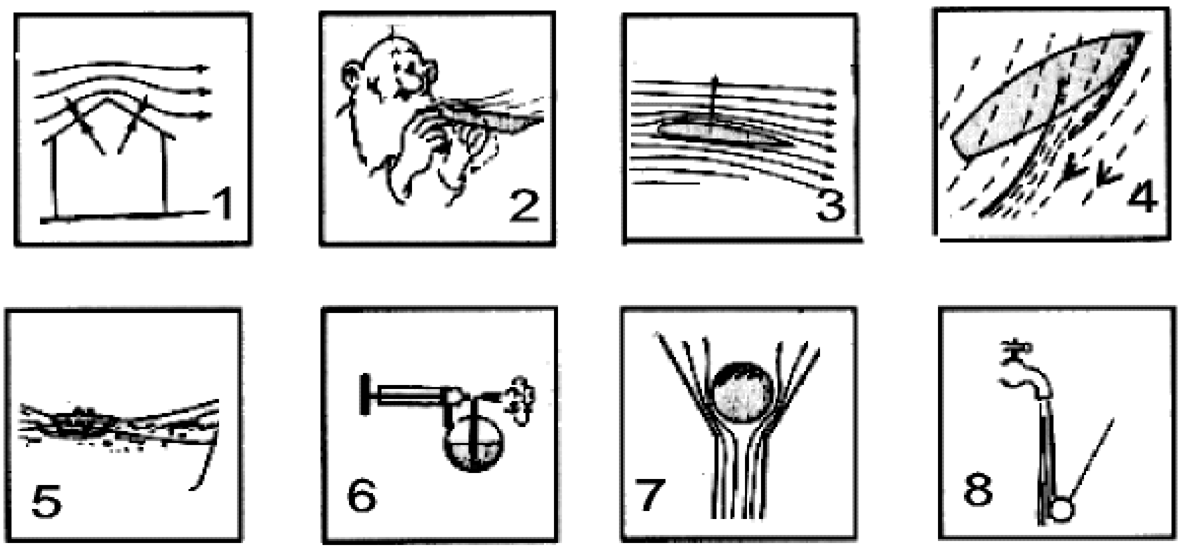
PIPE - Blow gently into the pipe without putting your mouth to the pipe. Describe what happens.____
____

WAVE MACHINE - Move the wave machine side by side? Describe what happens. Which other toy is this wave machine similar to?_____________________________
____

CONCLUSION: How many ways do fluids move?
____
____
____
____
____
____
____

APPLICATION OF BERNOULLI'S PRINCIPLE

Draw on the pictures below an H for high pressure and a L for low pressure. The higher pressure will move the toward the lower pressure, with sometimes disastrous results.



1. Air pressure above the roof is less than air pressure beneath the roof.

2. The paper rises when air is blown across its top surface.

3. Air pressure is less above the wing than below the wing.

4. The smaller sail acts as a channel that speeds up the air passing over the main sail.

5. Two toys boats are side by side. A stream of water is directed between them. The boats will draw together and collide.

6. A vaporizer forces air past the upper end of a tube, reducing the pressure. The greater atmospheric pressure outside the tube forces the liquid up into the tube where it is carried away by the stream of air.

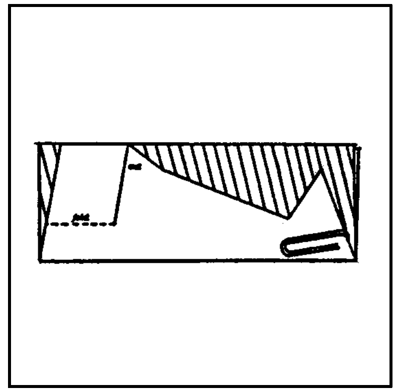
7. A hair dryer can keep a ping pong ball trapped in the center.

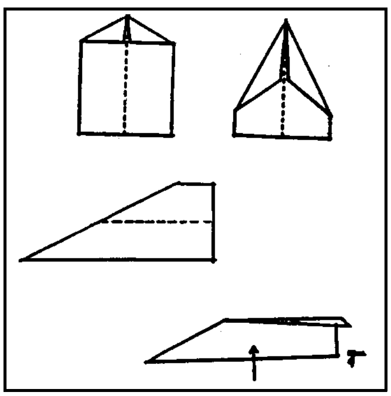
8. Pressure is greater in the stationary fluid (air) than in the moving fluid (water stream). The ball is pushed by the atmosphere into the region of reduced pressure.

APPLIED SCIENCE - TECHNOLOGY (6A) LAB

DIRECTIONS FOR CONSTRUCTING GLIDERS

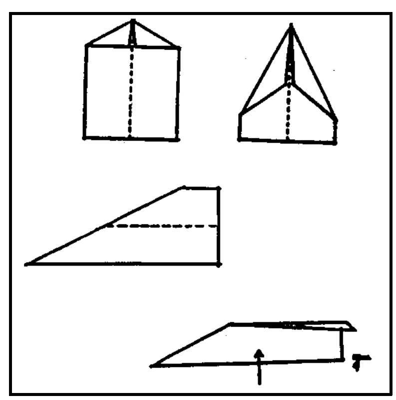
Glider 1. Use a 10 x 15 cm piece of stiff paper. Fold the paper lengthwise down the middle. Then draw the glider design as shown. After you draw the design, keep the paper folded while you cut away the shaded areas with a pair of scissors. Now cut down about two thirds of the way as shown in the drawing. Make this cut while the paper is still folded so the two wings will be of equal size. Fold each wing downwards and crease it. Now slip a small paper clip over the nose of the glider so it holds both sides together. With the paper clip firmly in place, make sure the wings stand out horizontally from the body of the glider.



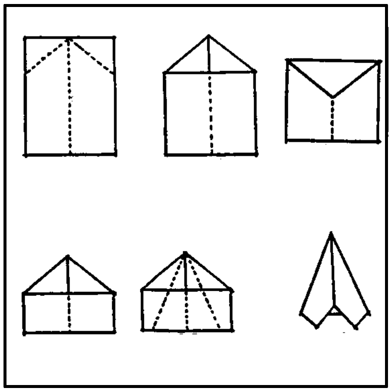


Glider 2. Use a piece of paper fold it lengthwise down the middle then unfold it. Now fold the two upper corners towards the center and crease them into place as in the diagram. Next fold point A toward the middle and crease it firmly. Do the same for point B. Refold your glider along the middle crease and place it on its side as shown in diagram. Fold the top side so it reaches the bottom. Crease it firmly. Turn the glider over and do the same with the other side. Now that you have constructed the glider's wings, its ready to fly.

Glider 3. Fold lengthwise a stiff paper (file card) that is 10 x 15 cm. Use the glider 3 model and copy the glider. Cut out the glider with the paper still folded. Fold the dashed lines at A, B, and C. Fold A outwards, B inwards, and C outwards as in the figure. Place two paper clips at point D on the gliders nose as in diagram. Put one clip on either side. Do not clip the two sides together. The body of the glider should remain open. Give the darter a quick toss and off it goes.



DIRECTIONS FOR CONSTRUCTING GLIDERS



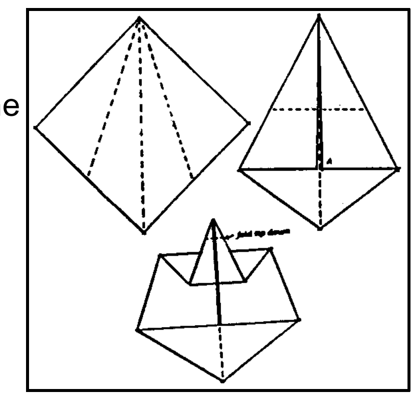
Glider 4. Fold paper lengthwise down the middle. Crease it then flatten the paper out as int he diagram. Use the middle fold for a guide line. Now fold the two upper corners towards the middle and crease them. Fold the triangular paper of the paper toward you. Next fold the top right corner towards the center line and crease it. Do the same with the top left corner.

Make the two folds at the dotted lines as show in diagram. The completed glider should look like the last diagram.

Glider 5. This glider flies in one loop and comes back to the same place. Start with an 20 cm square of paper. Fold it in half diagonally as show in the diagram. Crease the paper and unfold it. Then make the two side folds as indicated. Crease these folds and do not unfold the glider as in the diagram.

Fold the tail down and make the point of the tail extend about 2.5 cm past point A. Next fold the tail upwards so the tip of it extends about an 3 cm above the body of the glider. Now fold the tip of the tail downwards about 1 cm.

Fold the glider in half and put the bottom flap down.



APPLIED SCIENCE - TECHNOLOGY (6A)

PROBLEM: Which glider design is the best for keeping airborne?

PREDICTION:____

PROCEDURE:

MATERIALS: instructions for the following gliders 1-5, scissor

Construct the model glider assigned to you. Go out to the designated area and measure how far it traveled in the space below. You will use this data to plot the results in the POST LAB. Do more than one test, and make sure you measure this accurately with your partner. Do 10 trials and then take the average of your 10 trials and record this in the appropriate place. This is the number that will be used for graphing the data. Each test must be conducted with wind coming from behind you and from in front of you.

glider used: ____

	DISTANCE TRAVELED	
TRIAL	WIND-FRONT	WIND-BACK
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

total (wind-back) ______________ divide by 10: ____________ the average is: _____
total (wind-front)______________ divide by 10: ____________ the average is:______
State whether the wind direction was from behind or in front.
____
Does this make a difference in the flight pattern of your glider? Explain.
____
____

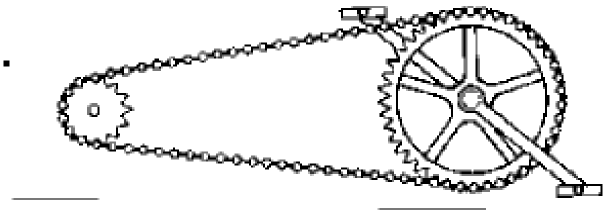
CONCLUSION: Why do you think your glider traveled the way it did? Any problems.
____

RECORD THE AVERAGE DISTANCE FROM EACH STUDENTS' EXPERIMENT (OR GROUP)							
WIND IN BACK							
Glider 1.							
Glider 2.							
Glider 3.							
Glider 4.							
Glider 5.							

RECORD THE AVERAGE FROM EACH STUDENTS' EXPERIMENT (OR GROUP)							
WITH THE WIND							
Glider 1.							
Glider 2.							
Glider 3.							
Glider 4.							
Glider 5.							

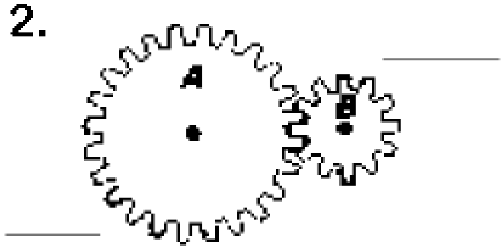
GRAPH THE INFORMATION ON THE DATA CHARTS BELOW OR ON GRAPH PAPER.

1.



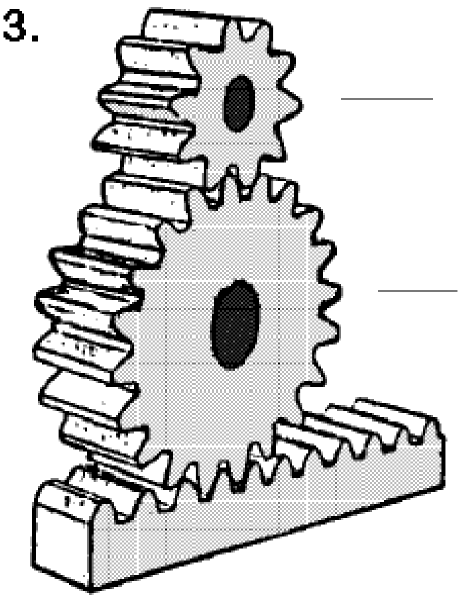
Gear ratio __________

2.



Gear ratio _________

3.

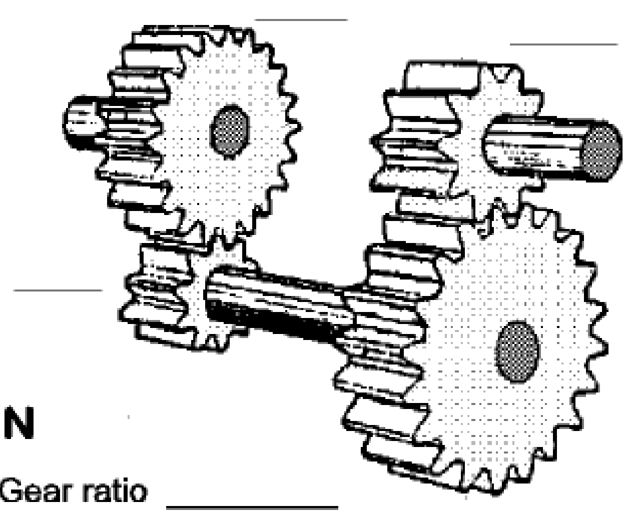


Gear ratio __________

$$\frac{\text{teeth on gear}}{\text{teeth on pinion}} \times \frac{\text{teeth on gear}}{\text{teeth on pinion}} = \text{gear ratio}$$

$$\frac{\text{teeth on gear}}{\text{teeth on pinion}} = \text{gear ratio}$$

4.



Gear ratio _________

GEAR RATIO

MAKING A MACHINE RUN

APPLIED SCIENCE - TECHNOLOGY (6B)

PROBLEM: Is the design of vehicles and balls for aerodynamic reasons?

PREDICTION:
____

MATERIALS: models of different vehicles, balls

PROCEDURE: Look at the vehicles or balls at your station. Try and determine if the design is aerodynamic. If it is not, state why. Try to figure out why the vehicle or ball was designed that way.

VEHICLE/BALL	AERODYNAMICALLY DESIGNED	WHAT IS THE DESIGN MEANT TO ACCOMPLISH

CONCLUSIONS:
____
____

APPLIED SCIENCE - BUILT ENVIRONMENT (6)

PROBLEM: Can you predict how certain toys act in space?

PREDICTION:____

PROCEDURE:
Go to the appropriate stations around the lab and experiment with the toys. Record how you think it works or describe the motion of that toy. Predict how it would react in space. After you view a video on Toys in Space, see if your predictions were correct.

	PREDICTION	DESCRIBE MOTION IN SPACE
1. glider		
2. paddleball		
3. slinky		
4. jacks		
5. juggling		
6. magnetic marbles		
7. wind up toys		
8. gyroscope		
9. top		
10. space wheel		
11. yo-yo		
12. car (wind up)		

CONCLUSIONS:
____

SPACE STATION OR CITY

ATMOSPHERE	RECREATION	BATHROOM
ENGINE ROOM	FOOD	PRIVATE ROOM
WORK AREAS	SEWAGE	WATER
TRANSPORT ROOM	GRAVITY GENERATOR	SCHOOL
HOSPITAL	FUEL	