The Big Top: Scene 1

All the performers are gathered around the center ring to hear from the Ringmaster regarding tonight's show.

Ringmaster: *(stretch out*) Ladies and Gentleman!!!!! (*clearing his throat*) Just warming up for tonight's show. Is everyone ready?

Magician: Of course we are.

TRW: I hope you are because you need some new tricks.

Magician: I have several, let me show you.

Magician begins to show everyone a few of his tricks

Ringmaster: Now, now children….Let's do a quick run through to make sure everything goes as planned.

Narrator: Just then Eddie climbs the pole and gets ready to run through his Flying Trapeze act.

Eddie: (yelling) Hey down there, I'm ready.

As Eddie gets ready he notices his back wheel is smaller that the rope. "That's strange my wheel usually fits around the rope. Must need some air in my tire.

Eddie goes through his show he suddenly stops in the middle of a swing.

TRW: Eddie whats going on?

Eddie: I'm not sure but I can't move. I usually make it to the end of the rope.

Just then the ringmaster remembered they put up new ropes.

Ringmaster: Eddie, I forgot to tell you we changed the ropes because the company we used went out of business.

Eddie: Aww man…Now I don't have enough force to get to the end.

Ringmaster: Well come down and you can try it again later.

Eddie jumps off the bicycle and lands in the net.

The Big Top: Scene 2

Just as the Ringmaster finished his sentence the lights went out.

Everyone: (grumbling)

FT1: What now?

FT1: It's probably the old wires; you know we need to rewire this entire tent.

Magician: Don't get you panties in a bunch….I'll go take a look.

After several minutes the magician returns.

Magician: Well….you want the good news or the bad news first?

TRW, FT1 & FT2: Just tell us already!!

Magician: Well, the bad news is the circuit is shot…The good news is we can fix it, I think?

Human cannon ball on wheels
Trapeze for action and reaction

Bicycle he lowers the rope and slides down
Dog and pony show
Acrobats with level (seesaw)
Elephants standing on ball
Ten people riding a bicycle
Spinning plates
Animals jumping through hoops on fire
Doppler Effect when circus first comes to town

Assignment/Rubric/Evaluation/Handout

Sample Rubric

Level	Scientific Procedures and Reasoning	Strategies	Scientific Communication/Using Data	Scientific Concepts and Related Content
Novice	Did not use appropriate scientific tools or technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather data (via measuring and observing).	No evidence of a strategy or procedure, or used a strategy that did not bring about successful completion of task investigation. No evidence of scientific reasoning used. There were so many errors in the process of investigation that the task could not be completed.	No explanation, or the explanation could not be understood, or was unrelated to the task investigation. Did not use, or inappropriately used scientific representations and notation (e.g. symbols, diagrams, graphs, tables, etc.). No conclusion stated, or no data recorded.	No use, or mostly inappropriate use, of scientific terminology. No mention or inappropriate references to relevant scientific concepts, principles, or theories (big ideas). Some evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Apprentice	Attempted to use appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather data (via measuring and observing) but some information was inaccurate or incomplete.	Used a strategy that was somewhat useful, leading to partial completion of the task/investigation. Some evidence of scientific reasoning used. Attempted but could not completely carry out testing a question, recording all data and stating conclusions.	An incomplete explanation or explanation not clearly presented (e.g., out of sequence, missing step). Attempted to use appropriate scientific representations and notations, but were incomplete (e.g., no labels on chart). Conclusions not supported or were only partly supported by data.	Used some relevant scientific terminology. Minimal reference to relevant scientific concepts, principles, or theories (big ideas). Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Practitioner	Effectively used some appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather and analyze data, with only minor errors.	Used a strategy that led to completion of the investigation/task. Recorded all data. Used effective scientific reasoning. Framed or used testable questions, conducted experiment, and supported results with data.	A clear explanation was presented. Effectively used scientific representations and notations to organize and display information. Appropriately used data to support conclusions.	Appropriately used scientific terminology. Provided evidence of understanding of relevant scientific concepts, principles or theories (big ideas). Evidence of understanding observable characteristics and properties of objects, organisms, and/or materials used.
Expert	Accurately and proficiently used all appropriate tools and technologies (e.g., rulers, pH paper, hand lens, computer, reference materials, etc.) to gather and analyze data.	Used a sophisticated strategy and revised strategy where appropriate to complete the task. Employed refined and complex reasoning and demonstrated understanding of cause and effect. Applied scientific method accurately: (framed testable questions, designed experiment, gathered and recorded data, analyzed data, and verified results).	Provided clear, effective explanation detailing how the task was carried out. The reader does not need to infer how and why decisions were made. Precisely and appropriately used multiple scientific representations and notations to organize and display information. Interpretation of data supported conclusions, and raised new questions or was applied to new contexts. Disagreements with data resolved when appropriate.	Precisely and appropriately used scientific terminology. Provided evidence of in-depth, sophisticated understanding of relevant scientific concepts, principles or theories (big ideas). Revised prior misconceptions when appropriate. Observable characteristics and properties of objects, organisms, and/or materials used went beyond the task investigation to make other connections or extend thinking.

Problem Solving with Friction and Air Resistance

Notes

When solving force problems, it is not always acceptable to ignore friction. When using Newton's Laws of Motion to solve problems involving forces when friction is included, the same problem solving strategy is used when friction is ignored.

1. *Determine what type of free body diagram (5 choices) best depicts the situation.*
2. *Determine if the force of friction will be considered in the problem.*
3. *Draw a free body diagram of the situation.*
4. *Label all of the forces acting on the object.*
5. *Show all of the known forces in the free body diagram.*
6. *List all of the equations that apply to the problem.*
7. *Determine what variables are known and needed.*
8. *Substitute the given quantities into the equations using proper units.*
9. *Solve the equation, carrying units throughout the problem.*
10. *Check your answer to make sure it makes sense.*

When solving force problems, all of the forces acting on an object must be calculated. When determining the net force acting on an object, the horizontal and vertical forces are calculated independently. If an object is not accelerating horizontally or vertically, the net force in that direction is zero and it does not affect the object's acceleration. The net force acting on an object is found by adding all of the forces acting on the object either horizontally or vertically.

Summary Review – Problem Solving with Friction and Air Resistance

- ✓ When using Newton's Laws of Motion to solve problems involving forces, the ten-step problem solving strategy is used.
- ✓ When solving force problems, all of the forces acting on an object must be calculated.
- ✓ When determining the net force acting on an object, the horizontal and vertical forces are calculated independently.
- ✓ Net force is the sum of all forces acting on an object.
- ✓ The force of friction always opposes the motion of an object.

The Big Top
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Classwork – Problem Solving with Friction and Air Resistance

$W = m\,g$ $\qquad$ $F_{net} = m\,a$ $\qquad$ $F_f = \mu\,F_N$

1. A 6 kg baby is dropped by a stork 50 meters above a house. Neglecting air resistance, what is the acceleration of the baby?

2. Being a quick-thinking baby (obviously a future physicists), the baby takes off her diaper and uses it as a parachute. If the parachute offers an upward force of 35 N on the baby, calculate the net force acting on the baby.

3. What is the acceleration of the baby as she falls with her diaper-parachute open?

4. Two people are pushing a stalled car. The mass of the car is 1850 kg. One person applies a force of 275 N to the car, while the other person applies a force of 395 N. Both people are pushing in the same direction. If there are 560 N of friction opposing the car's motion, what is the acceleration of the car?

5. You need to drag a 50 kg cement block horizontally across a wooden floor. The coefficient of friction between cement and wood is 0.25. Calculate the net force acting on the cement block and its acceleration if you apply a constant force of 185 N to the cement block.

Problem Solving with Newton's Second Law of Motion

Notes

To simplify problem solving, it is often convenient to ignore friction. When using Newton's Laws of Motion to solve problems involving forces when friction is ignored, the following problem solving strategy is used.

1. *Determine what type of free body diagram (5 choices) best depicts the situation.*
2. *Determine if the force of friction will be considered in the problem.*
3. *Draw a free body diagram of the situation.*
4. *Label all of the forces acting on the object.*
5. *Show all of the known forces in the free body diagram.*
6. *List all of the equations that apply to the problem.*
7. *Determine what variables are known and needed.*
8. *Substitute the given quantities into the equations using proper units.*
9. *Solve the equation, carrying units throughout the problem.*
10. *Check your answer to make sure it makes sense.*

When solving force problems, all of the forces acting on an object must be calculated. When determining the net force acting on an object, the horizontal and vertical forces are calculated independently. If an object is not accelerating horizontally or vertically, the net force in that direction is zero and it does not affect the object's acceleration. The net force acting on an object is found by adding all of the forces acting on the object either horizontally or vertically.

Summary Review – Problem Solving with Newton's Second Law of Motion

- ✓ When using Newton's Laws of Motion to solve problems involving forces, the ten-step problem solving strategy is used.
- ✓ When solving force problems, all of the forces acting on an object must be calculated.
- ✓ When determining the net force acting on an object, the horizontal and vertical forces are calculated independently.
- ✓ Net force is the sum of all forces acting on an object.

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Classwork – Problem Solving with Newton's Second Law of Motion

$$W = m\,g \qquad\qquad F_{net} = m\,a$$

1. What is the weight of a 2.26 kg bag of sugar?

2. What net force is required to accelerate a 1500 kg car at 3 m/s^2?

3. Draw a free body diagram of a 10 kg rock sitting on the ground. Calculate the net force acting on the rock.

4. Draw a free body diagram of a 10 kg rock as it is lifted straight up with a constant force of 148 N. Calculate the net force acting on the rock and its acceleration.

5. An 8000 kg Navy jet is accelerating upward at 4 m/s^2. Calculate the upward force provided by the jet's engines to achieve this acceleration.

Cooperative Group Role Cards

LEADER

Makes sure that every voice is heard
Focuses work around the learning task

Sound bites:

- *Let's hear from ____ next."*
- *"That's interesting, but let's get back to our task."*

RECORDER

Compiles group members' ideas on collaborative graphic organizer
Writes on the board for the whole class to see during the presentation

Sound bites:

- *"I think I heard you say_____; is that right?"*
- *"How would you like me to write this?"*

TIME KEEPER

Encourages the group to stay on task
Announces when time is halfway through and when time is nearly up

Sound bite:

- "*We only have five minutes left. Let's see if we can wrap up by then."*

PRESENTER

Presents the group's finished work to the class

Sound bite:

- *"How would you like this to sound?"*

ERRAND MONITOR

Briefly leaves the group to get supplies or to request help from the teacher when group members agree that they do not have the resources to solve the problem.

Sound bites:

- *"Do you think it's time to ask the teacher for help?*
- *"I'll get an extra graphic organizer from the shelf."*