

## Sample Inquiry Task at Grade 4

### Developing Extended Response (ER) Tasks as Hands-On Investigations

The purpose of this section is to provide a sample of what grade 4 investigations might look like, using the NECAP Planning Guide for Investigations as a model for ER task design.

#### Sample Grade 4 Investigation - Force and Motion Assessment

In this investigation, students are asked to find out how the force needed to move objects up a ramp (hill) change when the ramp gets steeper.

**Materials:** adjustable ramps and ladders for changing heights of ramps, rulers for measuring heights, washers for adding weight, string, paper clips for attaching washers to strings, and small cars.

**Grade Level:** 4  
**Extended Response Task:** Up the Hill – Force & Motion Assessment

**Item Types:** SAs and 3-CRs

**Testing Session:** 3

**Alignment to INQ Assessment Target(s):**

**FOCUS:** PS3 (K-4)-INQ+SAE –7

Use data to predict how a change in force (greater/less) might affect the position, direction of motion, or speed of an object (e.g., ramps and balls).

**Depth of Knowledge:** Levels 1, 2, and 3

### Sample Elementary School ER Task: “Up the Hill”

**Part 1:** In part 1, you will answer some questions about what you have learned regarding forces and motion. Read the questions carefully and write down your answers.

1a) A heavy truck and a light car are stopped on a road. Explain what is needed to get the vehicles to move.

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1b) Explain the relationship between the weight of each of the vehicles, the truck and the car, and what is needed to get each vehicle to move.

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**Part 2:** In part 2, you will work (with a partner) to investigate the effects of force on a moving car.

## “Up the Hill”

Alex and Mia were in their family’s car one day, driving to a favorite summer campground. When the car started to travel up a hill, they noticed that the engine seemed to get louder. Mia thought about the force and motion ideas that her class investigated before school closed for the summer. She wondered if the engine got louder because the car needed more force to go up the hill. When she shared her ideas with Alex, he said, “I think you have a good prediction Mia, but we can’t test it because experimenting with a car engine would be too dangerous.”

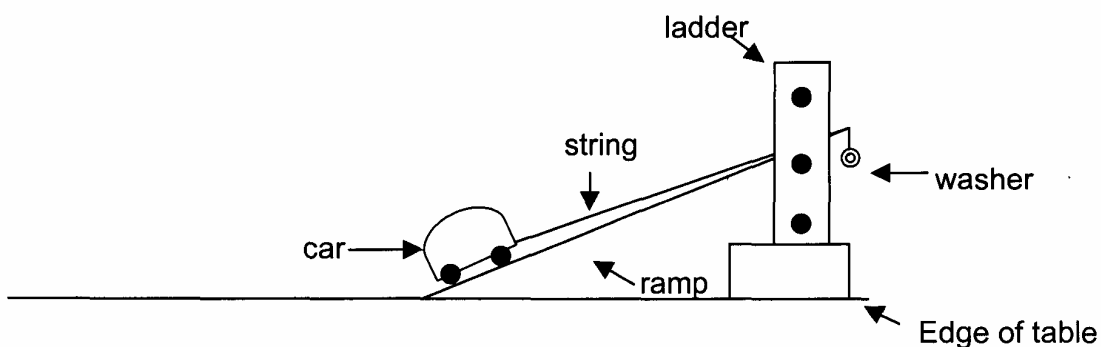
Mia agreed, but she added, “We could experiment with a toy car as a model and see if the amount of force needed to move the car up a ramp **changes** when you make the ramp (hill) steeper. Since Alex and Mia will be camping for the next couple of weeks, they are depending on you to complete the investigation for them.

Your investigation question is: **Does the force needed to move a toy car up hill change when the hill gets steeper?**

Look at the equipment that is in front of you. The drawing below shows how you will set up the equipment to investigate the force needed to move the vehicle up the ramp. You will change the **amount of force** by changing the number of washers attached to the string. More washers on the string will provide more force to pull the car up the ramp.

You will use these materials to try out some ideas that you have about using force to move vehicles up the hill.

### Materials for Ramp Investigations



2) Predict how the amount of **force** changes if you need to move the vehicle up a steeper ramp (or hill)? **Explain** your prediction.

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**Part 3:** You will now conduct an experiment to test your prediction. Use the materials in front of you and the drawing to set up your investigation.

**Read over the steps that you will follow:**

Your investigation will test the force needed for three different ramp heights.

1. Measure the first height of the ramp and record it on your recording sheet.
2. Add force (washers) to the end of the string until your car begins to move. Under Trial 1, record the number of washers (force) needed to move the car. Then, remove all washers.
3. Keep the height of the ramp the same and repeat the same steps. Under Trial 2, record the number of washers (force) needed to move the car. Then, remove all washers.
4. Now change the height of the ramp and repeat the same steps. Under Trial 1, record the number of washers (force) needed to move the car at this ramp height. Then, remove all washers.
5. Continue until you have tested 3 different ramp heights.

3) What will you be doing to make sure that your experiment is a fair test?

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4) Record data from your experiment here.

***Recording Sheet for Uphill Vehicle Experiment***

<b>Height of the Ramp</b>	<b>Amount of Force Needed Trial 1</b>	<b>Amount of Force Needed Trial 2</b>

**Part 4 (Individual Work):** Now you will be asked to use the data that you collected when you investigated the relationship between the steepness of

the hill and the amount of force needed to move a vehicle up the hill. Use your data from your investigation to answer the following questions.

5) Look at the information in your chart and summarize your results. What did you discover about the force needed to move a vehicle uphill when you make the hill steeper? **Use data from your chart to help you explain.**

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6) Look back at your prediction (in question 2). Explain how the data either supported or did not support your prediction.

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7) How can you use what you learned about moving an object up a hill to learn more about force and motion? Write a new question you can test with an investigation about the amount of force needed to move an object in another way? Use what you learned from your experiment to **explain the reason for your answer.**

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