Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hour \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Purple **Graphing Kinetic and Potential Energy**

**Unit Essential Question \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Objective:** I can describe the relationship between mass, speed and kinetic energy using a graphical displays highlighting patterns over time.

**Step 1** Watch “eureka 9 kinetic energy” on YouTube, https://www.youtube.com/watch?v=BGmUVoX5s58&t=1s and answer the following questions. (Link is also on my blog)

1. What is kinetic energy?

2. What is a joule?

3. What is the Greek word for movement?

**Step 2:** Go to the Roller Coaster Simulator, https://dptv.pbslearningmedia.org/resource/hew06.sci.phys.maf.rollercoaster/energy-in-a-roller-coaster-ride/ (link is also on my blog)

1. Watch the simulation.

2. Click on the “step” button to display the different positions on the track.

3. Using knowledge from the video answer the following:

A. Which position do you think will have the greatest kinetic energy (traveling the fastest) and explain why?

B. Which position will have the least kinetic energy (traveling the slowest) and explain why.

C. At position two, will more riders give the car more kinetic energy or less, explain why.

**Step 3 Graphing**

1. Read the background information. Highlight or underline the definitions of kinetic and potential energy. Answer the questions as you read.

**Storyline:** As a NASA engineer, you are designing transport vehicles to be used in future interplanetary missions. The transport vehicle will be traveling very fast when it hits the surface of the planet. As we design our vehicle we must consider.

-How much energy will be transferred to the vehicle at impact?

-How does it change with the size and speed of the lander?

- Which is the more IMPORTANT factor? Should we focus on making our vehicle lighter or worrying about its velocity?

In physics, Kinetic Energy is the energy an object has BECAUSE of its motion. Kinetic energy is also a measure of how much change an object can cause. A larger moving object will do more damage (cause more change) than a smaller moving object. A faster moving object will do more damage (cause more change) than a slower moving object.

BONUS INFO\*\* The **graph** of a **linear** function is a straight line. The equation of a **non-linear** function has at least one exponent higher than 1, and the **graph** of a **non-linear** function is a curved line

**Graphing:** Below is some experimental data that our NASA research scientist determined for the KINETIC ENERGY of the impact of our lander.

|  |  |  |  |
| --- | --- | --- | --- |
| **Mass (kg) experimental lander velocity= 50 m/s (about 100 mph)** | **Energy (kJ)** | **VELOCITY (m/s) experimental lander mass = 1000 kg (about 2200 lbs)** | **Energy (kJ)** |
| 200 kg | 250 kJ | 10 m/s | 50 kJ |
| 400 kg | 500 kJ | 20 m/s | 200 kJ |
| 600 kg | 750 kJ | 30 m/s | 450 kJ |
| 800 kg | 1,000 kJ | 40 m/s | 800 kJ |
| 1000 kg | 1,250 kJ | 50 m/s | 1,250 kJ |
| 1200 kg | 1,500 kJ | 60 m/s | 1,800 kJ |
| 1400 kg | 1,750 kJ | 70 m/s | 2,450 kJ |
| 1600 kg | 2,000 kJ | 80 m/s | 3,200 kJ |

2. The yellow and purple seats will graph Mass vs. KE. The red and green seats will graph Velocity vs. KE, and the orange and blue seats gets to choose.

-Label the axes for your data.

-Use the proper scale so that your data fills the entire graph

-plot the points and connect the dots to see the relationship

3. Use **both** graphs to answer the analysis questions

**Analysis Questions: Answer using complete sentences and a restate.**

***True or False***

1. Kinetic energy increases when mass increases

2. Kinetic energy decreases when speed increases.

3. A small object (small mass) can have the same kinetic energy as a large object (large mass) IF its velocity is large enough.

4. The shape of the mass vs. energy graph has a non-linear relationship.

5. The velocity vs. energy graph shows a non-linear relationship.

6. An increase in velocity of 100 m/s leads to a larger increase in kinetic energy than an increase of 100 kg.

***Written Response***

7. What happens to kinetic energy when you increase the mass?

8. What happens to the kinetic energy when you increase the speed?

9. How can a small object (small mass) have the same energy as a large object (large mass)?

10a. what is the shape of the mass vs. energy graph? Is in a linear relationship?

b. What happens when you double the mass?

11a. what is the shape of the velocity vs. energy graph? Is it linear relationship?

b. What happens if you double the velocity?

12. Based on your graphs, discuss the attributes of your future egg drop lander that should be considered in the design: mass of your lander? Or velocity of impact? Use specific evidence from the data to support your claims.

In my future lander, I believe the most important thing to consider is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(mass or velocity). I think this is the most important because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ This is supported by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (information from the activity)

\*\*\*Extra Credit\*\*\* While doing jumping jacks recite Newton’s Third Law of Motion