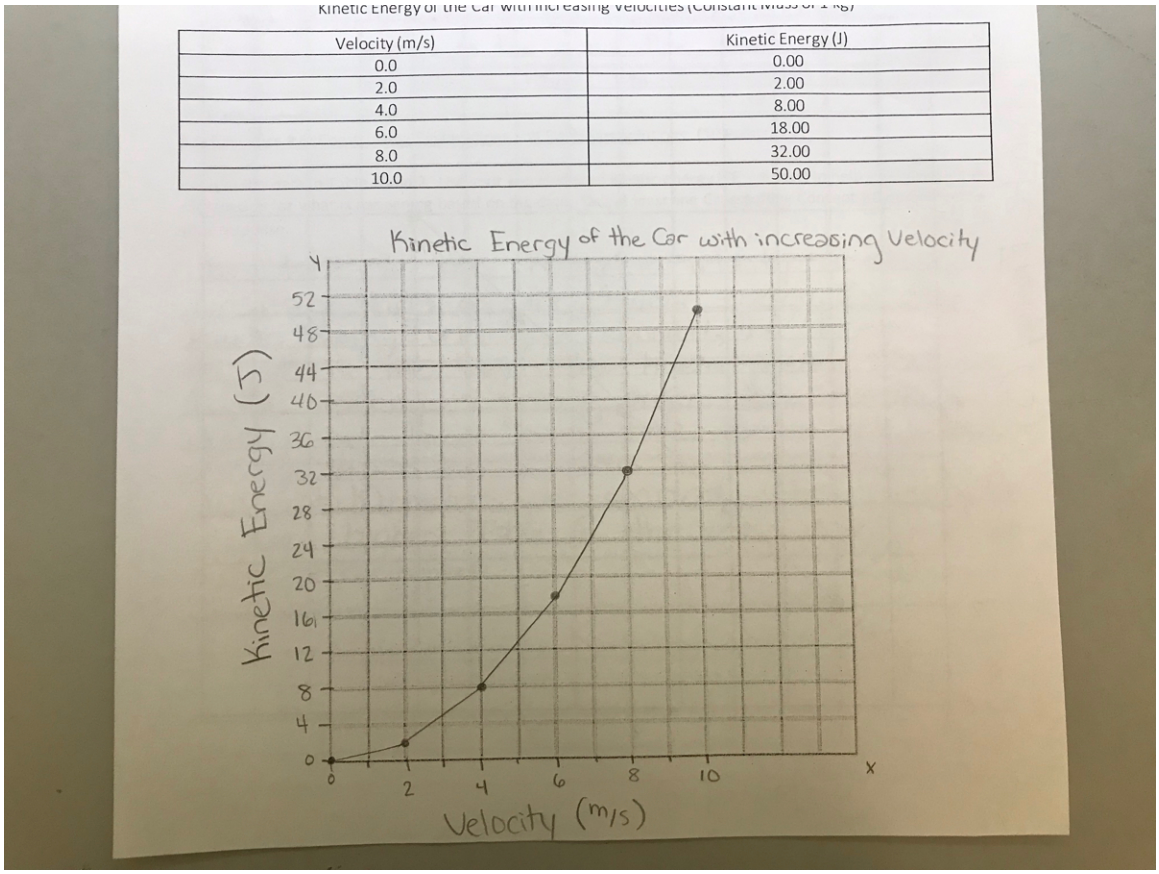
Graphing With NGSS: This graph was drawn by a student in our class. Answer the questions that follow in your lab notebook. Keep your work neat and organized.



Kinetic Energy of the Car with increasing Velocities (Constant Mass of 1 kg)

Velocity (m/s)	Kinetic Energy (J)
0.0	0.00
2.0	2.00
4.0	8.00
6.0	18.00
8.0	32.00
10.0	50.00

1. On a recent NGSS benchmark, a student made the amazing graph above. The title of her graph includes both of the variables mentioned in the data table. Name the variables she includes in her title in your lab notebook. (2 pts)

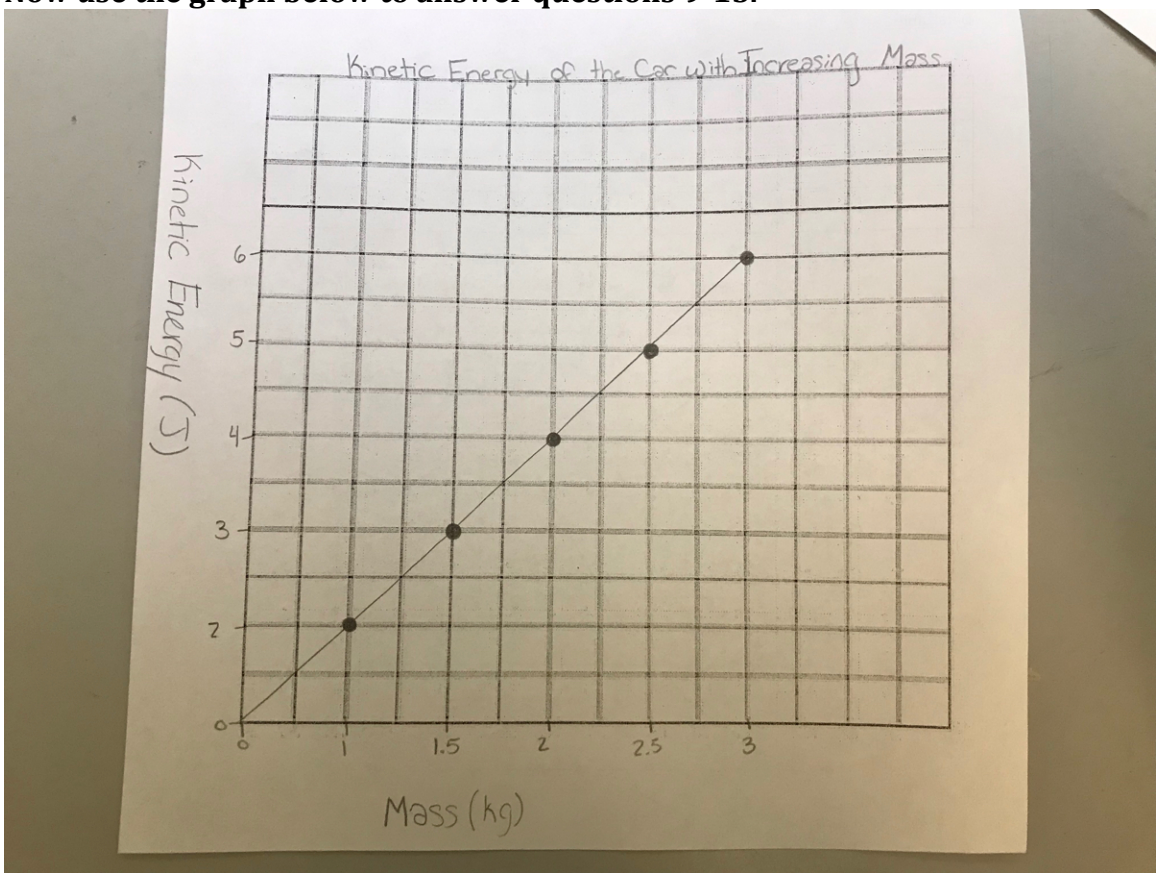
2. She also earned credit for labeling her x and y axis properly. Explain why it is correct to put Kinetic Energy on the y axis. (Why can't you put it on the x axis?)

3. What are the units for KE?
4. What are the units for velocity?
5. What is the formula (also known as the equation) for KE?
6. What is the formula for velocity?

7. We have learned about two types of line graphs in science thus far. One type is a **linear** graph where variables change at a constant rate. Lines can also be **exponential** and curve upwards. This student's graph is (a)_____ because it curves upwards. The formula for KE contains an **exponent** so this makes sense. The exponent in the KE formula is the number (b)_____. It means that you have to square the (c)__v_____ in the formula. (3 pts)

8. Kinetic energy is a measure of an object's _____(use the definition). Velocity is a measure of an object's _____. (2 pts)

Now use the graph below to answer questions 9-15.



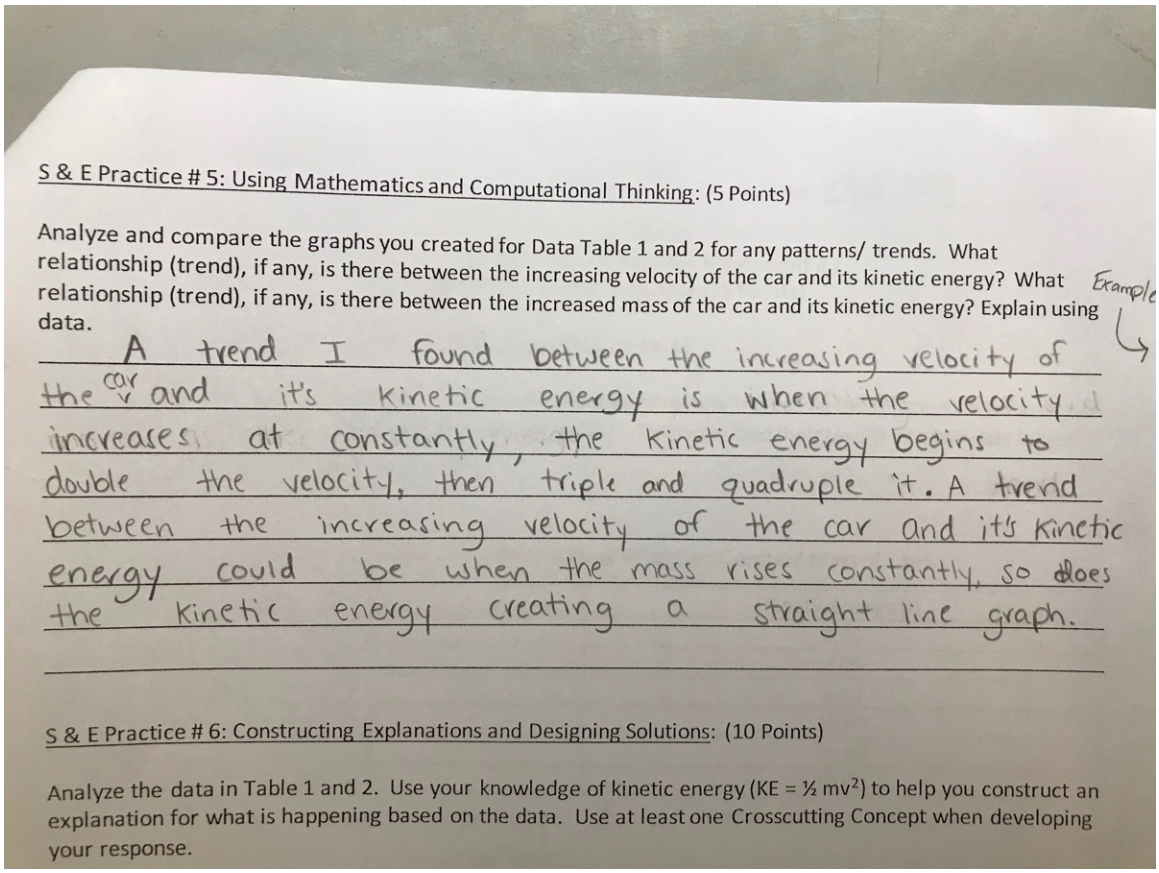
9. The variables on the graph above are _____ and _____. (2 pts)

10. J stands for _____ which is the unit of kinetic energy.

11. Kg stands for kilogram which is a unit of _____. Another word for this variable is heaviness.

12. On earth, there are .454 kilograms per pound. That means that your mass in kilograms would be about half of your weight in pounds. If I have a 50 lb object, its heaviness in kilograms would be about _____. (you can estimate here).

13. Is the graph above linear or exponential?
14. Does the graph above increase at a steady rate? (yes or no)
15. Does this graph's title mention both variables?
16. Which variable is different from the first graph?



S & E Practice # 5: Using Mathematics and Computational Thinking: (5 Points)

Analyze and compare the graphs you created for Data Table 1 and 2 for any patterns/ trends. What relationship (trend), if any, is there between the increasing velocity of the car and its kinetic energy? What relationship (trend), if any, is there between the increased mass of the car and its kinetic energy? Explain using data.

Example

A trend I found between the increasing velocity of the car and it's kinetic energy is when the velocity increases at constantly, the kinetic energy begins to double the velocity, then triple and quadruple it. A trend between the increasing velocity of the car and it's kinetic energy could be when the mass rises constantly, so does the kinetic energy creating a straight line graph.

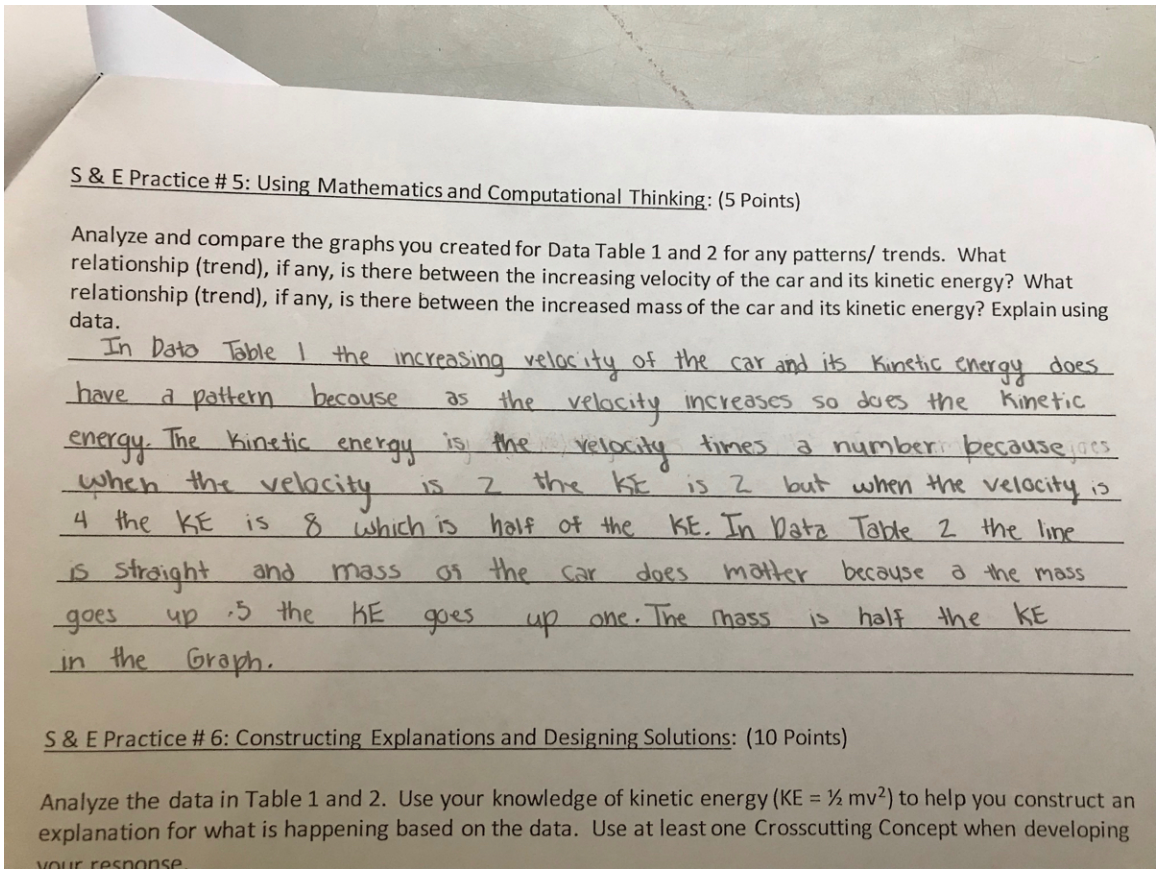
S & E Practice # 6: Constructing Explanations and Designing Solutions: (10 Points)

Analyze the data in Table 1 and 2. Use your knowledge of kinetic energy ($KE = \frac{1}{2} mv^2$) to help you construct an explanation for what is happening based on the data. Use at least one Crosscutting Concept when developing your response.

17. The student above did a pretty good job explaining the relationships between velocity and kinetic energy, as well as mass and kinetic energy. Read her response.

She points out that mass and kinetic energy are linear ("they create a straight line"). She also attempts to describe the exponential relationship between kinetic energy and velocity. She says that it doubles in a given time, then triples, and then quadruples as exponential data does. In other words, it does not increase at a steady rate. It increases at an increasing rate.

What data (use numbers) could the student add to her explanation to provide evidence for the last part of the question? The student above forgot to support her answer with data (numbers) from her graph. (3 pts)



S & E Practice # 5: Using Mathematics and Computational Thinking: (5 Points)

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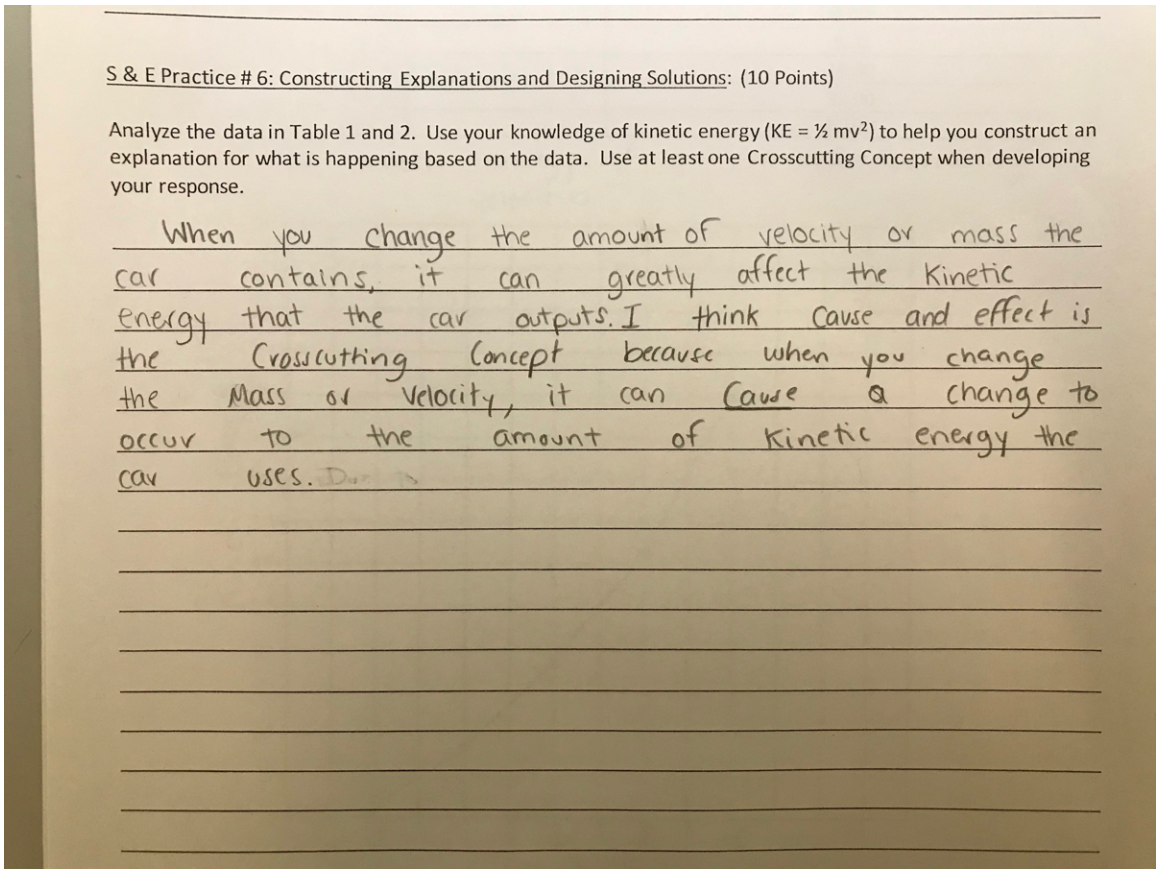
In Data Table 1 the increasing velocity of the car and its Kinetic energy does have a pattern because as the velocity increases so does the Kinetic energy. The Kinetic energy is the velocity times a number because goes when the velocity is 2 the KE is 2 but when the velocity is 4 the KE is 8 which is half of the KE. In Data Table 2 the line is straight and mass of the car does matter because a the mass goes up .5 the KE goes up one. The mass is half the KE in the Graph.

S & E Practice # 6: Constructing Explanations and Designing Solutions: (10 Points)

Analyze the data in Table 1 and 2. Use your knowledge of kinetic energy ($KE = \frac{1}{2} mv^2$) to help you construct an explanation for what is happening based on the data. Use at least one Crosscutting Concept when developing your response.

18. This student also did a pretty good job with Science and Engineering Practice #5. Read the student's response. She clearly states the pattern observed in the graph. What is the pattern she notices? (2 pts)

19. She also uses numbers to explain the relationships between KE and velocity. What could she add about the type of line generated to support her conclusion? Write a sentence about the types of line graphs created using Data Tables 1 and 2. (2 pts)



S & E Practice # 6: Constructing Explanations and Designing Solutions: (10 Points)

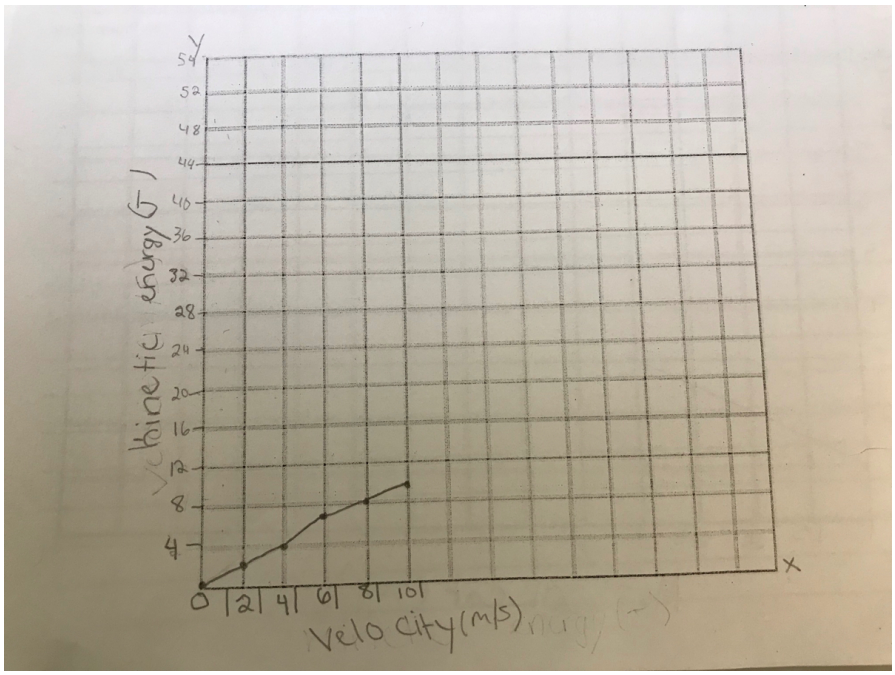
Analyze the data in Table 1 and 2. Use your knowledge of kinetic energy (KE = ½ mv^2) to help you construct an explanation for what is happening based on the data. Use at least one Crosscutting Concept when developing your response.

When you change the amount of velocity or mass the car contains, it can greatly affect the Kinetic energy that the car outputs. I think Cause and effect is the Crosscutting Concept because when you change the Mass or Velocity, it can Cause a change to occur to the amount of Kinetic energy the car uses.

20. S & E practice #6 is worth 10 points. This student got off to a great start. What crosscutting concept did this student focus on?

21. What are the other crosscutting concepts you've studied in grades 6 and 7 (if you don't remember look at the posters along the cabinets). List them in your notebook (7 pts).

22. This person lost several points because they don't use the definitions of KE and velocity to help explain Cause and Effect. Why does it make sense that KE will go up when v increases *based on the definitions*? (at least 2 sentences for 4 points).



23. The student above is an intelligent person who has proven previously that he can make stellar graphs. What are two things this student did well?

24. What are two things this student could improve?

25. One flaw with this graph is that the data points are unfortunately incorrect. It would show a curved graph if the student had plotted (4,8), (6,18), etc…as laid out on the first chart. What type of graph creates a curved line (we've mentioned this several times now)?

26. Nice Job! Make sure your work is neat and that you have answered all of the questions. Also, make sure that you have titled and dated this activity.