

Applying Understanding

Hinge Point Question Exemplars

What A Good One Looks Like

Example 1 Secondary Science

This is a good hinge point question as there are multiple correct answers.

Which of these is/are a molecule:

1. Salt (Sodium Chloride)
2. Carbon Dioxide
3. Iron Oxide
4. Oxygen
5. Water

This is a good hinge point question as there are multiple incorrect answers which have been chosen as this is where a common alternative conception about the idea exists

This is a good hinge point question as molecules are an area of science many students get confused about.

This is a good hinge point question as the students can respond in less than two minutes and the teacher could quickly decide from responses who did or did not understand the concept

This is a good hinge point question as it would not be easy to guess the two correct responses (2, 4 and 5), and different combinations of answers would point to students having different kinds of misconceptions

Applying Understanding Hinge Point Question Exemplars What A Good One Looks Like Example 2 Primary Science

This is a good hinge point question as there are multiple correct answers.

Which of the following is true about the Moon?

- A. It reflects light.
- B. It orbits the earth.
- C. It can't be seen during the day because there is too much light.
- D. It has no gravity.

This is a good hinge point question as students have alternative ideas about the Moon.

This is a good hinge point question as there are multiple incorrect answers which have been chosen as this is where a common alternative conception about the idea exists

This is a good hinge point question as it would not be easy to guess the two correct responses (A and B), and different combinations of answers would point to students having different kinds of misconceptions

This is a good hinge point question as the students can respond in less than two minutes and the teacher could quickly decide from responses who did or did not understand the concept

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Example 2 Secondary Maths

- **Factorise fully ...**

$$60a + 12$$

A. $6(10a + 2)$

B. $3(20a + 4)$

C. $2(30a + 6)$

D. $12(5a + 1)$

This has the potential to be a good hinge point question as the students can respond in less than two minutes and the teacher could quickly decide from responses who did or did not understand the concept

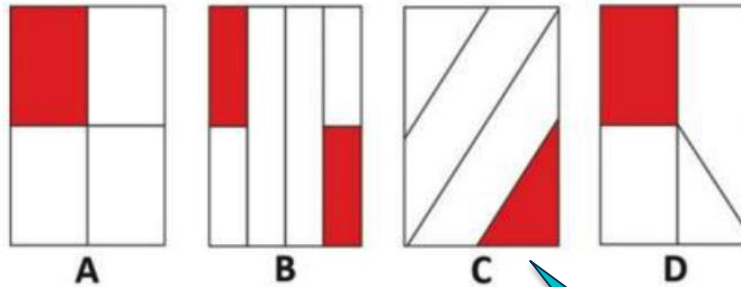
This has the potential to be a good hinge point question as students have alternative ideas about factorising.

This is a not good hinge point question as there is a 20% chance that a student could guess the correct answer

Applying Understanding Hinge Point Question Exemplars What A Good One Looks Like Example 2 Primary Maths

This is a good hinge point question as there are multiple correct answers.

In which of the following diagrams is one-fourth of the total area shaded?



This is a good hinge point question as students have alternative ideas about fractions.

This is a good hinge point question as it would not be easy to guess the three correct responses (A, B and D), and different combinations of answers would point to students having different kinds of misconceptions about fractions

This is a good hinge point question as the students can respond in less than two minutes and the teacher could quickly decide from responses who did or did not understand the concept

Physics Exemplars – Energy 1 – Troublesome Knowledge – Factors Affecting Kinetic Energy

Answer A is there because this is one of the big misconceptions students have with this concept, that all objects accelerate at the same rate.

- An apple of 200g and an apple of 300g fall at the same time from a tree. Which of the following statements is/are correct?

A. The heavy apple falls faster.

B. The heavy apple has more kinetic energy.

The heavy apple hits the ground first.

B. They both hit the ground at the same time.

Answer C is there to complement answer A and see if they do have the common misconception that heavy objects fall faster than light objects.

This question has been written because from experience I know that many students struggle with forces and motion; especially ideas about objects accelerating at the same rate when falling and factors that affect kinetic energy



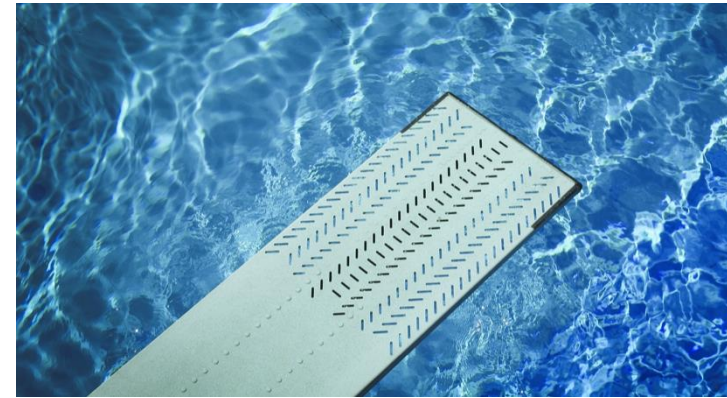
Answers B and D are the correct answers and are there to check whether students know what affects the amount of kinetic energy an object has as well as how it moves when a constant force is acting.



Physics Exemplars – Energy 2 – Troublesome Knowledge – Gravitational Potential Energy

- A diver is standing two meters from the edge of the diving board. Which of the following affects the amount of gravitational potential energy the diver has?
- A. The diver has no gravitational potential energy as they are not falling.
- B. The mass of the diver.
- C. The height of the diving board.
- D. The shape the diver makes when they dive.

Why do you think this question was chosen?
What are the reasons for all of the different alternative answers?

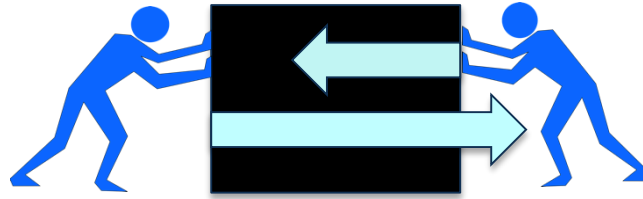


Physics Exemplars – Forces 1 – Troublesome Knowledge – Forces on a Moving Object

- A tennis ball is moving through the air.
Which of the following statements is/are correct?
- A. There are no forces acting on the tennis ball.
- B. The only force acting on the ball is weight.
- C. There are two forces acting on the ball
gravity and a force in the direction it is
moving.
- D. There is no forward force acting on the ball.



Physics Exemplars – Forces 2 – Troublesome Knowledge – Resultant Forces



- Two people are pushing a block as shown in the diagram. Which of the following statements is/are correct?
 - A. The person on the left pushes harder so the block will move towards the right.
 - B. There are no forces acting on the block and it will stay still.
 - C. The forces balance out so the block stays still.
 - D. The resultant force is to the right so the block moves in that direction.

Physics Exemplars – Motion 1 – Troublesome Knowledge – Constant Force and Motion

- A skater pushes a bobsleigh with a constant force across the ice. Which of the following statements is/are correct?
- A. The speed of the bobsleigh stays the same.
- B. The speed of the bobsleigh increases for a short time then it reaches a steady speed.
- C. The bobsleigh will keep getting faster all the time the skater pushes.
- D. The skater will have to run faster to keep up with the accelerating bobsleigh.



Physics Exemplars – Motion 2 –

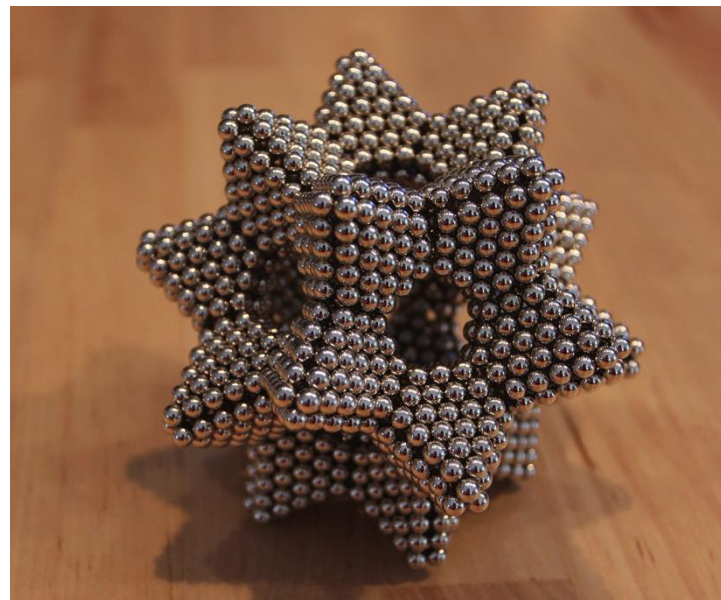
Troublesome Knowledge – Horizontal and Vertical Vectors of Motion

- When a skydiver jumps from a plane. Which of the following statements is/are correct?
 - A. The diver drops vertically straight down to Earth.
 - B. The diver drops in a forwards arch towards the Earth.
 - C. The diver drops in a backwards arch towards the Earth.
 - D. The diver accelerates towards the Earth.
 - E. The diver will reach a steady speed after falling for some time.



Physics Exemplars – Magnetism 1 – Troublesome Knowledge – Magnets

- Which of the following statements is/are correct about magnets?
 - A. All metals are attracted to a magnet.
 - B. All silver colored items are attracted to a magnet.
 - C. Objects can lose their magnetism when heated.
 - D. All magnets are made of iron.
 - E. Larger magnets are stronger than smaller magnets.
 - F. Some materials can be magnetised by placing them in a magnetic field.



Physics Exemplars – Magnetism 2 – Troublesome Knowledge – Electromagnets

- Which of the following statements is/are correct about electromagnets?
 - A. Increasing the number of coils increases the strength of the electromagnet.
 - B. Increasing the current increases the strength of the electromagnet.
 - C. Increasing the size increases the strength of the electromagnet.
 - D. Adding an iron core increases the strength of the electromagnet.

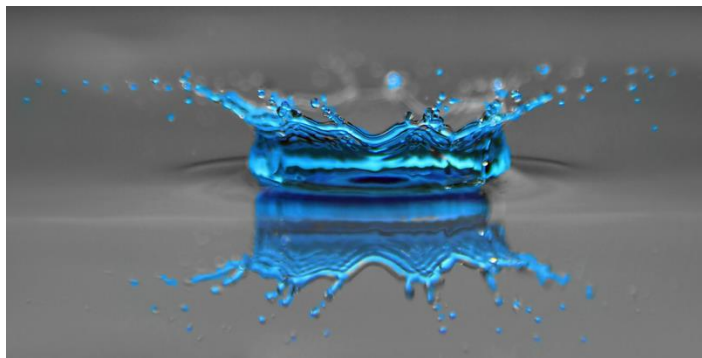


Physics Exemplars – Matter 1 – Troublesome Knowledge – Thermal Energy

- A student has a glass of water with ice cubes in it.
Which of the following statements is/are correct?
- A. The water has more thermal energy than the ice because its molecules are moving faster.
- B. The water and ice have the same amount of thermal energy as they are different forms of the same substance.
- C. The ice doesn't have any thermal energy as it is solid.
- D. The water has more thermal energy and this is why the ice melts.



Physics Exemplars – Matter 2 – Troublesome Knowledge – Characteristic Properties of Substances



Liquid	Boiling Point (°C)	Density (g/mL)	Volume (mL)
1	30	0.67	50
2	64	1.2	100
3	82	0.67	50

- A pupil carries out experiments to determine the properties of three unknown blue liquids and notes their results in a table. Which of the following statements is/are correct?
- A. All of the liquids could be the same substance, the pupil would need to carry out a fair test using the same volume before deciding.
- B. None of the liquids could be the same substance even though two have the same density.
- C. The boiling points are all different so the substances must be.
- D. Liquids 1 and 3 could be the same substance as they have the same density.

Physics Exemplars – Waves 1 –

Troublesome Knowledge – EMS, speed, wavelength and energy

- The electromagnetic spectrum is range of wavelengths or frequencies of electromagnetic radiation from gamma rays to radio waves including visible light. Which of the following statements is/are correct?
 - A. All electromagnetic waves travel at the same speed.
 - B. Different wavelengths of electromagnetic radiation have different amounts of energy and therefore different speeds.
 - C. A radio wave is a sound wave not part of the electromagnetic spectrum.
 - D. Gamma waves have the shortest wavelength and therefore shift more energy.
 - E. Radio waves have the longest wavelength and therefore shift the least amount of energy.



- Pupils are discussing penguins when learning about light.
Which of the following statements is/are correct?

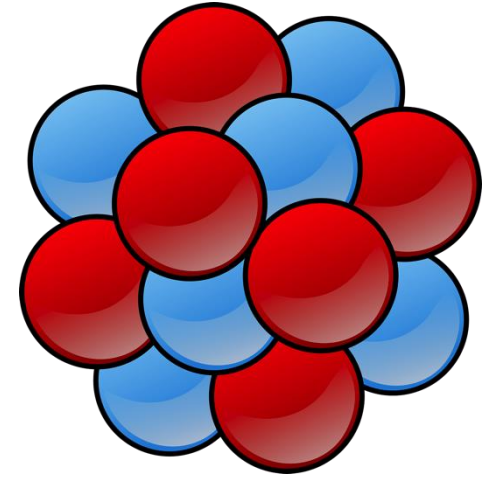
- A. The black parts of the penguin do not reflect any light.
- B. The white parts of the penguin do not absorb any light.
- C. The black parts of the penguin do reflect light.
- D. The white parts of the penguin do absorb light.
- E. Only the orange parts of the penguin reflect light.



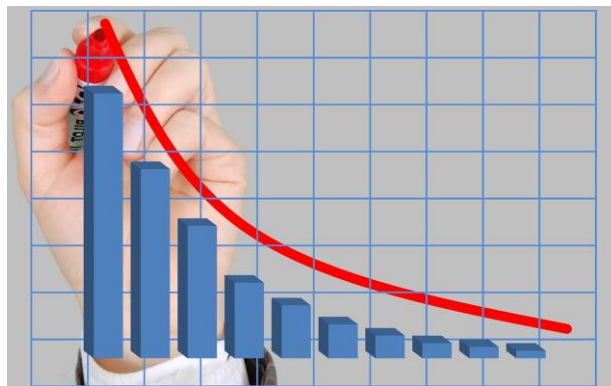
Physics Exemplars – Radiation 1 – Troublesome Knowledge – Radioactive Decay

- Radioactive decay is when nuclei spontaneously disintegrate to become more stable. Which of the following statements is/are correct?

- A. When a nucleus decays a new element is formed.
- B. When a nucleus decays it disappears.
- C. When a nucleus decays it becomes more stable.
- D. Most radioactive substances go through a number of decays before they become stable.
- E. All atoms in a radioactive substance will decay.



Physics Exemplars – Radiation 2 – Troublesome Knowledge – Half Life



- The teacher did an experiment and the pupils plotted the graph of the half life of radon gas. Which of the following statements is/are correct?
 - A. The half life is half the time for the radioactivity to disappear.
 - B. Half life is the time it takes for radioactivity to decrease by half.
 - C. Substances with a longer half life than radon are more dangerous.
 - D. The half life for radon always stays the same.
 - E. If you had more radon the half life would increase.