

Changes in matter

1. Does each of the following phenomena describe a physical change, a chemical change or a nuclear transformation? Explain your answers.
- a) Litmus paper turns red in a vinegar solution.
 - b) A rail on a railway track expands on a hot day.
 - c) Skin tans when exposed to ultraviolet rays from the sun.
 - d) The sun shines because its mass decreases by 6.3×10^{14} kg every second.
 - e) An egg cooks in a frying pan.
 - f) Salt scattered on roads deices them.

Chemical changes: _____

Physical changes: _____

Nuclear transformations: _____

[___ /6]

2. Identify the chemical changes in the following list, and for each change, write at least one sign that justifies your choice.
- a) A candle burns, making the wax melt.
 - b) Frost forms on a car windshield in winter.
 - c) Vinegar makes milk curdle.
 - d) Iron turns red when heated.
 - e) Wild strawberries ripen at the end of June.
 - f) Sugar crystals form in syrup that is too thick.
 - g) Baking powder makes a cake rise.



Name: _____ Group: _____ Date: _____

Chemical change	Sign
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

[___ /4]

3. Write the chemical equation for each of the following reactions. Make sure your equations are consistent with the law of conservation of mass.

a) Production of lime:

Calcium (Ca) reacts with molecular oxygen (O₂) to form calcium oxide.

b) Production of alumina:

Aluminum (Al) reacts with molecular oxygen (O₂) to form aluminum oxide.

c) Production of magnetite:

Iron (Fe) reacts with molecular oxygen (O₂) to form iron oxide.

[___ /6]

4. Jonathan really likes to ask his students riddles in the form of lab demonstrations. The following are two examples:

A. In a porcelain crucible, he heats 10 g of a reddish metallic powder for three minutes at high heat, stirring all the while. The powder turns black. The mass of the hot powder is 10.2 g. After half an hour, the cooled powder is still black, and its mass is still 10.2 g.

B. In a porcelain crucible, he heats 10 g of a blue salt for three minutes at high heat, stirring all the while. The salt turns white. The mass of the hot salt is 8.4 g. After half an hour, the cooled salt turns blue again, and its mass is now 10.0 g.

a) In which of the two demonstrations does a chemical change occur? Explain your answer.

b) What type of chemical change does this reaction illustrate?

[___ /4]

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5. Complete and balance the following equations for neutralization reactions.

- a) $\text{HCl} + \underline{\hspace{2cm}} * \text{KCl} + \text{H}_2\text{O}$
b) $\text{HNO}_3 + \text{NaOH} * \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$
c) $\underline{\hspace{2cm}} + \text{Mg}(\text{OH})_2 * \text{MgBr}_2 + \underline{\hspace{2cm}}$

[___ /3]

6. Which part of the triangle of fire are firefighters tackling in each of the following situations? Explain your answers.

- a) Firefighters at an airport pour foam onto a pool of flammable liquid spilled by an airplane in distress.

- b) Firefighters spray water onto the roofs and sides of two houses next to a blaze.

- c) During a forest fire, firefighters begin clear-cutting a threatened area. They cut a 50-m-wide stretch of forest a few kilometres ahead of the fire.

[___ /3]

7. Fires are often caused by a pan of oil left unsupervised on a stove element. Which type of combustion occurs in this situation? Explain your answer.

[___ /2]

8. Gases are more soluble in cold water than in warm water. The abundant fishing grounds of the North Atlantic, especially the banks of Newfoundland, illustrate this phenomenon. One of the risks of climate change is that such cold ocean waters will warm up, causing a drop in phytoplankton activity. Phytoplankton are microorganisms living on the surface of ocean waters, at a depth of no more than 15 m. They act like plants and are unquestionably the most important of all producers—more important than all the forests on Earth combined. The balance of gases around the world depends on them, making them vital to the survival of most living species.



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- a) Name the chemical reaction that occurs in phytoplankton and write a balanced equation for it.

- b) Explain how a loss of phytoplankton productivity can affect other living species on Earth.

[___ /4]

9. Using the law of conservation of mass, answer the following questions.

- a) Assuming that magnesium and oxygen will react completely with one another, predict the mass of magnesium oxide that will be produced.

Magnesium + Oxygen → Magnesium Oxide

12.12 g + 8.0 g → ? g [___ /4]

- b) Predict the mass of oxygen that will be left after the reaction of 48.6 grams of magnesium with 50.0 grams of oxygen, if 80.6 grams of magnesium oxide is produced.

Magnesium + Oxygen ---→ Magnesium Oxide

10. Balance the following equations.



[___ /40]