

## CHAPTER 2 & 3 WARM-UP

1. What is the definition of energy?
2. What is work?
3. What are the three forms of energy? Give an example of each.
4. Explain chemical potential energy and give an example of a substance with a lot of chemical potential energy.
5. What do we call a chemical reaction if chemical potential energy is released to the environment as heat? (see pg. 382)
6. What do we call a chemical reaction if heat is absorbed from the environment and turned into chemical potential energy? (see pg. 382)
7. What are some units of measuring energy? Which unit is the SI unit?
8. Many chemical reactions require an initial addition of energy to get them started. This is called **activation energy**. Give an example of such a reaction.
9. What is the difference between Cal and cal? What is the difference between a cal and a Joule?
10. What is the *Law of Conservation of Energy*?
11. What are the three temperature scales?  
a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_
12. Which scale is the SI scale for measuring temp?
13. What is the relationship between °C and K?
14. Define matter.
15. What are the 3 common states of matter (ignoring plasma)?
16. What is the “state” when a substance is dissolved in water?
17. What is the difference between physical and chemical properties?
18. What is the difference between physical and chemical changes?
19. What is the *Law of Conservation of Matter*?

20. An **element** is defined as “a substance that cannot be separated into simpler substances by a chemical change.”
- Give 3 examples of elements.
  - Where are elements listed?
  - Since elements cannot be separated into simpler substances, does that mean that they must be the basic building blocks of all matter?
  - Jimmy Hoffa runs an experiment where a substance is broken down into simpler substances. Was the initial substance an element.
  - Give an example of a situation where a substance reacts and is broken down into other substances.
21. A **compound** is defined as “Two or more elements chemically combined into a new substance that has different properties than the elements it is made of”.
- Give 3 examples of compounds.
  - Are physical or chemical changes required to separate the elements that make up a compound? Explain.
  - A sample of the compound ammonium carbonate  $(\text{NH}_4)_2\text{CO}_3$  is broken down into the elements that it is made of. How many elements form?
  - A compound is made between nitrogen (which is a gas) and oxygen (also a gas). Will the compound necessarily be a gas? EXPLAIN.
22. What are **pure substances**?
23. What is a **mixture**? Give an example.
24. Compare and contrast **homogeneous mixtures** vs. **heterogeneous mixtures**.
25. What is another name for homogeneous mixtures?
26. What are 3 ways to separate a mixture into the pure substances it is composed of? Briefly explain how each works.
- - 
  -
27. Elements are made up of \_\_\_\_\_. Define that word!!!
28. Why are there so many different substances in the world if there are only one hundred and something elements?

29. Fill in the following table

	Location	Charge	Mass in amu's
--	----------	--------	---------------

<b>Protons</b>			
<b>Neutrons</b>			
<b>Electrons</b>			

30. Using your answer above, what parts of the atom account for all the mass of an atom?
31. What is atomic number?
32. What are ions?
33. What are isotopes?
34. What is mass number?
35. What is atomic mass?
36. Why is a weighted average used for atomic mass?
37. In this class we will discuss many chemical reactions. Nuclear reactions, including radioactive decay, differ from chemical reactions in what way?

## ABUNDANCE OF THE ELEMENTS

Abundance (Number of atoms per 1,000 atoms)						
Element	Universe	Solar System	Earth	Earth's Atmosphere	Earth's Crust	Human Body
Hydrogen (H)	927	863	Trace	Trace	30	606
Helium (He)	71.8	135	Trace	Trace	Trace	Trace
Oxygen (O)	0.510	0.783	500	210	610	257
Nitrogen (N)	0.153	0.0809	Trace	780	Trace	24
Carbon (C)	0.0811	0.459	Trace	Trace	Trace	106
Silicon (Si)	0.0231	0.0269	140	Trace	210	Trace
Iron (Fe)	0.0139	0.00320	170	Trace	19	Trace

38. What percent of all atoms in the universe are either hydrogen or helium? What percent of all atoms in the solar system are either hydrogen or helium? What percent of the atoms here on earth are either hydrogen or helium?
39. Using gravity in your answer, explain the relatively high abundance of hydrogen and helium in the universe compared to their relatively low abundance on Earth.
40. What is the most abundant element in the Earth's atmosphere? What is the % abundance of this element?
41. Why do you think the most abundant element in the earth's atmosphere is only a trace element here on earth?

## CONVERTING UNITS (SECTION 2-1)

Answers	418,400	$6 \times 10^{-2}$	0.0958	$5.9 \times 10^6$	125,000
	24,806	$2.51 \times 10^{-2}$	198,740	62,760	200,048

Convert each of the following amounts of energy using dimensional analysis. Show allwork & Units

42. 105 J to Cal  
(scientific notation) Answer

43. 47,500 cal to J Answer

44. 0.251 kJ to kcal  
(scientific notation) Answer

45. 401 J to Cal  
(scientific notation) Answer

46. A teaspoon of catsup contains 15 Cal or how many Joules.  
Answer

47. A bagel contains 837,000 J or how many calories  
Answer

48. A pear contains 100 Cal. How many joules is this?  
Answer

49. An apple contains 523 kJ, how many calories is this.  
Answer

50. Bryant consumes 2800 Cal on Monday.  $\frac{1}{2}$  of these Calories come from his lunch. How many joules of energy did he consume at lunch?  
Answer

51. If there are 4.90 Cal in 10.0 g of parsley, how many joules are in 12.1 g parsley?  
Answer

## TEMPERATURE CONVERSIONS (2-2)

Answers	3847	28	294	-61	1337
	173	320	-241	253	1273

52.  $47^\circ\text{C} =$   K      53.  $1000^\circ\text{C} =$   K

54.  $-20^\circ\text{C} =$   K      55.  $-100^\circ\text{C} =$   K

56. 212 K =   $^\circ\text{C}$       57. 32 K =   $^\circ\text{C}$

58. 4120 K =   $^\circ\text{C}$       59. 301 K =   $^\circ\text{C}$

60. Typical room temperature is  $21.0^\circ\text{C}$ . What is room temperature on the Kelvin scale?

Answer

61. Pure gold melts at  $1064^\circ\text{C}$ . What is the melting point of gold in Kelvin's?

Answer

Fill in the following table

	Fahrenheit (°F)	Celsius (°C)	Kelvin (K)
Surface of the Sun	10,000	6,000	
Typical oven temp for baking	325		436
Boiling Point of water	212		
Normal Body Temp	98.6	37.0	
Hottest Ever on Earth (Al'Aziziyah, Libya in 1922)	136		331
Coldest Ever on Earth (Base Vostok, Antarctica 1983)	-129	-89	
Freezing point of Water	32		
Melting point of Ice	32		

Each of the following people has made an error while working with the different temperature scales. Analyze each situation and explain the mistake made.

62. Stacy's recipe for hard candy says to boil the syrup until it is 12°F hotter than the boiling point of water. She heats the syrup to 112°F but the candy does not harden.
63. Al writes the following equalities between the Kelvin and Celsius scales:  
 $-273\text{ K} = 0^{\circ}\text{C}$  ;  $100\text{ K} = 373^{\circ}\text{C}$  ;  $0\text{ K} = 273^{\circ}\text{C}$
64. On an extremely cold day, Stephanie notices there is ice on the ground and reads the backyard thermometer as 16°C.

### MATTER (2-3)

Identify whether each of the following changes is a physical change or a chemical change. Write "P" for physical and "C" for chemical.

- |                         |                      |                           |                      |
|-------------------------|----------------------|---------------------------|----------------------|
| 65. Water boiling       | <input type="text"/> | 66. Leaves changing color | <input type="text"/> |
| 67. Iron rusting        | <input type="text"/> | 68. Cooking a steak       | <input type="text"/> |
| 69. Butter melting      | <input type="text"/> | 70. Water freezing        | <input type="text"/> |
| 71. Alcohol evaporating | <input type="text"/> | 72. Glass breaking        | <input type="text"/> |
| 73. Wood rotting        | <input type="text"/> | 74. Baking a cake         | <input type="text"/> |
75. What is the relationship between the kinetic energy of molecules and their physical state?
76. How would you determine whether a change in matter is a physical or a chemical change?
77. Helium is an inert gas that does not react with other substances to form compounds. Would it be correct to say that helium has no chemical properties? Explain.
78. When fossil fuels are burned, carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O) are produced. What elements must be in fossil fuels?

## ELEMENTS AND COMPOUNDS (2-4)

Identify the following as either an element or a compound.

- |                                       |                      |   |                      |
|---------------------------------------|----------------------|---|----------------------|
| 79. Carbon (C)                        | <input type="text"/> | 80. Water (H <sub>2</sub> O)            | <input type="text"/> |
| 81. Aluminum foil                     | <input type="text"/> | 82. Plastic (Polyethylene, milk jugs)   | <input type="text"/> |
| 83. Tin (Sn)                          | <input type="text"/> | 84. Silicon dioxide (SiO <sub>2</sub> ) | <input type="text"/> |
| 85. carbon dioxide (CO <sub>2</sub> ) | <input type="text"/> | 86. Helium (He)                         | <input type="text"/> |
| 87. Arsenic (As)                      | <input type="text"/> | 88. Sodium chloride (salt – NaCl)       | <input type="text"/> |

## MIXTURES (2-5)

Identify each of the following substances as pure substances, heterogeneous mixtures, or homogeneous mixtures.

- |                   |                      |  |                      |
|-------------------|----------------------|--|----------------------|
| 89. Alphabet soup | <input type="text"/> | 90. Salt (NaCl)  | <input type="text"/> |
| 91. Concrete      | <input type="text"/> | 92. Sea Water  | <input type="text"/> |
| 93. Air           | <input type="text"/> | 94. Paint  | <input type="text"/> |
| 95. Steel         | <input type="text"/> | 96. Sugar (C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> ) | <input type="text"/> |

Answer the following questions.

97. How could you separate a mixture of iron filings and aluminum filings? What property of these metals would allow such a separation?
98. Could distillation be used to separate air into oxygen, nitrogen, carbon dioxide, argon and so forth? Explain.
99. Why is every solution a mixture, but not every mixture is a solution?

### SECTION 3-3

Fill in the following table.

100. How many protons and electrons ( $e^-$ ) are present in a vanadium atom?  
Protons  Electrons
102. How many protons and electrons are present in an argon atom?  
Protons  Electrons
104. How many protons and electrons are present in a platinum atom?  
Protons  Electrons
106. What is the name of the element that has atoms that contain 17 protons?
108. What is the name of the element that has atoms that contain 82 protons?
110. Write the chemical symbol for the ion with 12 protons and 10 electrons.
112. Write the chemical symbol for the ion with 95 protons and 89 electrons.
114. Write the chemical symbol for the ion with 29 protons and 27 electrons.
116. How many protons, neutrons and electrons are present in the  ${}^{91}_{40}\text{Zr}^{+4}$  ion?  
 $P^+$    $N$    $E$
118. How many protons, neutrons and electrons are present in the  ${}^{79}_{34}\text{Se}^{-2}$  ion?  
 $P^+$    $N$    $E$
120. How many protons, neutrons and electrons are present in the  ${}^{13}_6\text{C}^{-4}$  ion?  
 $P^+$    $N$    $E$
122. Write the complete chemical symbol for the ion with 27 protons, 32 neutrons, and 25 electrons.
124. Write the complete chemical symbol for the ion with 31 protons, 39 neutrons, and 28 electrons.
126. Give a possible isotope of gallium-72.
101. How many protons and electrons are present in a strontium-90 atom?  
 $P^+$     $E$
103. How many protons and electrons are present in a potassium atom?  
Protons  Electrons
105. What is the name of the element that has atoms with 5 protons?
107. What is the name of the element that has atoms with 25 protons?
109. What is the name of the element that has atoms that contain 92 protons?
111. Write the chemical symbol for the ion with 74 protons and 68 electrons.
113. Write the chemical symbol for the ion with 33 protons and 36 electrons.
115. How many protons, neutrons and electrons are present in the  ${}^{59}_{28}\text{Ni}^{+2}$  ion?  
 $P^+$    $N$    $E$
117. How many protons, neutrons and electrons are present in the  ${}^{140}_{58}\text{Ce}^{+3}$  ion?  
 $P^+$    $N$    $E$
119. How many protons, neutrons and electrons are present in the  ${}^{45}_{21}\text{Sc}^{+3}$  ion?  
 $P^+$    $N$    $E$
121. Write the complete chemical symbol for the ion with 84 protons, 125 neutrons, and 80 electrons.
123. Write the complete chemical symbol for the ion with 73 protons, 108 neutrons, and 68 electrons.
125. Write the complete chemical symbol for a chlorine-37 atom with a  $-1$  charge.
127. Are Cl-37 and Ar-37 isotopes? Explain.

Fill in the following table completely.

	Symbol	Atomic #	Mass #	# of Neutrons	# of Protons	# Electrons	Charge
128.	$^{13}\text{C}$						
129.		17		18		18	
130.		17		18		17	
131.		26	56			24	
132.			3	2			0
133.	$^{40}\text{Ca}^{+2}$						
134.		50		70			+4
135.	$^{151}\text{Eu}$						

### ATOMIC MASSES & PERCENT COMPOSITION

136. What is atomic mass? Why is it not a whole number?
137. What is the atomic mass of Ti? Of nitrogen? Of zinc?
138. What is the atomic mass of TiO? Of ZnN?
139. Magnesium oxide has the formula MgO. Calculate the % by mass of Mg and of O in MgO.

$$\% \text{Mg} = \frac{\text{mass Mg}}{\text{mass MgO}} \times 100\%$$

$$\% \text{O} = \frac{\text{mass O}}{\text{mass MgO}} \times 100\%$$

140. Using the answers to the problem above, calculate the total mass of a sample if it contains 10 grams of O.
141. A student calculated that if she heated 4 grams of magnesium powder in the presence of oxygen, the mass of the final MgO product would be 8.33. Is she correct? Explain.

### MIXED PROBLEMS – CHAPTER 3 (SHOW ALL YOUR WORK)

Answer 

60.7	$6.0 \times 10^5$	1.63	740	182
------	-------------------	------	-----	-----

142. A runner burns about 10 kcal per minute. If the runner completes a race in one hour and 14 minutes, how many kcal did he burn? How many Calories did he burn?

Answer

--

143. How many grams of pasta would have provided him with enough energy to run the above race? (The energy value of pasta is 17,000 J/g)

Answer



**144.** An electric current is passed through a 68.3 g sample of water to separate it into its component parts. The sample is completely decomposed into hydrogen and oxygen, if 7.6 g of hydrogen is produced, how much oxygen is produced?

Answer

**145.** If burning 1 mL of gas releases  $1.03 \times 10^{-4}$  cal, how many joules of potential chemical energy are in one gallon of gas?

Answer

**146.** Define absolute zero and explain why it has not been reached.

## TOPICS COVERED IN THESE CHAPTERS

### Chapter 2

### Chapter 3

Conservation of Energy and types of energy	Protons, Neutrons and Electrons
Energy in Reactions (endothermic, exothermic, activation energy)	Atoms Vs. Elements
Calories, calories and Joules	Atomic #, Mass #, electrons ( $e^-$ ), protons ( $p^+$ ), neutrons ( $n^0$ )
Temperature (Celsius and Kelvin)	Isotopes
Classes of Matter	<del>Atomic Mass &amp; Weighted Averages</del>
Phys & Chemical Properties and Changes	<del>Radioactivity (Nuclear Rxn's Vs. Chemical Rxn's)</del>
Conservation of Matter	<del>Laws of Conservation of Mass, Constant Comp, &amp; Mult Prop</del>
Elements and Compounds	<del>Expts to discover the structure of the atom</del>
States of Matter	Ions
Mixtures (homogeneous and heterogeneous)	% by mass