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CHEMACTIVITY 1A: ATOMS AND MOLECULES

ANSWERS TO CRITICAL THINKING QUESTIONS

1. 2
2. 2
3. Only one circle
4. More than one atom
5. They have different atoms, They have different numbers of atoms, etc.
6. A molecule is composed of two or more atoms.
7. An observation
8. No---laws are very general
9. Yes. One could observe something that contradicts a law and show that it is invalid.
10. A law summarizes a large number of observations.
11. Boyle's law
12. The law of conservation of mass
13. Theories explain why laws are true.
14. No. Laws summarize observations and theories explain laws.

CHEMACTIVITY 2A: WRITING NUMBERS

ANSWERS TO CRITICAL THINKING QUESTIONS

1. Statement 1
2. Statement 2
3. The one saying Statement 2. This scientist communicated more precision with more digits.
4. Statement 3
5. 0.6 °C
6. Their level of certainty. (The precision.)
7. 3
8. 10^3
9. 3
10. 10^{-3}
11. The number of factors of 10 or 1/10
12. In the boxes starting in the top left blank…
    a. 10·10·10·10·10·10
    b. 10^6
    c. (1/10)· (1/10)· (1/10)· (1/10)· (1/10)· (1/10)· (1/10)
    d. 10^{-7}
13. 5983
14. 5983 = 5.983 × 1000
15. 3
16. 0.00034 = **3.4** ÷ 10000 = **3.4** × (1/10) ×(1/10) ×(1/10) ×(1/10) = **3.4** × 10^{-4}
17.
    a. Write the number as a number between 1 and 10
    b. Determine how many factors of 10 or 1/10 are needed to make the number the same as the original
    c. Write those factors of 10 or 1/10 as the number 10 raised to an exponent
18. 1; 5
19. 3; 5.00
20. 1; 500
21. When a trailing zero is after a decimal point it is significant.
22. 2; 0.0051
23. Leading zeros are not significant
24. 4; 5.003
25. 1) after a decimal point, 2) between non-zero digits
26. Whether the zeros are significant or not
27. Scientific notation
28. (see answer in model)
29. (see table)

5.02 × 89.665 × 0.10 = 45.01183 = **45** (final answer)

3	5	2		2	significant figures
2	3	2		0	# digits after dec. pt.

		s.f.	# digits after decimal pt.
	1. 74	3	2
	11. 8231	6	4
+	12. 651	5	3
	26. 2141		
Final Answer →	**26. 21**	4	2

30. number of significant figures
31. number of decimal places

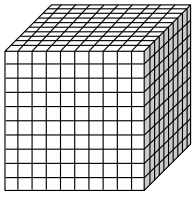
CHEMACTIVITY 2B: UNITS

ANSWERS TO CRITICAL THINKING QUESTIONS

1. m, kg, K
2. kg
3. False. kg is a base unit, and it has a prefix.
4. (answers will vary)
5. m; c; M; n; G
6. mg; nm; ps; dm; µK
7. 2.54
8. 1
9. 1 because the numerator and denominator are equal
10. 1
11. no
12. no; you are multiplying by 1
13. yes; 26.2 cm
14. We wanted to cancel in and keep cm
15. 1) The top and bottom are equal; 2) The units you want are on the top and the units you want to cancel are on the bottom.

CHEMACTIVITY 2C: MORE WITH CONVERSIONS

ANSWERS TO CRITICAL THINKING QUESTIONS

1. 1
2. No
3. $5.4\ \text{ft} \times \left(\frac{12\ \text{in}}{\mathbf{1\ ft}}\right) \times \left(\frac{\mathbf{2.54\ cm}}{1\ \text{in}}\right) = \quad \mathbf{160} \quad \text{cm}$
4. in ; m
5. 3 ft/1 yd; 12 in/1 ft; 2.54 cm/1 in; 0.01 m/1 cm; 1 km/1000m
6. 100 yd×(3 ft/1 yd)×(12 in/1 ft)×(2.54 cm/1 in)×(0.01 m/1 cm)×(1 km/1000m)=0.0914 km
7. A solution map shows the order in which units will be changed, starting with the units given and ending with the desired units.
8. yes; no
9. m^3
10. m/s
11. kg/m^3
12. 0.1 m
13. 0.001
14. no
15. no; 4.5 g = 1 cm^3
16. (1 cm^3/4.5 g) and (4.5 g/1 cm^3)
17. 1590 g × (1 cm^3/4.5 g) = 350 cm^3
18. 1.00
19. 1.00 in^3
20. 2.54 cm
21. 2.54 cm
22. $(2.54\ cm)^3 = 16.4\ cm^3$
23. 16.4
24. Circle both: $\left(\frac{1\ \text{in}}{2.54\ \text{cm}}\right)^3$ $\left(\frac{1\ \text{in}^3}{16.4\ \text{cm}^3}\right)$
25. 10
26. 
27. $(1\ m/10\ dm)^3 = 1\ m^3/1000\ dm = 1\ m^3/1000\ L$
28. 5 m × 8 m × 3 m = 120 m^3
29. $120\ m^3 \times (1000\ L/1\ m^3) = 1.2\times10^5\ L$

CHEMACTIVITY 3A: CLASSIFYING MATTER

ANSWERS TO CRITICAL THINKING QUESTIONS

1. No
2. No
3. Yes (a little)
4. gas
5. Something is compressible if it can be made smaller by squeezing it.
6. stay about the same
7. a lot bigger
8. gas
9. Solid and liquid. Because the gas is much bigger but the same amount of solid and liquid are about the same size.
10. liquid and gas
11. Because solids don't flow, the molecules must not be free to move around each other.
12. Similar to Fig. 3.4 in *Introductory Chemistry*
13. copper pipe
14. copper pipe, sugar
15. copper pipe, sugar
16. No. Sugar has more than one element, but they are all in one molecule.
17. sugar; yes, in the tea contents, etc.
18. tea and vinaigrette dressing
19. Answers will vary. (E.g. *The vinaigrette dressing has oil on top and water on the bottom. It also has other stuff in it.*)
20. tea; dressing
21. Answers will vary

CHEMACTIVITY 3B: CHEMICAL CHANGE

ANSWERS TO CRITICAL THINKING QUESTIONS

1. physical
2. physical
3. physical; melting point is listed in the table as physical, and boiling is a similar process
4. chemical
5. Chemical properties refer to reactivity, while physical properties do not.
6. physical
7. no
8. chemical
9. yes
10. In chemical change a new compound is formed.
11. chemical; a new compound is formed
12. 58 g butane, 208 g oxygen
13. 176 g carbon dioxide; 90 g water
14. 266 g
15. 266 g
16. the compounds present
17. the mass
18. 4.184
19. 4184
20. 3.60×10^{6}
21. J < cal < Cal < kWh
22. (4.184 J/1 cal)
23. 115 Cal × (1000 cal/1 Cal) × (4.184 J/1 cal) = 4.31×10^{5} J
24. Energy moves from the car to the air as heat.
25. reactants
26. given off
27. given off
28. absorbing
29. the product it goes uphill by absorbing energy
30. Similar to the second part of figure 3.16 in *Introductory Chemistry*

CHEMACTIVITY 3C: TEMPERATURE AND HEAT

ANSWERS TO CRITICAL THINKING QUESTIONS

1. 180 °
2. 100 °
3. 100 °
4. Celsius and Kelvin
5. A degree Celsius because there are fewer of them between freezing and boiling, so each one must be bigger
6. Yes, they are just shifted by 273
7. K = °C + 273.15 = 100 + 273.15 = 373.15 °C. Yes, it is consistent.
8. °C = (°F-32)/1.8
9. (212 °F-32)/1.8 = 100 °C
10. (70 °F -32)/1.8 = 21.1 °C
11. °F = 1.8 ×°C + 32
12. (1.8)(21.1) + 32 = 69.98 °F
13. Twice as much material should take twice as much heat. 4.184 × 2 = 8.368 J
14. Temperature change is 17 times greater, so it should take 17 times as much heat 4.184 × 17 = 71.13 J
15. Both have doubled so it should take four times as much heat 4.184 × 2 × 2 = 16.74 J
16. 37 times the temperature and 250 times the amount… 4.184 × 37 × 250 = 38.7 kJ
17. *q*; *m*; *C*; Δ*T*
18. 4.184 J/g °C
19. q = (2 g)(4.184 J/g °C)(2 °C) = 16.74 J
20. yes
21. yes
22. q = (2 g)(0.903 J/g °C)(2 °C) = 3.612 J
23. aluminium; it takes less heat to warm it by 1 °C, so the same amount of heat will warm it more
24. It is the ability of a substance to absorb heat without changing temperature.