Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Unit Review Sheet

Short Answer

Give the number of protons, electrons, and neutrons in each of the following atoms.
Atomic number = number of protons = number of electrons
Number of neutrons = mass number – atomic number

1. $^{108}_{47}Au$

2. $^{40}_{20}Ca$

3. $^{23}_{11}Na$

Name each isotope, and write it in symbolic notation.

4. atomic number 26; mass number 56

5. atomic number 29; mass number 64

6. atomic number 17; mass number 37

How many protons, electrons, and neutrons are in each of the following isotopes?
Atomic number = number of protons – number of electrons
Number of neutrons = mass number – atomic number

7. uranium-235

8. hydrogen-3

9. silicon-29

10. How many neutrons does europium-151 have? What is the isotope's mass number?
Number of neutrons = mass number – atomic number

11. How many more neutrons does thorium-230 have than protons? How many electrons does thorium-230 have?
Number of neutrons = mass number – atomic number

Give the mass number of each isotope.
Number of neutrons + number of protons = mass number

12. *Be* with 5 neutrons

13. *Ga* with 39 neutrons

14. *Si* with 16 neutrons

15. *Ti* with 26 neutrons

Give the atomic number of each isotope.

16. magnesium-25

17. bromine-79

18. antimony-121

19. Magnesium has three isotopes. Magnesium-24 has a percent abundance of 78.99%. Magnesium-26 has a percent abundance of 11.01%. What is the percent abundance of magnesium-25? Assume that there are no other magnesium isotopes.

20. List the sequence in which the following orbitals fill up: 1s, 2s, 3s, 4s, 5s, 6s, 7s, 2p, 3p, 4p, 5p, 6p, 7p, 3d, 4d, 5d, 6d, 4f, 5f.

21. Which element has the ground-state electron configuration $[Kr]5s^2 4d^{10} 5p^4$?

22. Which element has the ground-state electron configuration $[Ar]4s^2 3d^{10}$?

Write electron-dot structures for the following atoms.

23. $[Ne]3s^2 3p^3$

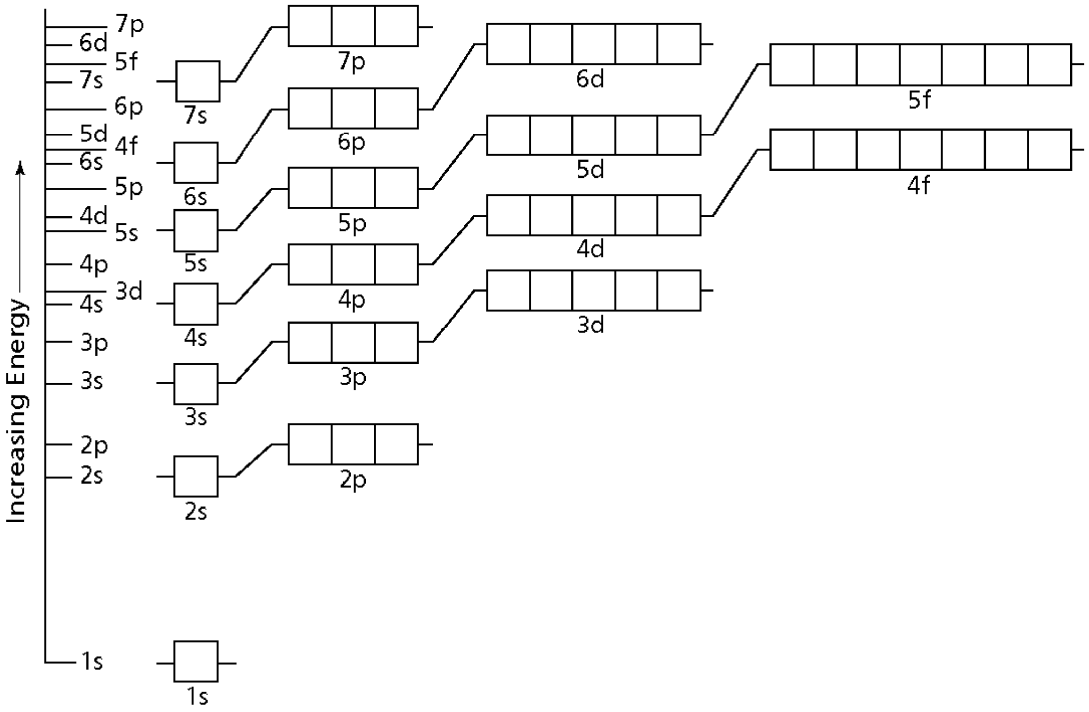
24. [Ar]4s23d3

25. potassium

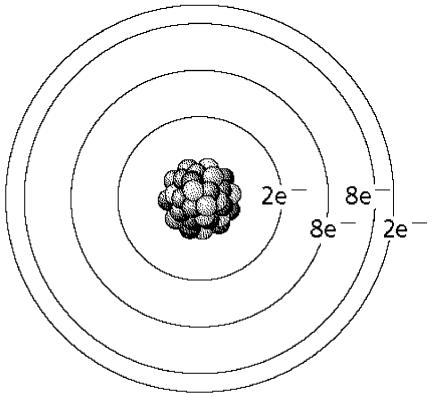
26. Complete the following table.

Element	Symbol	Orbitals					Electron Configuration
		1s	2s	$2p_x$	$2p_y$	$2p_z$	
a. Nitrogen							$1s^2 2s^2 2p^3$
b.	F	↑↓	↑↓	↑↓	↑↓	↑	
c. Carbon							
d.							$1s^2 2s^1$

27. Complete the orbital diagram for arsenic.



Use the figure below to answer the following questions.



28. How many valence electrons does an atom of this element have?

29. What is the atom's electron-dot structure?

30. If enough energy was added to remove an electron, from which energy level would the electron be removed? Explain your answer.

What is the ground-state electron configuration of each of the following atoms? Use noble-gas notation.

31. selenium

32. krypton

33. chlorine

What is the highest energy level (n) that is occupied in the following elements?

34. He

35. Ca

36. Sn

Write the electron configuration for each element described below and identify the element.

37. an element that contains 8 electrons

38. an element that contains 14 electrons

Problem

39. An 18-g sample of element A combines completely with a 4-g sample of element B to form the compound AB. What is the mass of the compound formed?

40. A substance breaks down into three component elements when it is heated. The mass of each component element is listed in the table below. What was the mass of the substance before it was heated?

Component	Mass (g)
A	39.10
B	59.94
C	64.00

41. During a chemical reaction, 2.445 g of carbon reacts with 3.257 g of oxygen to form carbon monoxide gas. How many grams of carbon monoxide are formed in this reaction?

42. During a chemical reaction, 4.032 g of hydrogen combined with oxygen to form 36.032 g of water. How many grams of oxygen reacted?

Nitrogen and oxygen combine to form different compounds, as shown below.

Compound	Chemical Formula	Mass N/1g O
Nitric Oxide	NO	1.76 g
Nitrogen dioxide	NO_2	0.88 g
Nitrous oxide	NO_4	0.44 g

What is the ratio of the masses of nitrogen in each of the following?

43. NO_2/NO_4

44. NO/NO_4 =

45. NO/NO_2 =

46. Phosphorus and chlorine combine to form two different compounds. In one compound, 3.88 g of phosphorus combines with 13.28 g of chlorine. In the other compound, 1.32 g of phosphorus combines with 7.56 g of chlorine. Do these data support the law of multiple proportions? Show your work.

47. Fluorine and xenon combine to form two different compounds. In one compound, 0.853 g of fluorine combines with 1.472 g of xenon. In the other compound, 0.624 g of fluorine combines with 2.16 g of xenon. Do these data support the law of multiple proportions? Show your work.

48. The chemical formula for baking soda is $NaHCO_3$. A 168.02-g sample of baking soda contains 45.98 g of sodium, 2.02 g of hydrogen, 24.02 g of carbon, and 96 g of oxygen. What is the mass percentage of each element in baking soda?

49. The chemical formula for chalk is $CaCO_3$. A100-g sample of chalk contains 40 g of calcium, 12 g of carbon, and 48 g of oxygen. What is the mass percentage of each element in chalk? What would be the mass of calcium in 200 g of chalk?

50. A 17-g sample of ammonia, NH_3, contains 3 g of hydrogen. What percentage of ammonia is hydrogen? How many grams of nitrogen does the sample contain?

51. Orange light has a frequency of $4.8 \times 10^{14}\ s^{-1}$. What is the energy of one quantum of orange light?

52. Which is greater, the energy of one photon of orange light or the energy of one quantum of radiation having a wavelength of 3.36×10^{-9}m?

53. Use the relationships $E = hv$ and $c = \lambda v$ to write E in terms of h, c, and λ.

54. A radio station emits radiation at a wavelength of 2.90 m. What is the station's frequency in megahertz?

55. Silver iodide powder has been used as an antiseptic and as an agent to seed clouds for rain. Silver iodide is 45.9% silver by mass. If you separate a 50-g sample of silver iodide into its elements, silver and iodine, how much silver would you have?

56. Ibuprofen has the chemical formula $C_{13}H_{18}O_2$. It is 75.69% carbon, 8.80% hydrogen, and 15.51% oxygen. How many mg of carbon does a 200-mg tablet of ibuprofen contain?

Unit Review Sheet
Answer Section

SHORT ANSWER

1. ANS:
   47 protons, 47 electrons, 61 neutrons
   (108 – 47 = 61)

   PTS: 1
2. ANS:
   20 protons, 20 electrons, 20 neutrons
   (40 – 20 = 20)

   PTS: 1
3. ANS:
   11 protons, 11 electrons, 12 neutrons
   (23 – 11 = 12)

   PTS: 1
4. ANS:
   iron-56; ${}^{56}_{26}Fe$

   PTS: 1
5. ANS:
   copper-64; ${}^{64}_{29}Cu$

   PTS: 1
6. ANS:
   chlorine-37; ${}^{37}_{17}Cl$

   PTS: 1
7. ANS:
   92 protons, 92 electrons, 143 neutrons
   (235 – 92 = 143)

   PTS: 1
8. ANS:
   1 proton, 1 electron, 2 neutrons
   (3 – 1 = 2)

   PTS: 1

9. ANS:
14 protons, 14 electrons, 15 neutrons
(29 – 14 = 15)

PTS: 1

10. ANS:
= 151 – 63 = 88 neutrons
The mass number is 151.

PTS: 1

11. ANS:
= 230 – 90 = 140 neutrons
Difference between the number of protons and the number of neutrons = 140 – 90 = 50
Therefore, thorium-230 has 50 more neutrons than it does protons.
Atomic number = number of protons = number of electrons
Therefore, thorium-230 has 90 electrons.

PTS: 1

12. ANS:
5 neutrons + 4 protons = 9

PTS: 1

13. ANS:
39 neutrons + 31 protons = 70

PTS: 1

14. ANS:
16 neutrons + 14 protons = 30

PTS: 1

15. ANS:
26 neutrons + 22 protons = 48

PTS: 1

16. ANS:
12

PTS: 1

17. ANS:
35

PTS: 1

18. ANS:
51

PTS: 1

19. ANS:
All the percentages should add up to 100%. Therefore:

100% = (percent abundance of magnesium-24) + (percent abundance of magnesium-25) + (percent abundance of magnesium-26)

100% = 78.99% + (percent abundance of magnesium-25) + 11.01%
Percent abundance of magnesium-25 = 100% – (78.99% + 11.01%) = 10.00%

PTS: 1

20. ANS:
The correct order is as follows:
1s, 2s, 2p, 3s, 3p, 4s, 3d, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p

PTS: 1

21. ANS:
tellurium

PTS: 1

22. ANS:
zinc

PTS: 1

23. ANS:


PTS: 1

24. ANS:
•V•

PTS: 1

25. ANS:
K•

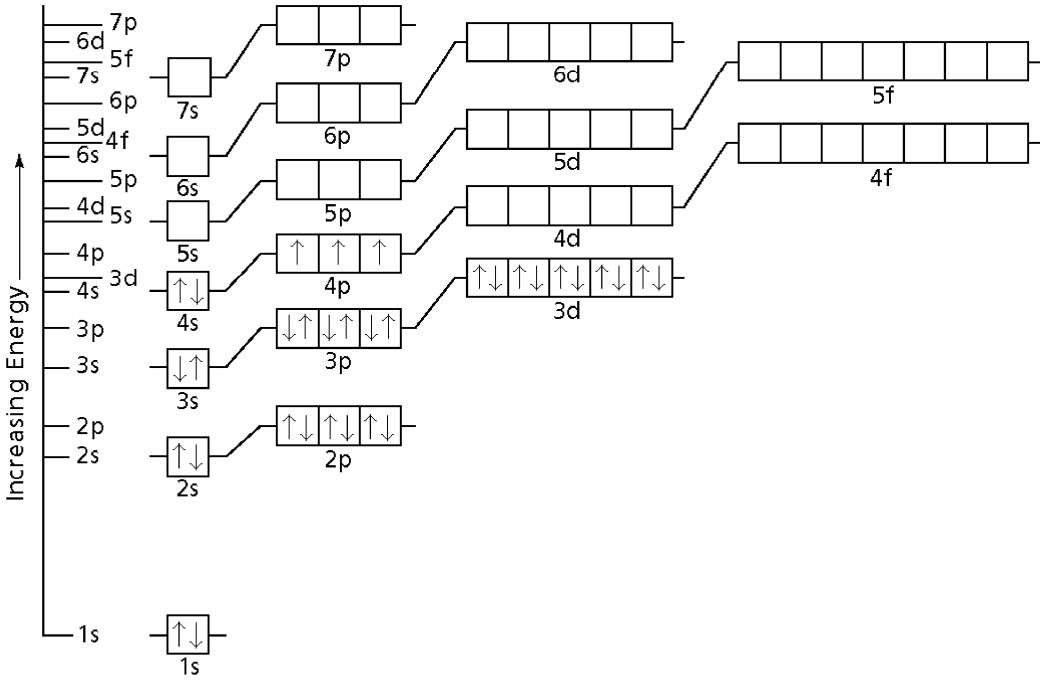
PTS: 1

26. ANS:

Element	Symbol	Orbitals					Electron Configuration
		1s	2s	$2p_x$	$2p_y$	$2p_z$	
a. Nitrogen	N	↑↓	↑↓	↑	↑	↑	$1s^2 2s^2 2p^3$
b. Fluorine	F	↑↓	↑↓	↑↓	↑↓	↑	$1s^2 2s^2 2p^5$
c. Carbon	C	↑↓	↑↓	↑	↑		$1s^2 2s^2 2p^2$
d. Lithium	Li	↑↓	↑				$1s^2 2s^1$

PTS: 1

27. ANS:



PTS: 1

28. ANS:
2

PTS: 1

29. ANS:
•Ca•

PTS: 1

30. ANS:
The first electron to leave the atom would be one in the highest energy level, which is the fourth energy level. Electrons in the highest energy level are the least attracted to the nucleus because they are the most distant.

PTS: 1

31. ANS:
$[Ar]4s^2 3d^{10} 4p^4$

PTS: 1

32. ANS:
[Kr] or $[Ar]4s^2 3d^{10} 4p^6$

PTS: 1

33. ANS:
$[Ne]3s^2 3p^5$

PTS: 1

34. ANS:
n = 1

PTS: 1

35. ANS:
n = 4

PTS: 1

36. ANS:
n = 5

PTS: 1

37. ANS:
$1s^2 2s^2 2p^4$

PTS: 1

38. ANS:
$1s^2 2s^2 2p^6 3s^2 3p^2$
The element is silicon.

PTS: 1

PROBLEM

39. ANS:
$Mass_{reactants} = Mass_{products}$
$Mass_A + Mass_B = Mass_{AB}$
$Mass_{AB} = 18\ g + 4\ g = 22\ g$

PTS: 1

40. ANS:
$Mass_{reactants} = Mass_{products} = 39.10 + 54.94 + 64.00 = 158.04\ g$

PTS: 1

41. ANS:
$Mass_{reactants} = Mass_{products}$
$Mass_{carbon} + Mass_{oxygen} = Mass_{carbon\ monoxide}$
$2.445\ g + 3.257\ g = 5.702\ g$

PTS: 1

42. ANS:
$Mass_{reactants} = Mass_{products}$
$Mass_{hydrogen} + Mass_{oxygen} = Mass_{water}$
$4.032\ g + Mass_{oxygen} = 36.032\ g$
$Mass_{oxygen} = 36.032\ g - 4.032\ g = 32\ g$

PTS: 1

43. ANS:
$$\frac{0.88\ g}{0.44\ g} = 2$$

PTS: 1

44. ANS:
$$\frac{1.76\ g}{0.44\ g} = 4$$

PTS: 1

45. ANS:
$$\frac{1.76\ g}{0.88\ g} = 2$$

PTS: 1

46. ANS:
First, find the mass ratio for each compound.

Compound I: $= \frac{\text{Mass}_{\text{p}}}{\text{Mass}_{\text{Cl}}} = \frac{3.88\ g}{13.28\ g} = 0.292$

Compound II: $= \frac{\text{Mass}_{\text{p}}}{\text{Mass}_{\text{Cl}}} = \frac{1.32\ g}{7.56\ g} = 0.175$

Then, compare the two mass ratios.

$$\frac{\text{Mass ratio compound I}}{\text{Mass ratio compound II}} = \frac{0.292}{0.175} = 1.67$$

These data are not consistent with the law of multiple proportions. The law of multiple proportions states that the different masses of Y that combine with a fixed mass of X can be expressed as a ratio of small whole numbers, and 1.67 is not a whole number.

PTS: 1

47. ANS:

Compound I: $\frac{\text{Mass}_{\text{F}}}{\text{Mass}_{\text{Xe}}} = \frac{0.853\ \text{g}}{1.472\ \text{g}} = 0.579$

Compound II: $\frac{\text{Mass}_{\text{F}}}{\text{Mass}_{\text{Xe}}} = \frac{0.624\ \text{g}}{2.16\ \text{g}} = 0.289$

Then, compare the two mass ratios.

$$\frac{\text{Mass ratio compound I}}{\text{Mass ratio compound II}} = \frac{0.579}{0.289} = 2.00$$

These data are consistent with the law of multiple proportions. The law of multiple proportions states that the different masses of Y that combine with a fixed mass of X can be expressed as a ratio of small whole numbers, and 2 is a whole number.

PTS: 1

48. ANS:

$$\text{Mass percentage}_{\text{sodium}} = \frac{\text{Mass}_{\text{sodium}}}{\text{Mass}_{\text{baking soda}}} \times 100\%$$

$$= \frac{45.98\ g}{168.02\ g} \times 100\% = 27.36\%$$

$$\text{Mass percentage}_{\text{hydrogen}} = \frac{\text{Mass}_{\text{hydrogen}}}{\text{Mass}_{\text{baking soda}}} \times 100\%$$

$$= \frac{2.02\ g}{168.02\ g} \times 100\% = 1.20\%$$

$$\text{Mass percentage}_{\text{carbon}} = \frac{\text{Mass}_{\text{carbon}}}{\text{Mass}_{\text{baking soda}}} \times 100\%$$

$$= \frac{24.02\ g}{168.02\ g} \times 100\% = 14.30\%$$

$$\text{Mass percentage}_{\text{oxygen}} = \frac{\text{Mass}_{\text{osygen}}}{\text{Mass}_{\text{baking soda}}} \times 100\%$$

$$= \frac{96\ g}{168.02\ g} \times 100\% = 57.14\%$$

PTS: 1

49. ANS:

$$\text{Mass percentage}_{\text{calcium}} = \frac{\text{Mass}_{calciium}}{\text{Mass}_{\text{chalk}}} \times 100\%$$

$$= \frac{40\ g}{100\ g} \times 100\% = 40\%$$

$$\text{Mass percentage}_{\text{carbon}} = \frac{\text{Mass}_{\text{carbon}}}{\text{Mass}_{\text{chalk}}} \times 100\%$$

$$= \frac{12\ g}{100\ g} \times 100\% = 12\%$$

$$\text{Mass percentage}_{\text{oxygen}} = \frac{\text{Mass}_{\text{oxygen}}}{\text{Mass}_{\text{chalk}}} \times 100\%$$

$$= \frac{48\ g}{100\ g} \times 100\% = 48\%$$

$$\text{Mass percentage}_{\text{calcium}} = \frac{\text{Mass}_{\text{calcium}}}{\text{Mass}_{\text{chalk}}} \times 100\%$$

$$\text{Mass}_{\text{calcium}} = \frac{(40\%)(200\ g)}{100\%} = 80\ \text{g}$$

PTS: 1

50. ANS:

$$\text{Mass percentage}_{\text{hydrogen}} = \frac{\text{Mass}_{hydrogen}}{\text{Mass}_{ammonia}} \times 100\%$$

$$= \frac{3\ g}{17\ g} \times 100\% = 18\%$$

$$\text{Mass}_{\text{reactants}} = \text{Mass}_{\text{products}}$$

$$\text{Mass}_{\text{nitrogen}} \text{ x } \text{Mass}_{\text{hydrogen}} = \text{Mass}_{\text{ammonia}}$$

$$\text{Mass}_{\text{nitrogen}} = \text{Mass}_{\text{ammonia}} - \text{Mass}_{\text{hydrogen}}$$

14 g = 17 g – 3 g

PTS: 1

51. ANS:

$$E_{\text{photon}} = h\nu = (6.626 \times 10^{-34}\ \text{J}\cdot\cancel{s})(4.8 \times 10^{14}\ \cancel{s^{-1}})$$
$$= 3.18048 \times 10^{-19}\ \text{J} = 3.2 \times 10^{-19}\ \text{J}$$

PTS: 1

52. ANS:

Calculate the frequency: $c = \lambda\nu$,

therefore, $\nu = \frac{c}{\lambda}$

$$\nu = (3.00 \times 10^{8}\ \text{m/s})/(3.36 \times 10^{-9}\ \cancel{\text{m}})$$
$$= 8.93 \times 10^{16}\ \text{s}^{-1}$$

Calculate the energy of one quantum:

$$E_{\text{photon}} = h\nu$$

$$E_{\text{photon}} = (6.626 \times 10^{-34}\ \text{J}\cdot\cancel{s})(8.93 \times 10^{16}\ \cancel{s^{-1}})$$
$$= 5.92 \times 10^{-17}\ \text{J}$$

Orange light has an energy of 3.2×10^{-19} J. Therefore, a quantum of radiation with a wavelength of 3.36×10^{-9} m has more energy than orange light does.

PTS: 1

53. ANS:

From $c = \lambda\nu$, $\nu = .\frac{c}{\lambda}$.

$$\text{E} = h\nu = \frac{hc}{\lambda}$$

PTS: 1

54. ANS:

$c = \lambda v$c 5 ln, therefore, $v = .\frac{c}{\lambda}$

$v = \frac{3.00 \times 10^8 \text{ m/s}}{2.90 \text{ m}} = 1.034 \times 10^8 \text{ s}^{-1}$ $= 1.034 \times 10^8 \text{ s}^{-1}$

$1.034 \times 10^{-8} \text{ s}^{-1} = 103.4 \times 10^{-6} \text{ s}^{-1}$
= 103.4 megahertz
You can tune in at 103.4 FM.

PTS: 1

55. ANS:
From the conservation of mass, the mass of silver recovered is equal to the mass of silver in the initial silver iodide sample. The amount of silver recovered would be $50.0 \text{ g} \times 45.9\% = 50.0 \times 0.459 = 22.95 \text{ g} = 23 \text{ g}$.

PTS: 1

56. ANS:
Mass percentage of an element (%) =
$\frac{\text{Mass of element}}{\text{Mass of compound}} \times 100\%$

$\text{Mass percentage}_{\text{carbon}} = \frac{\text{Mass}_{\text{carbon}}}{\text{Mass}_{\text{compound}}} \times 100\%$

$75.69\% \text{ carbon} = \frac{\text{Mass}_{\text{carbon}}}{200\text{mg}} \times 100\%$

$75.69\% \text{ carbon} \times \frac{200\text{mg}}{100\%} = \text{Mass}_{\text{carbon}}$

$\text{Mass}_{\text{carbon}}$ in the tablet = 151.38 mg

PTS: 1