Final Review
Physical Science – Matter

Name: *Key*   Per:___

1. What system of measurement is used worldwide by scientists?

   SI (metric) system

2. What are the two parts of a measurement?

   number (value) and unit

3. Fill in the following blanks:

   1 gram = ___10___ dg

   = ___100___ cg

   = ___1000___ mg

   1 kg = ___1000___ g

4. Convert 3.45 cg to kg.

   $3.45 \, cg \times \dfrac{1g}{100 \, cg} \times \dfrac{1 kg}{1000 g} = 0.0000345 \, kg \quad (3.45 \times 10^{-5} \, kg)$

5. What are significant figures?

   The known digits of a measurement plus one estimate.

6. A physical property can be __measured__ or __observed__.

7. A property that can only be observed when a substance changes into another is called __chemical property__.

8. Give two examples of a physical change.

   · Phase change   · volume change

   · solubility   · ~~density~~ mass change

9. What are some indicators that a chemical change has occurred?

   · gas produced   · color change

   · precipitate formed   · odor change

   · Energy change

10. Describe the three subatomic particles in an atom.

    proton: positive charge; in nucleus ⎫ both 2000x size of e⁻

    Neutron: neutral charge; in nucleus ⎭

    electron: negative charge; outside nucleus in electron cloud – 2000x smaller than p⁺ or n.

11. What does the atomic number represent?

    # of protons

12. What does the mass number represent?

# of p⁺ & n

13. What is an isotope?

atom of an element with different # of neutrons & different mass #.

14. What is the difference between mass number and atomic mass?

mass # is the # of p⁺ & n for one specific isotope.

Atomic mass is the weighted average of all isotopes of an element.

15. A common isotope of iron has a mass number of 56. How many protons, electrons, and neutrons does this isotope have?

26 p⁺
26 e⁻
30 n

16. What do the vertical columns on the periodic table represent?

Groups or families

17. What are the horizontal rows called?

Periods

18. Where are the metals located on the periodic table? What are some characteristics of metals?

left of staircase

shiny   solid at room temp (except for Hg)
malleable   good conductors of heat/electricity
Ductile

19. Where are the non-metals located? Describe some characteristics of non-metals.

Right of staircase
·Brittle solids   ·poor conductors

20. What are metalloids?

Elements with characteristics of both metals & non-metals.
"Semi conductors"

21. Which groups contain the transition metals?

3-12

22. What are valence electrons?

Electrons in the highest or outermost energy level; e⁻ involved in chemical bonding.

23. How many electrons can occupy the first energy level of an atom? How about the 2nd – 5th levels?

1st level: 2 e⁻
2nd/3rd: 8 e⁻
4th/5th: 18 e⁻

24. What is an ion?

An atom that has lost or gained e^-; so is electrically charged.
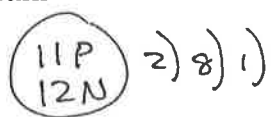
25. For groups 1, 2, 13-18, indicate the number of valence electrons and then indicate the charge of the ions formed from these atoms.

	Valence e^-	charge
1:	1	+1
2:	2	+2
13:	3	+3
14:	4	+4
15:	5	-3
16:	6	-2

	Valence e^-	charge
17:	7	-1
18:	8	∅

26. Draw energy level diagrams for the atoms and ions that these atoms form.

a. Sodium

Na (11 P, 12 N) 2) 8) 1)

Na^+ (11 P, 12 N) 2) 8)

b. Sulfur

S (16 P, 16 N) 2) 8) 6)

S^{-2} (16 P, 16 N) 2) 8) 8)

c. Phosphorus

P (15 P, 16 N) 2) 8) 5)

P^{-3} (15 P, 16 N) 2) 8) 8)

d. Barium

Ba (56 P, 81 N) 2) 8) 8) 16) 18) 2)

Ba^{+2} (56 P, 81 N) 2) 8) 8) 18) 18)
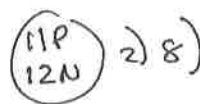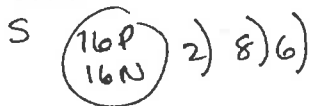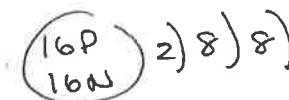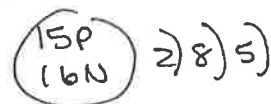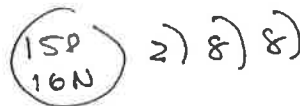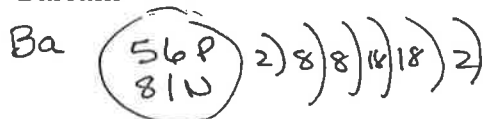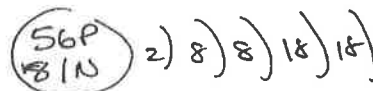
27. What group of elements are the least reactive? Why is this?

group 18   They have a full outer energy level (octet)

28. Why do atoms form chemical bonds?

To become more stable

29. Compare and contrast the two types of chemical bonds.

Ionic Bonds: e^- are transfereed; Bond between opposite charged ions

Covalent bonds: e^- are shared between atoms

30. Write formulas and names for the following combination of ions.

    a. Ca^{+2} and Cl^-

        $CaCl_2$ Calcium Chloride

    b. Na^+ and O^{-2}

        Na_2O Sodium Oxide

    c. Al^{+3} and S^{-2}

        Al_2S_3 Aluminium Sulfide

31. Given the equation: $CH_4 + O_2 \rightarrow CO_2 + H_2O$

    a. Identify the reactants and products.

        Reactants: CH_4 & O_2 Products: CO_2 & H_2O

    b. Balance the equation.

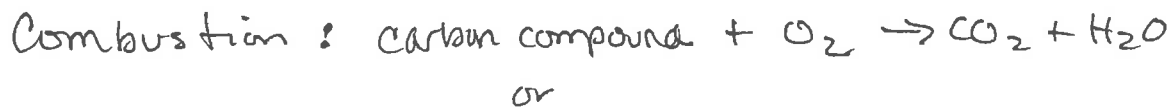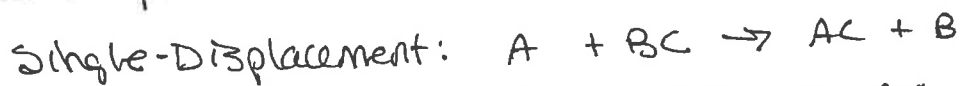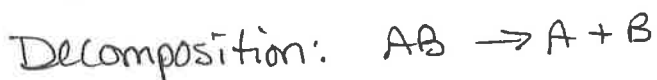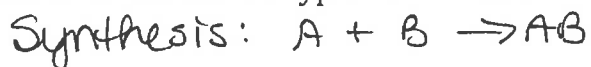$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

    c. Identify the type of reaction.

        Combustion

32. What is the law that states the reason why chemical equations must be balanced?

    Law of conservation of mass

33. List and describe the five types of chemical reactions.

    Synthesis: $A + B \rightarrow AB$

    Decomposition: $AB \rightarrow A + B$

    Single-Displacement: $A + BC \rightarrow AC + B$

    Double-Displacement: $AX + BY \rightarrow AY + BX$

    Combustion: carbon compound $+ O_2 \rightarrow CO_2 + H_2O$

        or

        O_2 is a reactant

34. What is a subscript and what does it represent in a chemical formula?

A # that is lower and after an atom. Represents # of that atom O_2 = 2 oxygen atoms

35. What is a coefficient in a chemical equation?

The # before a substance in a chemical equation.

36. How is a nuclear reaction different from a chemical reaction?

Produces far more energy; involves the nucleus, rather than valence e^-.

37. Complete the following table to compare the types of nuclear decay.

	Particle Emitted	Change in Number of Protons	Number of Neutrons	Mass Number	Atomic Number
Alpha Decay	$_2^4He$	↓ 2	↓ 2	↓ 4	↓ 2
Beta Decay	e^-	↑ 1	↓ 1	—	↑ 1
Gamma Decay	γ	—	—	—	—

38. Define half-life.

The amount of time required for ½ of a radioactive isotope to decay.

39. What isotope is used to determine the age of fossils?

Carbon-14

40. Most substances are (more/less) dense in their solid phase than in their liquid phase. Water is a notable exception since solid ice is (more/less) dense than liquid water.

41. What kind of intermolecular attraction exists between water molecules?

hydrogen bonding

42. What does "like dissolves like" mean?

polar substances tend to dissolve polar substances.

43. What are the two major types of mixtures?

Heterogeneous – not uniformly mixed

Homogeneous – uniformly mixed

44. Colloids and suspensions are examples of which type of mixture?

Heterogeneous

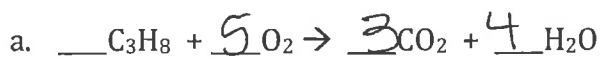45. What are the two parts of a solution?

Solute & Solvent

46. Describe the difference between unsaturated, saturated, and supersaturated solutions.
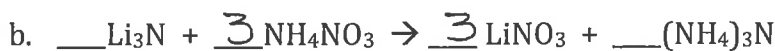
unsat: less than maximum amount is dissolved

sat: maximum amount dissolved for that temp.

supersat: more than maximum dissolved

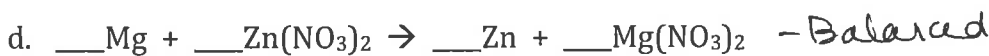47. Balance the following equations, then name the reaction type.

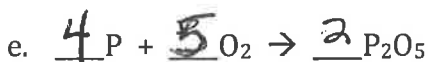a. ___C_3H_8 + _5_O_2 → _3_CO_2 + _4_H_2O

Combustion

b. ___Li_3N + _3_NH_4NO_3 → _3_$LiNO_3$ + ___$(NH_4)_3N$

Double Displacement

c. _2_H_2O → _2_H_2 + ___O_2

Decomposition

d. ___Mg + ___$Zn(NO_3)_2$ → ___Zn + ___$Mg(NO_3)_2$ — Balanced
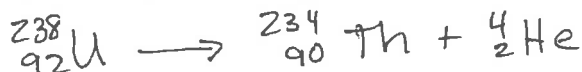
Single Displacement

e. _4_P + _5_O_2 → _2_P_2O_5

Synthesis / Combustion

48. Write nuclear equations for the following:

a. Alpha decay of Uranium-238

$$^{238}_{92}U \longrightarrow \, ^{234}_{90}Th + \, ^{4}_{2}He$$

b. Alpha decay of Polonium-218

$$^{218}_{84}Po \longrightarrow \, ^{214}_{82}Pb + \, ^{4}_{2}He$$
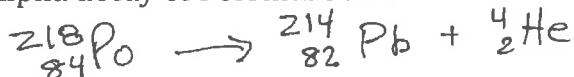
c. Beta decay of Carbon-14

$$^{14}_{6}C \longrightarrow ^{14}_{7}N + e^-$$
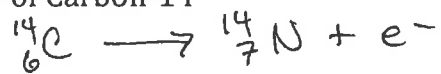
d. Beta decay of Bismuth-214

$$^{214}_{83}Br \longrightarrow ^{214}_{84}Po + e^-$$
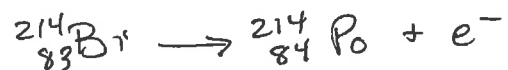
49. The half-life of Carbon-14 is 5,730 years. How much of a 25 g sample of C-14 remains after 22,920 years?

$$\frac{22920}{5730} = 4 \text{ half lives}$$

$$25g \cdot \frac{1}{16} = 1.56g$$

$$1.6g$$