

Name:

Physical Science 4012 Pretest

1. Indicate whether each of the following statements is true (T) or false (F):

- a) The ratio of a proton's mass to an electron's mass is 1840. T
- b) The ratio of a neutron's mass to a proton's mass is 1. T
- c) The mass of an electron is 1840 times less than that of a neutron. T
- d) The nucleus of a neutral atom contains the same number of protons and electrons.
F * electrons are outside the nucleus
- e) The number of protons in an atom is always equal to the number of neutrons. F
different isotopes have diff # neutrons

2. Identify the type of subatomic particle that helps to hold the nucleus together.

neutron

3. In one sentence, describe the distribution of electrons within the atom.

Electrons travel in well-defined energy levels (orbits) around the nucleus.

4. Comment on the volume of the nucleus as it compares to the volume of the atom.

Volume of nucleus is very small compared to the volume of the atom.

5. Indicate the charge (positive, negative, or neutral) of each of the following:

a) proton +

b) neutron neutral

c) electron -

6. List the alkali metals.

Li, Na, K, Rb, Cs, Fr *# H is not an alkali metal*

7. Circle the characteristics below that apply to metals:

- a) shiny
 - b) ductile
 - c) malleable
 - d) conductors of electricity
 - e) all solid at room temperature
 - f) found to the right of the staircase on the periodic table.
- No: Hg*

8. Indicate whether each of the following statements is true (T) or false (F).

- a) Alkali metals react readily with oxygen and halogens. T
- b) The chemical properties of alkali metals are different from those of alkaline earth metals. T
- c) Nonmetals are poor conductors of electricity. T

9. Complete the following table:

	electron configuration	family name	period number
<i>17</i> ←	2e8e7e	<i>halogens</i>	<i>3</i>
<i>14</i> ←	2e8e4e	<i>carbon</i>	<i>3</i>
<i>Mg</i> <i>12</i>	<i>2e8e2e</i>	Alkaline Earth Metal	3
<i>Ne</i> <i>10</i>	<i>2e8e</i>	Noble Gas	2

10. Complete the table below indicating the name or chemical formula of each compound.

Chemical formula	New nomenclature	Traditional nomenclature
AsI_5	arsenic pentaiodide	[blacked out]
Ni_2S_3	nickel(III) sulfide	[blacked out]
Li_2SO_4	[blacked out]	Lithium sulphate
$NaHCO_3$	[blacked out]	Sodium bicarbonate

Handwritten notes:
 → polyatomic ion
 type 2 → Ni_2S_3
 $Ni^{+3} S_3^{-2}$
 $+6 -6$
 $Li^{+1} SO_4^{-2}$
 $Na^{+1} HCO_3^{-1}$

11. a) Referring to the periodic table, identify which of the following elements are chlorine isotopes.

Element	Number of protons	Number of neutrons	Number of electrons
A	18	18	18
B	17	17	18
C	16	17	18
D	18	17	17
E	17	18	17
F	17	16	16

Handwritten notes:
 atomic #. 17
 17 protons

Answer: B, E, F

$\#p^+ = \#e^-$ more e^- than p^+ - more p^+ than e^- +

b) Classify the six elements listed above as either neutral atoms, anions, or cations. Write the appropriate letters in the spaces provided.

Neutral atoms	Anions	Cations
A, E	B, C	D, F

12. Match each of the substances below with the appropriate category of matter, by writing the letter corresponding to your answer in the space provided.

- Categories: A - Homogeneous mixture (solution)
 B - Element
 C - Suspension
 D - Heterogeneous mixture
 E - Compound

Substance:

1. 100% pure sugar ($C_{12}H_{22}O_{11}$) E
2. 100% pure aluminum B
3. orange juice C
4. stainless steel (alloy) A
5. filtered air A
6. filtered sea water A
7. blueberry milkshake D
8. dirt D

13. Give the chemical formula of the binary compounds formed by the combination of elements A, D, E, and G from the families indicated below:

$+4$ or -4 ← Element A: IVA
 Element E: IIIA
 Element D: VA
 Element G: IIA

Compound formed by G and A: $G^{+2} A^{-4} = G_2A$

Compound formed by D and E: $E^{+3} D^{-3}$

ED

14. Indicate whether each of the following is an acid, base or salt.

Explain your answer referring to the substance's dissociation in water.

- a) ^{or HCH₃COO} CH₃COOH : acid; breaks apart in water to release H⁺
 (exception)
- b) RbCl: salt; doesn't release H⁺ or OH⁻
- c) Ca(OH)₂: base; breaks apart in water to release OH⁻
- d) H₂SO₄: acid; breaks apart in water to release H⁺

15. Place the following four substances in increasing order of acidity, i.e. from the least acidic to the most acidic.

- 3.4 A) Stomach acid: pH of 3.4
- 7 B) Salt water: neutral
- 5 C) Acetic acid: H⁺ concentration of approximately 1×10^{-5} mol/L
- 12 D) Bleach: H⁺ concentration of approximately 1×10^{-12} mol/L

Answer: D, B, C, A
 highest pH → lowest pH

16. You obtained the following lab results from tests using litmus paper and an electric conductivity detector:

Test	A	B	C	D	E
Conducts current	+++	+++	+	+++	no
Red litmus paper	red	red	red	blue	red
Blue litmus paper	red	blue	red	blue	blue

Based on these results:

- a) Which liquid is a salt solution? B
- b) Which liquid is a nonelectrolyte? E
- c) Which liquid is a strong base? D
- d) Which liquids are strong electrolytes? A, B, D

17. Hydrogen peroxide (H_2O_2) must be kept in an opaque container because when it is exposed to light, it decomposes to form water (H_2O) and oxygen gas (O_2). Give the balanced equation representing this decomposition.



18. Consider potassium (K) and fluorine (F).

- a) What type of chemical bond exists between these two elements?

Ionic bond

- b) Referring to electronegativity values, explain how you reached your conclusion.

$4.0 - 0.8 = 3.2$ / Since e.d. is greater than 1.7.

- c) Draw the Lewis diagram for each of these elements.

K ·



- d) Draw the Lewis diagram for the compound formed by these two elements.



- e) Can this bond be represented using a structural formula? No

If so, what would it look like?

19. Consider arsenic (As) ^{2.0} and bromine (Br) ^{2.8}.

a) What type of chemical bond exists between these two elements?

Polar covalent

b) Referring to electronegativity values, explain how you reached your conclusion.

$2.8 - 2.0 = 0.8$ / Since e.d. is between 0.4 + 1.7.

c) Draw the Lewis diagram for each of these elements.

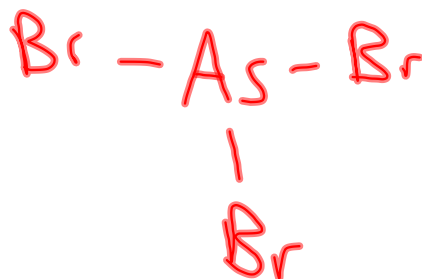


d) Draw the Lewis diagram for the compound formed by these two elements.



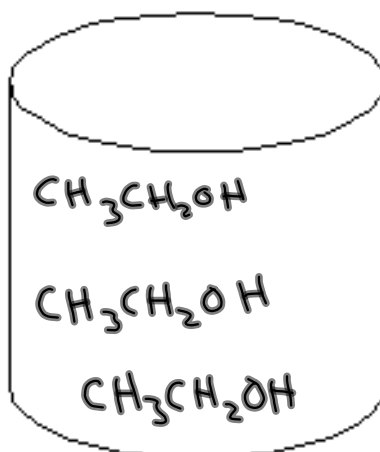
e) Can this bond be represented using a structural formula? Yup

If so, what would it look like?



20. An alcohol solution will not conduct electricity.

a) In the tank below, illustrate what happens when alcohol ($\text{CH}_3\text{CH}_2\text{OH}$) dissolves in water.



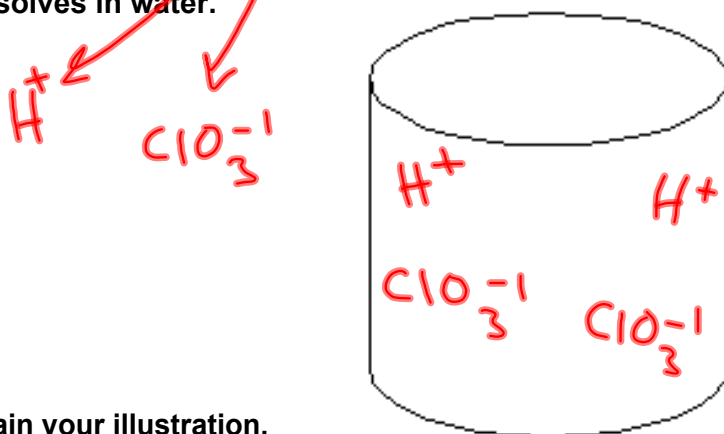
b) Explain your illustration.

Since it doesn't conduct electricity,
the molecules must not break apart

c) Specify the type of dissolution that occurs. Molecular Dissolution

21. A chloric acid solution (HClO_3) is a good conductor of electricity.

a) In the tank below, illustrate what happens when chloric acid dissolves in water.



b) Explain your illustration.

Since it conducts electricity the
substance must break apart into ions.

c) Specify the type of dissolution that occurs. Ionic dissolution

22. You are given three solutions:

Molar mass
of SrBr_2 : 247.42g

Solution 1: 75 g of SrBr_2 in 0.25 L of solution

Solution 2: 0.24 mol of SrBr_2 in 200 mL of solution

Solution 3: 0.2 kg of SrBr_2 in 0.45 L of solution

Which of the above solutions has the highest concentration of SrBr_2 ?

Your answer must include all calculations and clearly show all the units of measure and formulas used.

Solution 1: $75\text{g SrBr}_2 \times \frac{1\text{mol}}{247.42\text{g}} = 0.3031\text{mol}$

$$M = \frac{n}{V} = \frac{0.3031\text{mol}}{0.25\text{L}} = 1.213\text{M} \quad \text{Sol \# 1} \leftarrow$$

Solution 2:

$$M = \frac{n}{V} = \frac{0.24\text{mol}}{0.2\text{L}} = 1.2\text{M} \quad \text{Sol \# 2} \leftarrow$$

Solution 3:

$$0.2\text{kg} \times 1000 = 200\text{g SrBr}_2$$

$$200\text{g} \times \frac{1\text{mol}}{247.42\text{g}} = 0.8083\text{mol}$$

$$M = \frac{n}{V} = \frac{0.8083\text{mol}}{0.45\text{L}} = 1.796\text{M} \quad \text{Sol \# 3} \leftarrow$$

Solution # 3 has the highest concentration

23. You want to spray your lawn with a liquid fertilizer. You own a 20-L sprayer and you want to fill it to capacity. The concentration on the 750-mL bottle of fertilizer is 14 mol/L. Your lawn requires a 0.2 mol/L solution.

How much undiluted fertilizer must you pour into the sprayer?

Your answer must include all calculations and clearly show all the units of measure and formulas used.

$$C_1 = 14 \text{ M} \qquad C_2 = 0.2 \text{ M}$$
$$V_1 = ? \qquad V_2 = 20 \text{ L}$$

$$C_1 V_1 = C_2 V_2$$
$$(14) V_1 = (0.2)(20)$$

$$V_1 = \frac{(0.2)(20)}{14} = 0.29 \text{ L}$$

24. The following table provides the turning points of four different indicators:

Indicator	Colour change	Turning point
A	red to yellow	4.4 to <u>6.2</u>
B	colourless to fuchsia	<u>8.2</u> to 10
C	yellow to violet	3.0 to <u>4.6</u>
D	yellow to blue	6.0 to <u>7.6</u>

$pH > 6.2$
 $pH < 8.2$
 $pH > 4.6$
 $pH > 7.6$

Adding indicator A to an unknown solution will turn the solution yellow. Indicator B will turn the solution colourless. Indicator C will turn the solution violet, while indicator D will turn the solution blue.

Based on these results and the data in the above table, determine the pH range of the unknown solution. Your answer must include the possible pH values of the solution for each indicator.

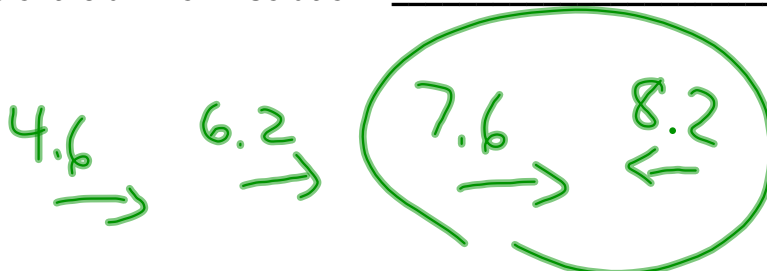
Answer:

Unknown solution

Indicator	Colour of solution	Possible pH values
A	yellow	$pH > 6.2$
B	colourless	$pH < 8.2$
C	violet	$pH > 4.6$
D	blue	$pH > 7.6$

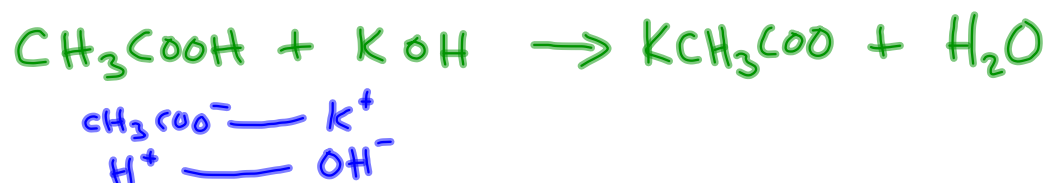
} 2 marks
 } 2 marks

pH range of the unknown solution: 7.6 - 8.2

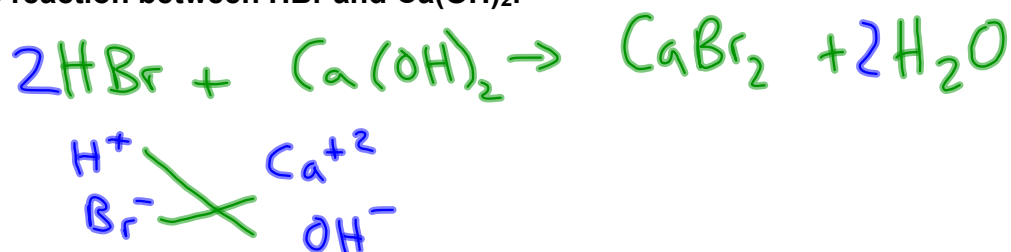


25. Write the neutralization equations for:

a) the reaction between acetic acid (CH_3COOH) and KOH .



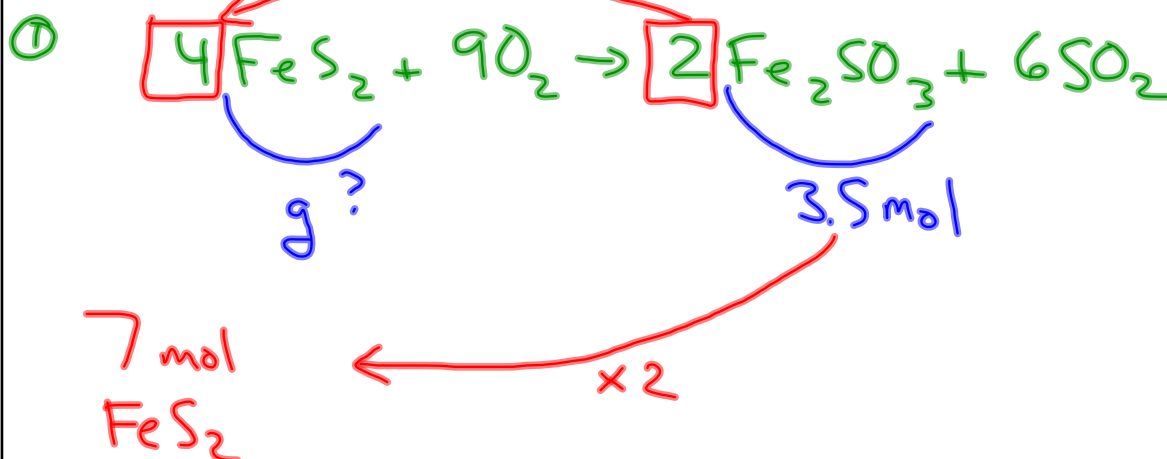
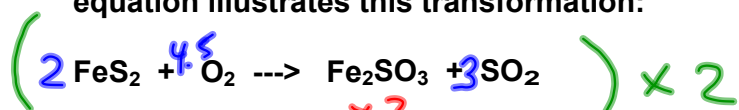
b) the reaction between HBr and $\text{Ca}(\text{OH})_2$.



Why are the above reactions considered to be neutralization reactions?

Because neutral salt water is produced.

26. How many grams of pyrite (FeS_2) are needed to manufacture 3.5 mol of iron sulphite (Fe_2SO_3)? The following chemical equation illustrates this transformation:



$$7 \text{ mol FeS}_2 \times \frac{119.97 \text{ g}}{1 \text{ mol}} = 839.79 \text{ g FeS}_2$$

27. How many moles of carbon dioxide (CO_2) would be produced if 2350 g of acetylene gas (C_2H_2) are combusted?

The following chemical equation illustrates this combustion:

