

REVIEW OF BASIC CHEMISTRY ANSWER KEY

1. Name the following elements. Spelling counts:

H **hydrogen**
S **sulphur**
Cl **chlorine**
C **carbon**
N **nitrogen**
Na **sodium**
Pb **lead**
Ag **silver**

2. Write the symbols for the following elements.

sodium **Na**
phosphorus **P**
fluorine **F**
magnesium **Mg**
potassium **K**
calcium **Ca**
zinc **Zn**
iron **Fe**

3. Using a periodic table, record the atomic number for the following elements:

gold (Au) **79** copper (Cu) **29**

4. Using a periodic table, record the atomic mass for the following elements to one decimal place:

chlorine (Cl) **35.5** calcium (Ca) **40.1**

5. Complete the following table. Use the information provided in the chart – not a periodic table – to determine atomic masses, but you may refer to a periodic table to name the element.

Element	Atomic Number	Atomic Mass	Protons	Neutrons	Electrons
Lead	82	207	82	125	82
Argon	18	58	18	40	18
Barium	56	137	56	81	56
Tin	50	89	50	39	50

6. Match the unit with its description:

F 1. amount of substance

C 2. density

B 3. mass

D 4. molar mass

A 5. energy

E 6. volume

A. joule

B. g

C. g/mL

D. g/mole

E. L

F. mole

7. Complete the following questions concerning the element **oxygen**:

- a. Number of protons 8
- b. Electron configuration $1s^2 2s^2 2p^4$
- c. Number of electrons (neutral atom) 8
- d. Number of valence electrons 6
- e. Electron-dot diagram (Lewis dot) $\cdot\ddot{O}\cdot$ (the single dots may be on any of the 4 sides)
- f. Ion most commonly formed by oxygen O^{2-}
- g. Is the ion in part (f) an anion or a cation? **anion**
- h. Define these terms:
- Anion - **negative ion formed by gaining electrons**
- Cation - **positive ion formed by losing electrons**

8. Draw electron-dot diagrams for:

- a. potassium $\cdot K$
- b. nitrogen $\cdot\ddot{N}\cdot$
- c. phosphorus $\cdot\ddot{P}\cdot$
- d. krypton $:\ddot{Kr}:$

9. What type of chemical bond (ionic or covalent) will most likely form between:

- a. sodium and chlorine **ionic**
- b. carbon and oxygen **covalent**

10. Define these terms:

- ionic bond - **bond formed by the transfer of electrons**
- covalent bond - **bond formed by sharing valence electrons**

11. Name **and provide the correct charge** for these polyatomic ions:

- | | | | | | |
|------------------|-------------------------|--------------------------------|--------------------------------|--------------------------|----------------------------------|
| SO ₄ | <u>sulphate</u> | <u>SO_4^{2-}</u> | NH ₄ | <u>ammonium</u> | <u>NH_4^+</u> |
| NO ₃ | <u>nitrate</u> | <u>NO_3^-</u> | OH | <u>hydroxide</u> | <u>OH^{1-}</u> |
| PO ₄ | <u>phosphate</u> | <u>PO_4^{3-}</u> | CO ₃ | <u>carbonate</u> | <u>CO_3^{2-}</u> |
| CrO ₄ | <u>chromate</u> | <u>CrO_4^{2-}</u> | Cr ₂ O ₇ | <u>dichromate</u> | <u>$Cr_2O_7^{2-}$</u> |

12. Write chemical formulas for the compounds:

a. sodium chloride	<u>NaCl</u>	e. magnesium fluoride	<u>MgF₂</u>
b. ammonium sulfate	<u>(NH₄)₂SO₄</u>	f. lead(II) phosphate	<u>Pb₃(PO₄)₂</u>
c. potassium nitrate	<u>KNO₃</u>	g. dinitrogen pentoxide	<u>N₂O₅</u>
d. calcium hydroxide	<u>Ca(OH)₂</u>	h. sulphur trioxide	<u>SO₃</u>

13. Name the following:

a. CO	<u>carbon monoxide</u>
b. CO ₂	<u>carbon dioxide</u>
c. Na ₂ SO ₄	<u>sodium sulphate</u>
d. H ₂ O ₂	<u>hydrogen peroxide</u>
e. (NH ₄) ₂ CO ₃	<u>ammonium carbonate</u>

14. List the seven diatomic molecules, using proper notation: H_2 N_2 O_2 F_2 Cl_2 Br_2 I_2

15. Calculate the molar masses of the following:

Molar mass – the mass of 1 mole of a substance. Find molar mass by adding together atomic masses of the individual elements. Atomic mass has the units amu (atomic mass units); molar mass has the units g/mol (NOT g!!!)

a. H ₂ O	b. CaCO ₃	c. (NH ₄) ₃ PO ₄	d. Al(OH) ₃
2H = 2 × 1.0 = 2.0	1Ca = 1 × 40.1 = 40.1	3N = 3 × 14.0 = 42.0	1Al = 1 × 27.0 = 27.0
1O = 1 × 16.0 = 16.0	1C = 1 × 12.0 = 12.0	12H = 12 × 1.0 = 12.0	3O = 3 × 16.0 = 48.0
	3O = 3 × 16.0 = 48.0	1P = 1 × 31.0 = 31.0	3H = 3 × 1.0 = 3.0
H ₂ O = 18.0g / mol		4O = 4 × 16.0 = 64.0	
	CaCO ₃ = 100.1g / mol		Al(OH) ₃ = 78.0g / mol
		(NH ₄) ₃ PO ₄ = 149.0g / mol	

16. Solve for x:

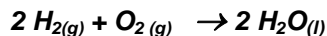
a. $39 = \frac{x^2}{5.2}$	b. $20 = \frac{4x}{5}$	c. $2.5 \times 10^{-8} = \frac{(6.2 \times 10^{-2})(8.3 \times 10^{-3})}{x}$
$x^2 = (39)(5.2)$	$4x = (20)(5)$	$2.5 \times 10^{-8} x = 5.146 \times 10^{-4}$
$x^2 = 202.8$	$x = \frac{100}{4} = 25$	$x = \frac{5.146 \times 10^{-4}}{2.5 \times 10^{-8}} = 2.1 \times 10^4$
$x = \pm 14$		

17. Liquid water is produced when hydrogen gas and oxygen gas combine.

a. List the reactant(s) in this reaction **hydrogen and oxygen**

b. List the product(s) **water**

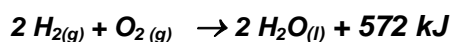
c. Write a balanced equation for the reaction, including physical states



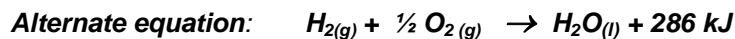
d. 286 kJ of energy are released during the formation of one mole of water.

Therefore, is the reaction endothermic or exothermic? **exothermic – energy is released**

e. Rewrite the equation but now also include the energy term within the equation.



Important note – the question tells you that 286 kJ are released PER MOLE of water. Since 2 moles of water are produced according to our balanced equation, then 2×286 or 572 kJ are released.



18. Perform the necessary calculations for the following questions, expressing the final answer to the correct number of significant digits. It is not necessary to show work.

a. An empty beaker has a mass of 32.41 g. When some water is placed in the beaker, the total mass is 33.7822 g. Find the mass of the water.

1.37 g

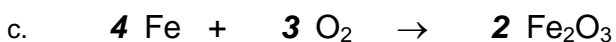
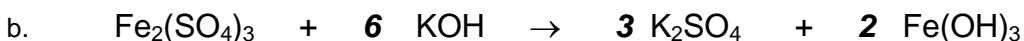
b. Convert 275 mL to litres.

0.275 mL

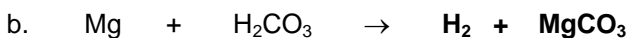
c. Ethyl alcohol has a density of 0.789 g/mL. Calculate the mass of 25.0 mL of this liquid.

$$g = \frac{0.789g}{mL} \times \frac{25.0mL}{1} = 19.7g$$

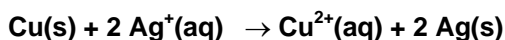
19. Balance the following equations:



20. Predict the products of the following reactions:



21. Write a net ionic equation for: $\text{Cu(s)} + 2 \text{AgNO}_3(\text{aq}) \rightarrow \text{Cu(NO}_3)_2(\text{aq}) + 2 \text{Ag(s)}$



(The spectator ions – those that undergo no chemical change – are removed from the equation. The only spectator ion in this reaction is nitrate, NO_3^-)

22. Perform the following calculations. Show your work.

a. Calculate the mass of 0.500 mol of CO.

$$1\text{C} = 12.0$$

$$1\text{O} = 16.0$$

$$g = 0.500\text{mol} \times \frac{28.0\text{g}}{\text{mol}} = 14.0\text{g}$$

$$\text{CO} = 28.0 \frac{\text{g}}{\text{mol}}$$

b. How many moles of KOH are present in a 25.0 g sample of the substance?

$$1\text{K} = 39.1$$

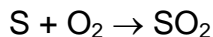
$$1\text{O} = 16.0$$

$$1\text{H} = 1.0$$

$$\text{mol} = 25.0\text{g} \times \frac{\text{mol}}{56.1\text{g}} = 0.446\text{mol}$$

$$\text{KOH} = 56.1 \frac{\text{g}}{\text{mol}}$$

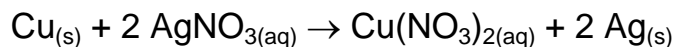
23. In a reaction between sulfur and oxygen, 80.0 g of sulfur dioxide is formed. What mass of sulfur was burned?



$$g \text{ S} = 80.0\text{g} \times \frac{\text{mol}}{64.1\text{g}} \times \frac{1\text{molS}}{1\text{molSO}_2} \times \frac{32.1\text{g}}{\text{mol}} = 40.1\text{g}$$

The next two questions show a different approach to solving stoichiometry questions. With a little practice it can make stoichiometry quite easy as it helps you set up the conversions correctly. Either method you use is perfectly fine – there are often several legitimate ways to solve a problem.

24. What mass of silver is precipitated (formed) when 40.0 g of copper reacts with an excess of silver nitrate in solution, according to the following equation:

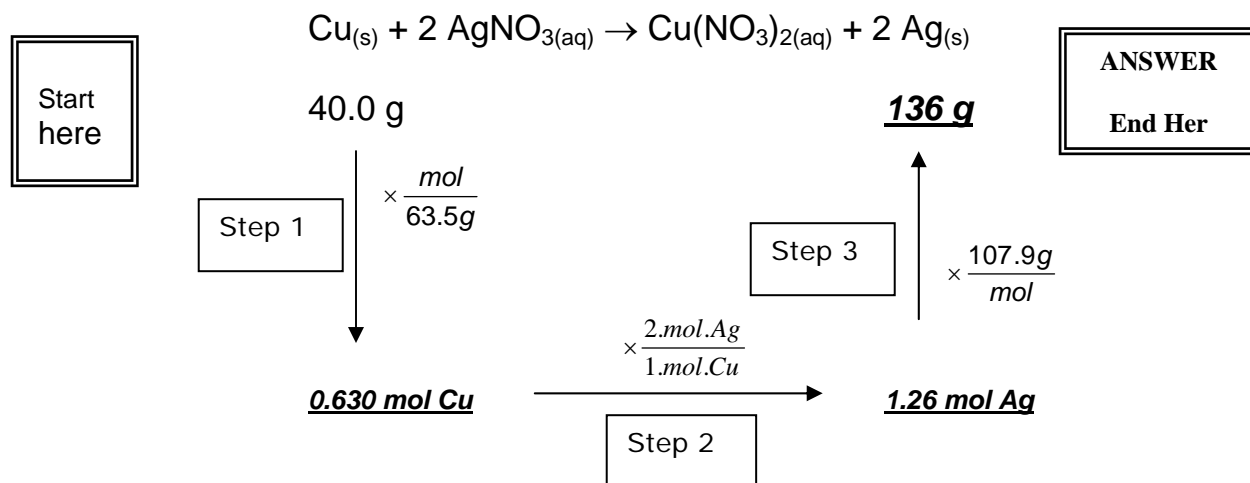


Having trouble with stoichiometry? Try this method.

- 1 – Be sure to begin with a balanced equation. Beneath the equation we will draw a map. Begin with the substance that you are given information about – in this case we know we are dealing with 40.0 g Cu. Our map will involve converting the unit given into moles, because moles are our “bridge”.
- 2 – Next, use the coefficients from the balanced equation to convert moles of one substance (Cu) into moles of the substance we want to know about – silver (Ag) in this question.

To set up the ratio, place the number where you want to go (the Ag) on top and the coefficient where you are coming from (the Cu) on the bottom.

- 3 – The final step is to convert moles of the desired material into the desired unit. For this question we are asked to find mass, so our unit is grams.



25. (Challenge question) Some antacid products contain aluminium hydroxide, $\text{Al}(\text{OH})_3$, to neutralize excess stomach acid. What volume of a 0.10 mol/L stomach acid, HCl, can be neutralized by 912 mg of aluminium hydroxide. The reaction is shown:

