

Science 10 Chemistry Review

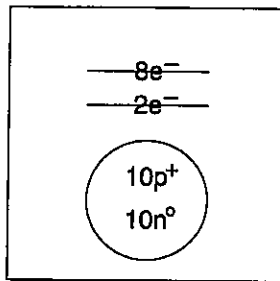
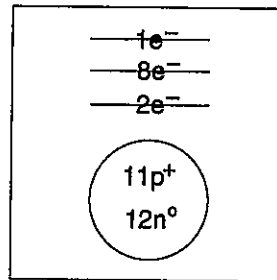
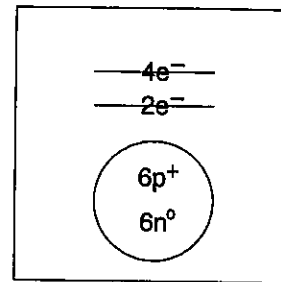
1. Identify each element.

(a) the element in group 5 and period 5 niobium(b) only halogen that is a liquid at room temperature and pressure bromine(c) alkali metal with the most massive atoms francium(d) synthetic element in period 5 technetium(e) metal in group 16 and period 4 tellurium (metalloid)

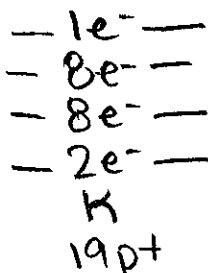
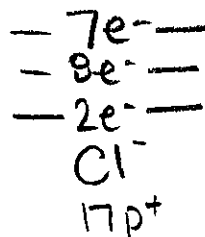
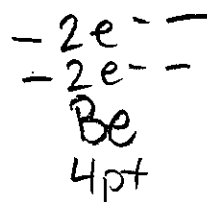
2. Complete the following table. The first row is completed as an example.

Name of element	Symbol of isotope	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
silicon	$^{28}_{14}\text{Si}$	14	28	14	14	14
oxygen	$^{16}_8\text{O}$	8	16	8	8	8
chromium	$^{52}_{24}\text{Cr}$	24	52	24	24	28
sodium	$^{23}_{11}\text{Na}$	11	23	11	11	12

3. Identify each isotope represented by the diagram below.

neon-20sodium-23carbon-12

4. Draw an energy level diagram, as shown in question 5, for each ion.

(a) potassium ion, K^+ (b) chloride ion, Cl^- (c) beryllium ion, Be^{2+} 

5. What two major families of elements does the bold "staircase" line in your periodic table separate?

metals

non metals

6. Complete the following table.

Name of element	Period number	Group number	Number of energy levels	Number of valence electrons
hydrogen	1	1	1	1
aluminum	3	13	3	3
oxygen	2	16	2	6
strontium	5	2	5	2

7. Complete the following table by drawing both the energy level diagram and electron dot diagram for each element. The first row is completed as an example.

Name of element	Energy level diagram	Electron dot diagram
carbon		
oxygen		
lithium		

8. Draw an electron dot diagram for an atom of each of the following elements.

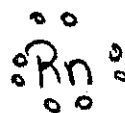
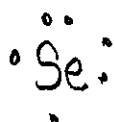
selenium (Se)

bromine (Br)

strontium (Sr)

radon (Rn)

francium (Fr)



Explain how you decided on the number and placement of the dots.

last digit of group # = # of dots (valence e⁻)
 one dot per side and then double up if more than 4

9. Complete the following table by filling in the missing information about ions.

Name of ion	Symbol	Number of protons	Number of electrons	Ion charge
lithium ion	Li^{1+}	3	2	1+
potassium ion	K^{1+}	19	18	1+
magnesium ion	Mg^{2+}	12	10	2+
chloride ion	Cl^{1-}	17	18	1-
fluoride ion	F^{1-}	9	10	1-
oxide ion	O^{2-}	8	10	2-

10. Complete the following table by filling in the missing information about isotopes. The first row is completed as an example

Name of isotope	Symbol	Mass number	Number of protons	Number of neutrons
hydrogen-3 (tritium)	${}^3_1\text{H}$	3	1	2
scandium-49	${}^{49}_{21}\text{Sc}$	49	21	28
cobalt-60	■	60	27	33
nitrogen-15	${}^{15}_7\text{N}$	15	7	8
uranium-238	■	238	92	146
iodine-129	■	129	53	76

11. Circle the binary compounds in the following list.
 → 2 types of atoms

(a) HCl

(b) SO_3

(c) MgCO_3 - polyatomic (more than 2 types of atoms)

(d) hydrogen sulfide

(e) sodium hydrogencarbonate - polyatomic

12. Identify whether each name or formula represents an ionic or molecular substance.

(a) sodium sulfide ionic

(b) PCl_3 molecular

(c) nitrogen dioxide molecular

(d) zinc oxide ionic

(e) MgI_2 ionic

→ only non-metal

↳ metal + non-metal

13. Complete the following table.

Element		Anion	
Name	Symbol	Name	Symbol
fluorine	F	fluoride	F ⁻
chlorine	Cl	chloride	Cl ¹⁻
bromine	Br	bromide	Br ¹⁻

14. Complete the following table.

Formula	Total charge on cation(s)	Total charge on anion(s)	Correct (✓) or incorrect (X) formula?	Correct formula and name of compound
(a) LiO	Li ¹⁺	O ²⁻	X	Li ₂ O
(b) MgO	Mg ²⁺	O ²⁻	✓	MgO
(c) K ₂ S	2 × K ¹⁺ = 2+	S ²⁻	✓	K ₂ S

15. Complete the following table to write the formula of each compound.

Name of compound	Cation	Anion	Formula
(a) beryllium fluoride	Be ²⁺	F ¹⁻	BeF ₂
(b) sodium nitride	Na ¹⁺	N ³⁻	Na ₃ N
(c) calcium sulfide	Ca ²⁺	S ²⁻	CaS
(d) aluminum chloride	Al ³⁺	Cl ¹⁻	AlCl ₃

16. Complete the following table to find the charge on the cation in these compounds. Decide if your answers are reasonable before you move on to step 10.

Compound	Charge on cation
(a) Cu_2S	1+
(b) Cr_2O_3	3+
(c) PbO_2	2+

17. Complete the following table by adding the missing Stock system names.

Formula	Ion	Name
FeCl_3	Fe^{3+}	iron(III) chloride
FeO	Fe^{2+}	iron(II) oxide
Cu_2S	Cu^+	copper(I) sulfide
PbO_2	Pb^{4+}	lead(IV) oxide

uses roman numerals to indicate charge on the metal ion (cation)

18. Complete the following table to write the chemical formula for each compound.

Name of compound	Cation	Anion	Chemical formula
(a) copper(I) oxide	Cu^{1+}	O^{2-}	Cu_2O
(b) lead(IV) bromide	Pb^{4+}	Br^{1-}	PbBr_4
(c) iron(III) sulfide	Fe^{3+}	S^{2-}	Fe_2S_3

19. There is something wrong with the name written beside each of the following compounds. In each case, explain why the name is wrong, and then write the correct name.

Formula	Incorrect name	Explanation	Correct name
(a) Ti_2O_3	dititanium trioxide	it's ionic! ∴ no prefixes	titanium oxide
(b) NaCl	sodium(I) chloride	not a multivalent ion ∴ no Roman numerals needed	sodium chloride

(c) CuCl_2	copper chloride	needs roman numerals	copper (I) chloride
(d) NO_2	nitrogen(IV) oxide	not multivalent	nitrogen oxide

20. Complete the following table.

Chemical formula	Ionic or molecular?	Name of compound
NH_4Cl	I	ammonium chloride
K_2S	I	potassium sulfide
Cl_4	M	chlorine tetroxide
CaO	I	calcium oxide
NH_4Cl	I	ammonium chloride
Li_3N	I	lithium nitride
$\text{Mg}(\text{OH})_2$	I	magnesium hydroxide
ZnO	I	zinc oxide
CuNO_3	I	copper (I) nitrate
SiO_2	M	silicon dioxide
OCl_2	M	oxygen dichloride
CuCl	I	copper (I) chloride
FeCl_2	I	iron (II) chloride

21. Complete the following table.

Name	Formula	Ionic or molecular?
sodium chloride	NaCl	I
dinitrogen trioxide	N_2O_3	M
magnesium oxide	MgO	I
lithium iodide	LiI	I
tetra phosphorus decaoxide	P_4O_{10}	M
carbon dioxide	CO_2	M
strontium hydroxide	$\text{Sr}(\text{OH})_2$	I
potassium sulfide	K_2S	I
carbon trisulfide	CS_3	M
copper (II) bromide	CuBr_2	I

22. Match each name in column A with the correct formula in column B. Write the formula on the line beside the name.

A	B
<u>H₂O</u> (a) water	NH ₃
<u>CH₄</u> (b) methane	H ₂ O
<u>NH₃</u> (c) ammonia	CH ₄
<u>CH₃OH</u> (d) methanol	CH ₃ OH

23. Complete the following table about acids and bases. The first row has been completed as an example.

Name of substance	Chemical formula of aqueous solution	Name of acid or base
hydrogen sulfide	H ₂ S _(aq)	hydrosulfuric acid
hydrogen carbonate	H ₂ CO _{3(aq)}	carbonic acid
hydrogen phosphate	H ₃ PO ₄	phosphoric acid

24. Use the following terms and symbols to complete the sentences below. Some terms and symbols will be used more than once, and some not at all.

H ⁺	OH ⁻	NH ₄ ⁺
sour	bitter	sweet
red	blue	orange
turns pink	remains colourless	lower
higher	Arrhenius	greater than
less than	conduct	do not conduct

(a) According to Arrhenius, acids are substances that dissolve in water to release H⁺ ions.

(b) They are characterized by a pH value less than 7.

(c) The lower the pH value, the more acidic a solution is.

(d) When an acid is added, blue litmus turns a red colour and phenolphthalein remains colorless.

(e) Acidic solutions conduct electricity.

(f) According to Arrhenius, bases are substances that dissolve in water to release OH⁻ ions.

(g) Acids are responsible for the sour taste in foods.

(h) Bases are characterized by a pH value greater than 7.

(i) The higher the pH value, the more basic a solution is.

(j) When a base is added, red litmus turns a blue colour and phenolphthalein pink.

(k) Basic solutions conduct electricity.

(l) Bases are responsible for the bitter taste in foods.

25. Classify each change in the following table as either chemical or physical. Explain your classification.

Change	Chemical or physical?	Explanation
A sheet of paper is crumpled into a ball.	physical	no change in chemical properties
A sheet of paper is set on fire and burns to ashes.	chemical	smell goes off
Steel wool is placed in a glass of salty water. The steel wool rusts.	chemical	color change

Use the following solubility table to complete the tables below.

Ions	NH_4^+	NO_3^- ClO_3^- ClO_4^-	CH_3COO^-	Cl^- Br^- I^-	SO_4^{2-}	S^{2-}	OH^-	CO_3^{2-} PO_4^{3-} SO_3^{2-}
High solubility	all	all	most	most	most	group 1 group 2 NH_4^+	group 1 NH_4^+ Sr^{2+} Ba^{2+} Tl^+	group 1 NH_4^+
Low solubility	none	none	Ag^+ Hg^+	Ag^+ Pb^{2+} Cu^+ Hg^+ Tl^+	Ag^+ Pb^{2+} Ca^{2+} Ba^{2+} Sr^{2+} Ra^{2+}	most	most	most

27. Complete the following table.

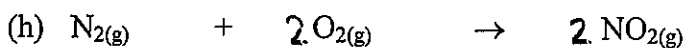
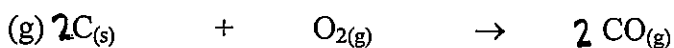
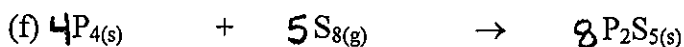
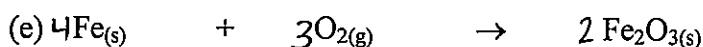
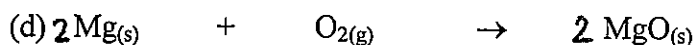
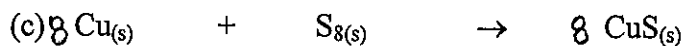
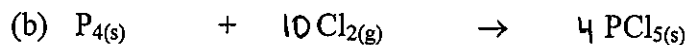
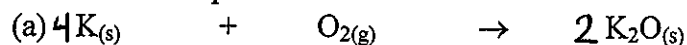
Name	Formula	Cation	Anion	High or low solubility?
sodium chloride	NaCl	Na^+	Cl^-	high
lithium iodide	LiI	Li^+	I^-	high
magnesium chlorate	$\text{Mg}(\text{ClO}_3)_2$	Mg^{2+}	ClO_3^-	high
strontium hydroxide	$\text{Sr}(\text{OH})_2$	Sr^{2+}	OH^-	high
barium carbonate	BaCO_3	Ba^{2+}	CO_3^{2-}	low

28. Complete the following table.

Name	Formula	High or low solubility?
	Al(OH) ₃	low
ammonium chloride		high
	K ₂ S	high
molybdenum(V) chlorate		high
	Pb(CH ₃ COO) ₂	high
copper(II) iodide		high
	FeCO ₃	low
calcium sulfite	CaSO ₃	low
	Ba ₃ (PO ₄) _{2(s)}	low
palladium(II) bromide	PdBr ₂	high

* copper(I) would be low

29. Balance each equation for a formation reaction.

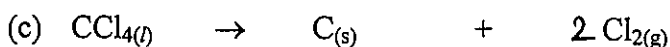
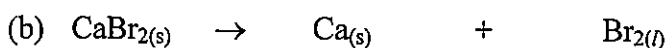
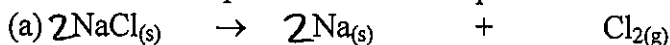


30. Write a balanced chemical equation to represent each reaction described below.

(a) Solid aluminum metal reacts with oxygen gas to form solid aluminum oxide.

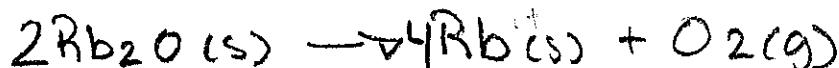


31. Balance each equation for a decomposition reaction.

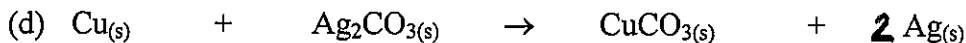
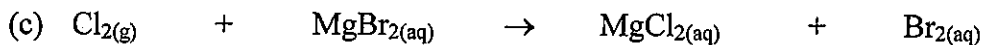


32. Write a balanced chemical equation to represent each reaction described below.

(a) Rubidium oxide decomposes into its elements.



33. Balance each equation for a single replacement reaction.



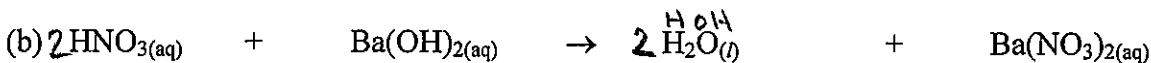
34. Write a balanced chemical equation to represent each reaction described below.

(a) Silver reacts with gold(III) nitrate.



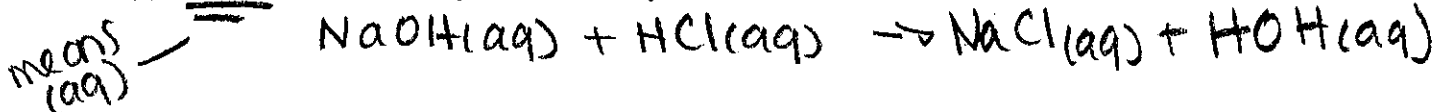
check solubility chart

35. Balance each equation for a double replacement reaction.

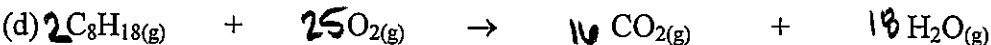
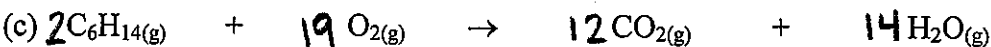
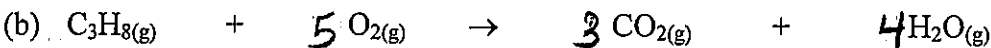
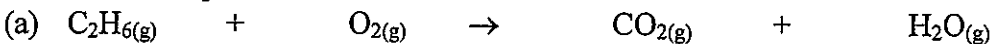


36. Write a balanced chemical equation to represent each reaction described below.

(a) Solutions of sodium hydroxide and hydrochloric acid react.

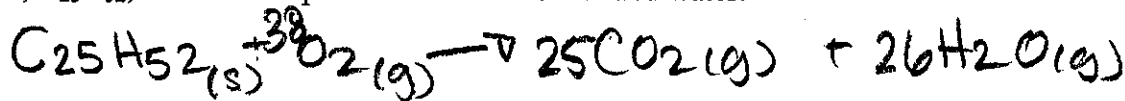


37. Balance each equation for a combustion reaction.



38. Write a balanced chemical equation to represent each reaction described below.

(a) Candle wax, $\text{C}_{25}\text{H}_{52}$, is burned to produce carbon dioxide and water.



39. Classify each reaction as a formation (F), decomposition (D), single replacement (SR), double replacement (DR), or combustion (C) reaction. Then balance each equation.

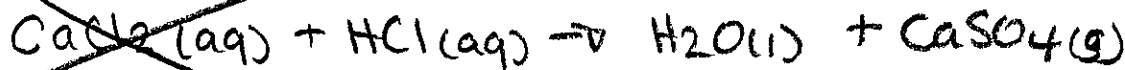
Reaction	Classification
$3\text{Li}_{(s)} + \text{AlCl}_{3(aq)} \rightarrow \text{Al}_{(s)} + 3\text{LiCl}_{(aq)}$	SR
$2\text{NH}_3(g) \rightarrow \text{N}_2(g) + 3\text{H}_2(g)$	D
$2\text{K}_{(s)} + \text{Br}_{2(l)} \rightarrow 2\text{KBr}_{(s)}$	F
$2\text{C}_{10}\text{H}_{22}(l) + 31\text{O}_2(g) \rightarrow 20\text{CO}_2(g) + 22\text{H}_2\text{O}(g)$	C
$2\text{NH}_4\text{OH}_{(aq)} + \text{H}_2\text{CO}_{3(aq)} \rightarrow 2\text{H}_2\text{O}_{(l)} + (\text{NH}_4)_2\text{CO}_{3(aq)}$	DR

40. Balance each equation, and classify the reaction as a formation (F), decomposition (D), single replacement (SR), double replacement (DR), combustion (C), or other (O) reaction.

Reaction	Classification
$\underline{\quad}$ Ni(s) + $\underline{2}$ HCl(aq) \rightarrow $\underline{\quad}$ NiCl ₂ (aq) + $\underline{\quad}$ H ₂ (g)	SR
$\underline{2}$ Au(CN) ₃ (aq) + $\underline{3}$ Zn(s) \rightarrow $\underline{2}$ Au(s) + $\underline{3}$ Zn(CN) ₂ (aq)	SR
$\underline{\quad}$ O ₂ (g) + $\underline{2}$ Be(s) \rightarrow $\underline{2}$ BeO(s)	F
$\underline{2}$ FeCl ₃ (aq) + $\underline{3}$ Na ₂ SO ₃ (aq) \rightarrow $\underline{6}$ NaCl(aq) + $\underline{\quad}$ Fe ₂ (SO ₃) ₃ (s)	DR
$\underline{2}$ C ₈ H ₁₈ (g) + $\underline{25}$ O ₂ (g) \rightarrow $\underline{16}$ CO ₂ (g) + $\underline{18}$ H ₂ O(g)	C
$\underline{\quad}$ (NH ₄) ₂ S(aq) + $\underline{\quad}$ Mn(NO ₃) ₂ (aq) \rightarrow $\underline{2}$ NH ₄ NO ₃ (aq) + $\underline{\quad}$ MnS(s)	DR
$\underline{\quad}$ P ₄ (s) + $\underline{6}$ F ₂ (g) \rightarrow $\underline{4}$ PF ₃ (l)	F
$\underline{\quad}$ Al ₂ (SO ₄) ₃ (aq) + $\underline{2}$ Na ₃ PO ₄ (aq) \rightarrow $\underline{3}$ Na ₂ SO ₄ (aq) + $\underline{2}$ AlPO ₄ (s)	DR

41. Write a balanced chemical equation to represent each reaction. Then classify the reaction as a formation, decomposition, single replacement, double replacement, or combustion reaction.

(a) A solution of calcium chloride reacts with hydrochloric acid to produce water and a calcium sulfate precipitate.



(b) Butane gas, C₄H₁₀(g), in a lighter burns in the presence of oxygen gas to form carbon dioxide gas and water vapour.



42. Find the molar mass of each compound.

(a) calcium chlorate, Ca(ClO₃)₂

Ca: 1 x 40.08 = 40.08
 Cl: 2 x 35.45 = 70.90
 O: 6 x 16.00 = 32.00
 } add = 142.98 g/mol

(b) magnesium hydroxide, Mg(OH)₂

Mg: 1 x 24.31 = 24.31
 O: 2 x 16.00 = 32.00
 H: 2 x 1.01 = 2.02
 } add = 62.33 g/mol

43. In each sample, determine what amount (in mol) of the compound is present.

(a) 8.40 g of NaOH

Step 1: Find molar mass

Na: 22.99
 O: 16.00
 H: 1.01

} - 40.00 g/mol

Step 2: cross multiply

(b) 4.2 kg of water (H₂O)

Step 1: H: 2 x 1.01
 O: 1 x 16.00 } - 18.02 g/mol

$\frac{40.00 \text{ g}}{1 \text{ mol}} = \frac{8.40 \text{ g}}{0.21 \text{ mol}}$

$\frac{18.02 \text{ g}}{4200 \text{ g}} = 0.00429 \text{ mol}$

