



A-level Chemistry Summer Homework: Transition activities

The following activities cover some of the key skills from GCSE science that are relevant at A-level. They include the vocabulary used when working scientifically, and some maths and writing skills.

You must complete these activities before you start A-level chemistry in September and have them ready to hand to your new teacher in your first lesson.

The activities are **not a test**. Try the activities first and see what you remember, and then use textbooks or other resources to answer the questions. **Don't** just go to Google for the answers! Actively engaging with your notes and resources from GCSE will make this learning experience *more* worthwhile. You will have a solid head-start to A-level chemistry, because you will be able to <u>retrieve</u> the knowledge and skills <u>if the work has come from you</u>!

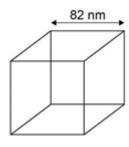
Using maths skills

Throughout A-level Chemistry you will need to be able to use maths skills you developed in GCSE Chemistry and GCSE maths, such as using standard form, rounding correctly and quoting your answer to an appropriate number of significant figures.

Activity 1 Using maths skills

- 1. Write the following numbers in standard form:
 - a. 4000 c. 16 001
 - b. 1 000 000 d. 12.45
- Zinc oxide can be produced as nanoparticles. A nanoparticle of zinc oxide is a cube of side 82nm.

Calculate the surface area of a nanoparticle of zinc oxide. Give your answer in standard form.



- 3. Express the following numbers to 3 significant figures:
 - a. 57 658 c. 0.001000
 - b. 0.045346 d. 2.03988 x 10⁻⁴
- 4. Make the bracketed symbol after each equation the subject of the equation, e.g. in question (a), write the equation in the form: λ =

(a)
$$c = f \lambda$$
 (λ)
(b) $c = \frac{n}{V}$ (V)
(c) $q = m c \Delta T$ (ΔT)
(d) $n = c x \frac{V}{1000}$ (V)
(e) $n = c x \frac{V}{1000}$ (c)
(f) $E = hf$ (h)
(g) $\Delta G = \Delta H - T\Delta S$ (ΔS)

Using the periodic table

The Periodic Table of the Elements

During A-level Chemistry you will need to become familiar with the periodic table of the elements and be able to use information from the table to answer questions.

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c	(18)	H 40	helium 2	20.2 Ne	neon 10	39.9 Ar	argon 18	83.8 Kr	krypton 36	131.3 X B	xenon 54	Bn	radon 86	0 <mark>8</mark>	ogenesson 118	175.0	Intetium	4	[262] L	n lawrencium 103
۲	-		(17)	19.0 F	fluorine 9								astatine 85	18 18	nnessine 117	173.0	vtterbium vt	20	[259] No	102
ű	0		(16)	16.0 O	oxygen 8							[209] Po	oolonlum 84	[293] Lv	'ermorium 116	168.9	H T T T	69	[258] Md	mendelevium 101
u	0		(15)	14.0 N	nitrogen 7	31.0 P	phosphorus 15	74.9 As	arsenic 33	121.8 Sb	antimony 51	209.0 Bi	bismuth 83	[289] Mc	moscovium 115	167.3	Ъ			femium 100
	t		(14)	12.0 C			silicon 14		gemanium 32	118.7 Sn	50 ti	207.2 Pb		[289] Fl	E	164.9	Ho Holmium	67	[252] Es	einsteinium 99
ç	0		(13)	10.8 B	boron 5	27.0 Al	aluminium 13	69.7 Ga	gallium 31	114.8 In	indium 49	204.4 Tl	thalllum 81			162.5		99	ପ୍ଟ] ଅଧ୍ୟ	californium 98
							(12)	65.4 Zn	30 c	112.4 Cd	cadmium 48	200.6 Hg	mercury 80	G ²⁸⁵	copernicium 112	158.9	terbium terbium	65	[247] BK	berkelium 97
							(11)	63.5 Cu	copper 29	107.9 Ag	silver 47	197.0 Au	gold 79	[281] Pg	-		Gd aadolinium	64	[247] Cm	curium 96
							(01)	58.7 Ni	nickel 28	106.4 Pd	palladium 46	195.1 Pt	78 78	D3	mstadtium 110	152.0				americium 95
							(6)	58.9 Co	cobalt 27	102.9 Rh	thodium 45	192.2 Ir	Iridium 77	[278] Mt	meitnerium 109	150.4	Smanum	62	244] Pu	plutonium 94
		₽	hydrogen 1				(8)	55.8 Fe	iron 26	101.1 Ru	ruthenium 44	190.2 Os	osmlum 76	[270] Hs	hassium 108	[145]	Pm promethium	61	237] ND	neptunium 93
			Ĩ			Î	6	54.9 Mn	manganese 25	JC [26]	technetium 43	186.2 Re	rhenlum 75	I [269] [270] [270] [270] [270]	bohrium 107	144.2		99	238.0 U	protactinium uranium r 91 92
				mass	umber		(0)	52.0 Cr	chromium 24	96.0 Mo	molybdenum 42	183.8 W	tungsten 74	ଅକ୍ଟି ଅକ୍ଟି	seaborgium 106	140.9	Pr Drasendomium	59	231.0 Pa	protactinium 91
			Key	relative atomic mass symbol	name atomic (proton) number	199 1994	(2)	۲ 50.9	vanadium 23		niobium 41	180.9 Ta	tantalum 73	200 200 200	dubnik 105	140.1	Serium Cerium		232.0 Th	
				relat	atom	2	(4)	47.9 TT	titanium 22	91.2 Zr	zirconium 40	178.5 Hf	hafnlum 72	267 Rf	rutherfordium 104					
							(3)	45.0 S C	scandium 21	88.9 Y	yttrium 39	138.9 La *	lanthanum 57		actinium 89		nides		-	Sap
G	N		(2)	9.0 Be	beryllium 4	24.3 Mg	magnesium 12	69 1:0 0	calcium 20	87.6 Sr	strontium 38	137.3 Ba	barlum 56	[226] Ha	radium 88		* 58 - 71 Lanthanides			T 90 - 103 Actinides
•	-		(1)	6.9 Li	lithium 3	23.0 Na	sodium 11	39.1 K	potassium 19	85.5 Rb	rubidium 37	132.9 Cs	caeslum 55	[223] Fr	francium 87		* 58 - 71			1 - 06 L

Here is a copy of the periodic table that you will be given to use in your exams.

Activity 2 Atoms

- 1. Give the atomic number of:
 - a. Osmium
 - b. Lead
 - c. Sodium
 - d. Chlorine
- 2. Give the relative atomic mass (A_r) of:
 - a. Helium
 - b. Francium
 - c. Barium
 - d. Oxygen
- 3. What is the number of neutrons in each of the following elements?
 - a. Fluorine
 - b. Beryllium
 - c. Gold

Activity 3 Formulae of common compounds

Give the formulae of the following compounds:

- 1. Methane
- 2. Sulfuric acid
- 3. Potassium manganate (VII)
- 4. Water

7. Ethane
 8. Ethene

6. Nitric acid

9. Ethanol

5. Ammonia

- 9. Elhanoi 10 Dheanharia ag
- 10. Phosphoric acid

Activity 4 lons and ionic compounds

The table below lists the formulae of some common ions.

Positive ions		Negative ions				
Name	Formula	Name	Formula			
Aluminium	Al ³⁺	Bromide	Br [_]			
Ammonium	NH_4^+	Carbonate	CO ₃ ^{2–}			
Barium	Ba ²⁺	Chloride	Cl⁻			
Calcium	Ca ²⁺	Fluoride	F⁻			
Copper(II)	Cu ²⁺	lodide	I-			
Hydrogen	H⁺	Hydroxide	OH⁻			
Iron(II)	Fe ²⁺	Nitrate	NO ₃ ⁻			
Iron(III)	Fe ³⁺	Oxide	O ²⁻			
Lead	Pb ²⁺	Sulfate	SO4 ²⁻			
Lithium	Li⁺	Sulfide	S ^{2–}			
Magnesium	Mg ²⁺					
Potassium	K ⁺	7				
Silver	Ag⁺	7				
Sodium	Na⁺	7				
Zinc	Zn ²⁺	7				

Use the table to write the formulae for the following ionic compounds.

- 1. Magnesium bromide
- 2. Barium oxide
- 3. Zinc chloride
- 4. Ammonium chloride
- 7. Calcium nitrate

6. Aluminium bromide

- 8. Iron (II) sulfate
 - 9. Iron (III) sulfate
- 5. Ammonium carbonate

Activity 5 Balancing equations

- 1. Write balanced symbol equations for the following reactions, using the information on the previous pages to work out the formulae of the compounds. Remember some of the elements may be diatomic molecules.
 - a. Aluminium + oxygen \rightarrow aluminium oxide
 - b. Methane + oxygen \rightarrow carbon dioxide + water
 - c. Calcium carbonate + hydrochloric acid \rightarrow calcium chloride + water + carbon dioxide
- 2. Chalcopyrite is an important copper ore mineral with formula CuFeS₂. Copper can be produced from rock that contains CuFeS₂ in two stages.

Balance the equations for the two stages in this process. Hint: remember that fractions can be used to balance equations.

 $CuFeS_2 + O_2 + SiO_2 \rightarrow Cu_2S + Cu_2O + SO_2 + FeSiO$ Stage 1:

Stage 2: $Cu_2S + CuO \rightarrow Cu + SO_2$

- 3. Balance the following equations:
 - a. $H_2 + O_2 \rightarrow H_2O$ b. $S_8 + O_2 \rightarrow SO_3$ c. HgO \rightarrow Hg + O₂ d. Zn + HCl \rightarrow ZnCl₂ + H₂ e. Na + H₂O \rightarrow NaOH + H₂ f. $C_{10}H_{16}$ + $CI_2 \rightarrow C$ + HCl g. Fe + $O_2 \rightarrow Fe_2O_3$ h. $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$ i. $Fe_2O_3 + H_2 \rightarrow Fe + H_2O$ j. Al + FeO \rightarrow Al₂O₃ + Fe

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Activity 6 Moles

The amount of a substance is measured in moles. The mass of one mole of a substance in grams is numerically equal to the relative formula mass of the substance. One mole of a substance contains the same number of particles – atoms, molecules or ions - as one mole of any other substance. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02×10^{23} particles per mole.

1. Complete the table. Use the periodic table to help you.

Substance	Mass of substance in grams	Amount in moles	Number of particles				
Helium			18.12 × 10 ²³				
Chlorine (Cl)	14.2						
Methane		4					
Sulfuric acid	4.905						

2. Answer the following questions on moles.

- a) How many moles of phosphorus pentoxide (P_4O_{10}) are in 85.2g?
- b) How many moles of potassium are in 73.56g of potassium chlorate (V) (KClO₃)?
- c) How many moles of water are in 249.6g of hydrated copper(II) sulfate (CuSO₄.5H₂O)? For this one, you need to be aware the dot followed by 5H₂O means that the molecule comes with 5 water molecules, so these have to be counted in as part of the formula mass.
- d) What is the mass of 0.125 moles of tin sulfate (SnSO₄)?
- e) If I have 2.4g of magnesium, how many g of oxygen (O₂) will I need to react completely with the magnesium? 2Mg + $O_2 \rightarrow MgO$
- 3. Answer the following questions.
 - a) What is the concentration (in mol dm⁻³) of 9.53g of magnesium chloride (MgCl₂) dissolved in 100cm³ of water?
 - b) What is the concentration (in mol dm⁻³) of 13.248g of lead nitrate (Pb(NO₃)₂) dissolved in 2dm³

of

- water?
- c) If I add 100cm³ of 1.00 mol dm³ HCl to 1.9 dm³ of water, what is the concentration of the new solution?
- d) What mass of silver is present in 100cm³ of 1 mol dm⁻³ silver nitrate (AgNO³)?
- e) The Dead Sea, between Jordan and Israel, contains 0.0526 mol dm⁻³ of Bromide ions (Br⁻). What mass of bromide ions is in 1 dm³ of Dead Sea water?

Extended writing

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The ability to write coherently in a logical, well-structured way is an essential skill to develop. At GCSE the 6-mark extended response questions are used so students can demonstrate this skill. At A-level you will still need to write precise answers using precise scientific language.

The command word in a question, like at GCSE, is important as it gives you an indication of what to include in your answers. For example, 'explain' means you must give scientific reasons why things are happening, not just a description. A comparison needs advantages and disadvantages, or points for and against.

Activity 7 Types of bonding extended response question

Compare the similarities and differences between ionic, covalent and metallic bonding. Do not bulletpoint your answer. Ensure your response is communicated coherently and in a logical order.

Continue on separate paper if you need to...