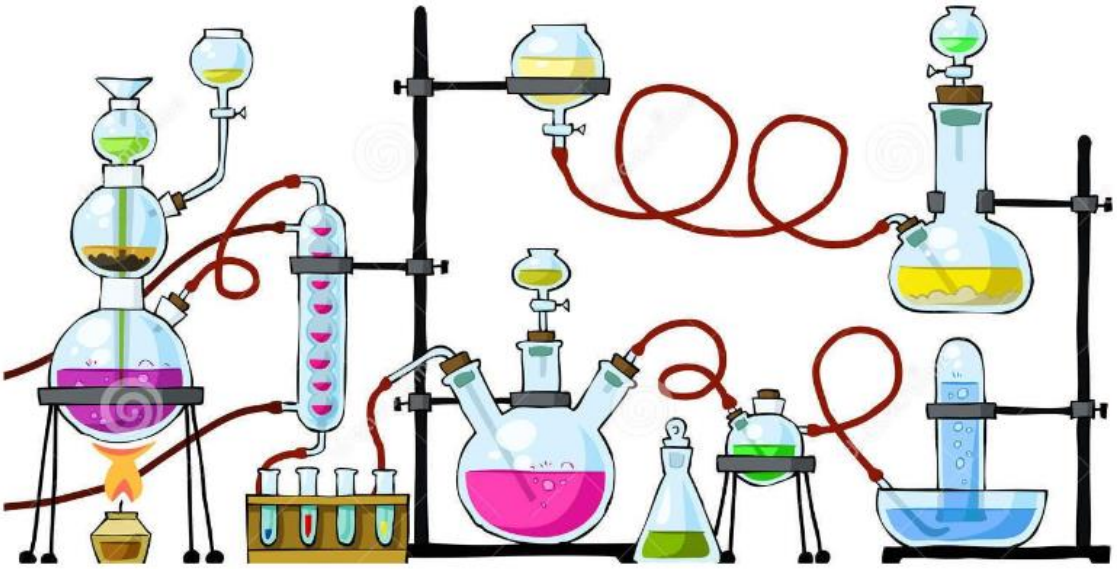
A-Level Chemistry Transition booklet

"Every aspect of the world today, even politics and international relations, is affected by chemistry."
Linus Pauling (1901 – 1994)



RAD July 2023

Welcome to Chemistry at SJBC!

This transition work is designed to help you bridge the gap between your GCSE studies and A-Level.

Why do transition work?

Preparation is crucial for studying A-Levels. A-Levels require you to be an independent learner. Although you will be studying fewer subjects, A-Levels require different study skills and the volume of work is greater due to the increased demand of depth and detail.

The exercises in this booklet will ensure you are ready for A-Level chemistry in September.

Is transition work assessed?

YES! In September, your chemistry teacher will ask you for your transition work, and it will be assessed.

You must bring all the work with you for your first Year 12 chemistry lesson in September.

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Research activities

Use your online searching abilities to find out as much about the following topics, and make a one-page summary for each using Cornell notes, see the link below:

http://coe.jmu.edu/learningtoolbox/cornellnotes.html

You will make Cornell notes during the two year course, so get as much practice as you can.

Task 1: The chemistry of fireworks

What are the component parts of fireworks? What chemical compounds cause fireworks to explode? What chemical compounds are responsible for the colour of fireworks?

Task 2: Why is copper sulphate blue?

Copper compounds like many of the transition metal compounds have vivid and distinctive colours – but why?

Task 3: Aspirin

What was the history of the discovery of aspirin, how do we manufacture aspirin in a modern chemical process?

Task 4: The hole in the ozone layer

Why did we get a hole in the ozone layer? What chemicals were responsible for this? Why were we producing so many of these chemicals? What is the chemistry behind the ozone destruction?

Task 5: ITO and the future of touch screen devices

ITO – indium tin oxide is the main component of touch screen in phones and tablets. The element indium is a rare element and we are rapidly running out of it. Chemists are desperately trying to find a more readily available replacement for it. What advances have chemists made in finding a replacement for it?

Atomic structure and the Periodic Table

Complete the following sentences and definitions to give a summary of this topic.

Structure of an atom

The nucleus contains …

The electrons are found in the …

To work out the number of each sub-atomic particle in an atom we use the Periodic Table (PT). The number of protons is given by …

In a neutral atom the number of electrons is …

To work out the number of neutrons we …

State what is meant by the following terms.

1 Relative atomic mass

2 Relative molecular mass

3 Isotope

4 Relative isotopic mass

Structure of an ion

When an atom becomes an ion, only the number of _____ changes.

For positive ions this _____ by the number equivalent to the charge on the ion.

For negative ions this _____ by the number equivalent to the charge on the ion.

Chemical formulae

Write the formulae of the following compounds.

Copper(II) sulphate	
Nitric acid	
Copper(II) nitrate	
Sulphuric acid	
Sodium carbonate	
Aluminium sulphate	
Ammonium nitrate	
Nitrogen dioxide	
Sulphur dioxide	
Ammonia	
Ammonium sulphate	
Potassium hydroxide	
Calcium hydroxide	

Cations and anions

Complete the table below to show the substance, its formula and its individual ions.

Substance	**Formula**	**Cation (exact number)**	**Anion (exact number)**
Sodium bromide			
	KI		
Silver nitrate			
Copper(II) sulphate			
	$NaHCO_3$		
Magnesium carbonate			
Lithium carbonate			
	$Ca(HSO_4)_2$		
Aluminium nitrate			
Calcium phosphate			
Potassium hydride			
Sodium ethanoate			
	$KMnO_4$		
Potassium dichromate(VI)			
Zinc chloride			
Strontium nitrate			
Sodium chromate(VI)			
Calcium fluoride			
Potassium sulphide			
Magnesium nitride			
Lithium hydrogensulphate			
	$(NH_4)_2SO_4$		

Writing equations

Write: (a) the chemical equation, and
(b) the ionic equation for each of the following reactions.

1. Magnesium with sulphuric acid

2. Calcium carbonate with nitric acid

3. Hydrochloric acid with sodium hydroxide

4. Aqueous barium chloride with aqueous sodium sulphate

5. Aqueous sodium hydroxide with sulphuric acid

6. Aqueous silver nitrate with aqueous magnesium chloride

7. Solid magnesium oxide with nitric acid

8. Aqueous copper(II) sulphate with aqueous sodium hydroxide

9. Aqueous lead(II) nitrate with aqueous potassium iodide

10. Aqueous iron(III) nitrate with aqueous sodium hydroxide

Essential Maths Skills for A-Level Chemistry

Significant figures

A significant figure is any digit which you are confident is correct. A non-significant figure is any digit that you can't be sure about. It's important to recognise how many significant figures a value has been quoted to and how to round your own data to an appropriate number of significant figures.

Remember:

- Count the number of significant figures from the first non-zero digit.
- Zeros at the start of a number are not significant.

So,

- 187.23 (5 s.f.)
- 0.038 (2 s.f.)
- 448 000 (3 s.f.)

The rule for significant figures in calculations is to give your final answer to the same number of significant figures as the data value with the fewest significant figures used in the calculation.

1. How many significant figures are each of these values given to?

a) 221 985 Pa ……..

b) 15 200 g ……..

c) 39.00 K ..……

d) 0.00186 mol ……..

2. Write each of the following to the number of significant figures shown:

a) 345789 4 s.f. ……

b) 297300 3 s.f. ..……..

c) 0.07896 3 s.f. ..…… …….

d) 6.0961 3 s.f. ….……...

e) 0.001563 3 s.f. …….

f) 0.010398 4 s.f. ……. ……

3. Complete the following sums and give the answers to the appropriate number of s.f.s.

a) 6125 x 384
..……...

b) 25.00 x 0.010
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c) 13.5 + 0.18
…..…….

4. 0.175 moles of sodium chloride were dissolved in 1.2 dm^3 of water.

Use the formula concentration = moles/volume to calculate the concentration of the solution and quote your answer to the correct number of significant figures.

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Standard form

Standard form tidies up very big or very small numbers in calculations.

For example, there are 602 000 000 000 000 000 000 000 particles in 1 mole.

This is much easier to write as 6.02×10^{23}

or $0.0051\ m^3$ is easier to write as $5.1 \times 10^{-3}\ m^3$

1. Write the following in standard form:

   a) $0.000\ 035\ mol\ dm^{-3}$ …….

   b) 201500 Pa …….

   c) 0.0167 moles …….

   d) $6850000000\ dm^3$ …….

   e) 0.000000382 g …….

2. Complete the following calculations and give the answers to the appropriate number of s.f.s.

   a) $6.125 \times 10^{-3} \times 3.5$ ……,,,,,……...

   b) $4.3 \times 10^{-4} / 7.00$ ……..

   c) $4.0 \times 108 + 35000$,…….....

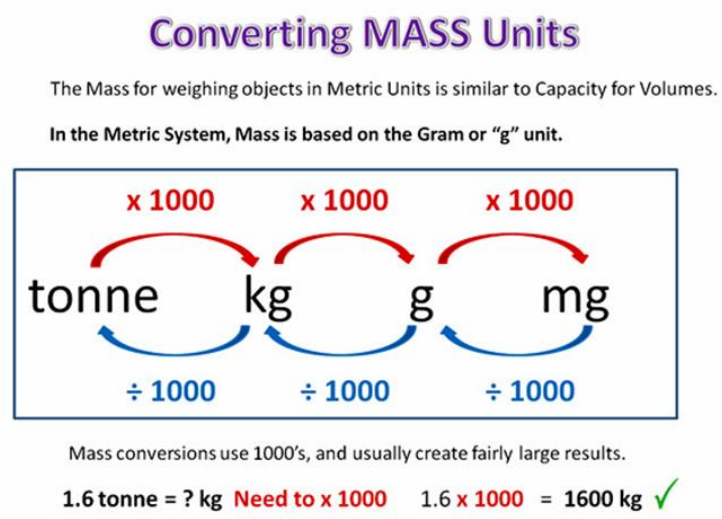
   d) $0.00156 + 2.4 \times 10^3$ …….

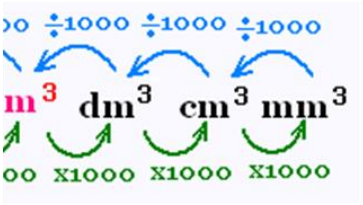
   e) $6.10 \times 10^{-2} – 3.4 \times 10^{-5}$ ……..

   f) $8.00 \times 10^{-3} \times 0.100 \times 10^{-3}$ ……

Converting units

Make sure you know the following common unit conversions.





Convert the following units:

1. 10 kg into g ……
2. 360 mg into g ……
3. 360 cm into m ……
4. 360 cm^3 into m^3 ……
5. 250 cm^3 into dm^3 ……
6. 2 dm^3 into mm^3 ……
7. 42357 g into mg ……
8. 4.1 kJ mol^{-1} to J mol^{-1} ……

9. During a titration, 31 cm^3 of an alkali is needed to neutralise 0.025 dm^3 of an acid. What is the total volume of the acid and alkali in cm^3?

10. What is the total mass, in grams, of 137 mg, 4g and 32kg?

Using Formulae

Formulae are used often in chemistry, as they give a relationship between two or more quantities.

It is an essential skill that you need to be able to **rearrange formulae**, **substitute values**, **converting to the correct units** if needs be.

You should be familiar with these formulae:

$$\text{number of moles} = \frac{\text{mass of substance}}{\text{relative molecular mass (Mr)}}$$

$$\text{concentration (mol dm}^{-3}\text{)} = \frac{\text{number of moles}}{\text{volume of solution (dm}^3\text{)}}$$

Always show your working in calculations, ie.

- state the formula
- input values
- then calculate your answer.

Always give the correct units with your answer.

Show your working for each of these calculations.

1. The Mr of CO_2 is 44. Calculate the number of moles in 125g of CO_2.

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2. 5.0 moles of $CaCl_2$ is dissolved in 750 cm^3 of water. What is the concentration in mol dm^{-3}?

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3. 2.0 g of NaOH were dissolved in 250 cm^3 of water in a flask.

   a) How many moles of NaOH are in this solution?

   b) What is the concentration of the solution in mol.dm-3?

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Rearranging equations

Equations are used in chemistry in both Year 12 and Year 13.

This is an essential skill that you need to have.

Rearrange these equations:

1. $c = \frac{n}{v}$ to find **v**

2. $n = \frac{m}{Mr}$ to find **moles**

3. $pV = nRT$ to find **T**

4. Rate = $k[NO]^2$ to find **[NO]**

5. $\Delta G = \Delta H - T\Delta S$ to find **T**

   (Δ means change)

Useful websites

There are a number of websites that will be useful to you now and throughout your time studying A-level Chemistry, including:

1. Physics and Maths Tutor

https://www.physicsandmathstutor.com/chemistry-revision/a-level-aqa/

This website allows you to access a range of resources, from course notes, flashcards and tutorial videos to exam question packs and mark schemes for every topic covered at A-level.

2. Chemguide

https://www.chemguide.co.uk/

This website has detailed notes on all areas of the A-level course and also identifies and addresses common misconceptions.

3. Seneca Learning

https://senecalearning.com/en-GB/

This website has many subjects linked to the specific exam boards which you can use to support your knowledge. It allows you to study and then test the information you have learnt.

4. Isaac Physics

https://isaacphysics.org/alevel?stage=all

This website is useful for physical chemistry, particularly the calculation topics.

Become a better chemist… 😊

READ SOME BOOKS

1. ***Why Chemical Reactions Happen.*** Keeler and Wothers
2. ***The chemistry of explosives.*** Akhavan, Jacqueline
3. ***The periodic kingdom – a journey into the land of the chemical elements.*** Atkins, Peter
4. ***Chemistry in the market place.*** Selinger, Ben
5. ***Bad science.*** Goldacre, Ben
6. ***Bad Pharma.*** Goldacre, Ben
7. ***The chemistry of fragrances.*** Pybus, David & Sell, Charles
8. ***Prometheans in the lab – chemistry and the making of the modern world.*** McGrayne, Sharon Bertsch

VISIT SOME WEBSITES

1. **Catalyst** (http://www.catalyststudent.org.uk/), a science magazine for students aged 14-19

2. Resources for students collated by **Royal Society of Chemistry** (http://www.rsc.org/Education/SchoolStudents/index.asp)

3. **Chemistry World magazine** (http://www.rsc.org/chemistryworld/index.asp)

4. **ChemNet society** (http://www.rsc.org/Membership/Networking/ChemNet/index.asp)

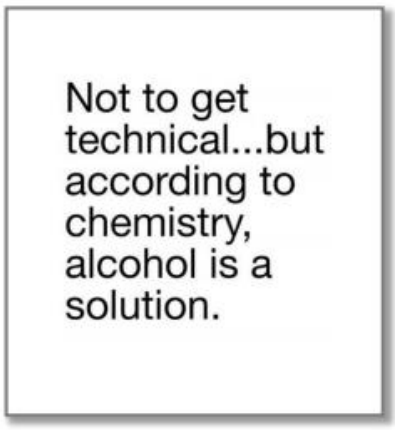
5. **New Scientist** (http://www.newscientist.com)

6. The Periodic Table **videos** from the University of Nottingham (http://periodicvideos.com)

7. AS/A level resources from the **University of Liverpool** (http://www.liv.ac.uk/chemistry/Undergrad/ALevel.html)

8. **Animations** of organic reactions mechanisms (http://www.chemtube3d.com/ALevel.html)

9. A level chemistry **notes** (http:www/chemguide.co.uk)



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