Bridging Activity for September 2017

A level Chemistry

Marks: 111

Why do I need to complete a bridging activity?

The purpose of this activity is to aid your preparation for advanced level study and make the transition from GCSE study as smooth as possible. Some activities are written pieces of work, some are research-based and some are practical. They should be completed to the best of your ability and they will give you the opportunity to start to showcase your talent for your chosen subjects. As these are compulsory activities, it is vital that you put in the time and effort to ensure they are completed to the highest standard.

When should I hand this in?

You should complete this activity for the start of your first lesson in September.

How will I be given feedback?

Feedback appropriate to the task will be given to you by your teacher.

Summary of the activity

There are 19 questions that test your previous GCSE knowledge in order to provide a bridge to AS level work. Anything that is unfamiliar to you should be researched as fully as possible.

A periodic table and a table of common ions has been provided.

It is essential that you attempt all questions as your marks will be taken into consideration when assessing your suitability for the course.

Student Name (to be completed by the student)

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1. Complete the following table. The first few have been done for you

element	symbol	atomic number	mass number	number of protons	number of neutrons	number of electrons	electron arrangement
hydrogen	H	1	1	1	0	1	1
helium	He	2	4	2	2	2	2
lithium	Li	3	7	3	4	3	2,1
beryllium		4	9				
boron		5	11				
carbon		6	12				
nitrogen		7	14				
oxygen		8	16				
fluorine		9	19				
neon		10	20				
sodium		11	23				
magnesium		12	24				
aluminium		13	27				
silicon		14	28				
phosphorus		15	31				
sulphur		16	32				
chlorine		17	35				
argon		18	40				
potassium		19	39				
calcium		20	40				

(17 marks)

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A level Chemistry

2. Neatly draw diagrams to show the electron arrangement of an atom for the following elements.
    a. nitrogen
    b. carbon
    c. potassium
    d. phosphorus
    e. argon

(5 marks)

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3. Ionic bonding.

Draw a dot and cross diagram that shows the ionic bonding in the following compounds.

Lithium Fluoride (LiF)

(2 marks)

Calcium Fluoride (CaF_2)

(2 marks)

Bridging Activity for September 2017

A level Chemistry

Aluminium Oxide (Al_2O_3)

(3 marks)

4. Using the Periodic Table, write the symbol for the ion formed (including its charge) from each of the following elements:

element	symbol of ion formed	element	symbol of ion formed
lithium		fluorine	
rubidium		iodine	
calcium		astatine	
strontium		selenium	
gallium		phosphorus	

(5 marks)

5. Fill in the table to show the electron arrangements for the following ions:

ion	electron arrangement	ion	electron arrangement
K^+		F^-	
S^{2-}		Mg^{2+}	
Al^{3+}		N^{3-}	

(3 marks)

Bridging Activity for September 2017

A level Chemistry

6. **Formulae:** Using the table of common ions provided complete the following table by writing in the symbols for all the ions, positive (cations) and negative (anions), which are part of the named compounds. Hence work out the formulae of the compounds. You are permitted to use a Periodic Table.

Name of Compound	Symbol for positive ion (cation)	Symbol for negative ion (anion)	Formula of Compound
potassium iodide			
rubidium oxide			
sodium nitride			
beryllium fluoride			
magnesium oxide			
aluminium oxide			
sodium nitrate			
magnesium hydroxide			
magnesium nitrate			
calcium phosphate			
ammonium sulphate			
copper(II) carbonate			
iron(II) sulphate			
sodium hydrogencarbonate			

(14 marks)

Bridging Activity for September 2017

A level Chemistry

Covalent bonding and properties of covalent compounds

7. Draw 'dot and cross' diagrams showing all the electrons in the following molecules:

Fluorine (F_2)

(2 marks)

Phosphine (PH_3)

(2 marks)

Hydrogen sulphide (H_2S)

(2 marks)

Nitrogen (N_2)

(2 marks)

Carbon dioxide (CO_2)

(2 marks)

Bridging Activity for September 2017

A level Chemistry

8. Balancing Equations.

Balance the following equations:

$C_2H_6(g)$ + O_2 (g) → CO_2 (g) + $H_2O(l)$

Fe(s) + $O_2(g)$ → $Fe_2O_3(s)$

Na(s) + $H_2O(l)$ → NaOH(aq) + $H_2(g)$

KI(aq) + $Pb(NO_3)_2(aq)$ → $PbI_2(s)$ + $KNO_3(aq)$

$CaCO_3(s)$ + HCl(aq) → $CaCl_2(aq)$ + $CO_2(g)$ + $H_2O(l)$

(5 marks)

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A level Chemistry

Question 9 – 16 involve Chemical Calculations and bonding.

9. Rubidium forms an ionic compound with silver and iodine. This compound has a potential use in miniaturised batteries because of its high electrical conductivity.

The empirical formula of this ionic compound can be calculated from its percentage composition by mass: Rb, 7.42%; Ag, 37.48%; I, 55.10%.

(i) Define the term *empirical formula*.

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(1 marks)

(ii) Calculate the empirical formula of the compound showing your working clearly.

(3 marks)

10. Barium metal can be extracted from barium oxide, BaO, by reduction with aluminium.

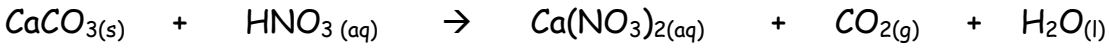
$$6BaO_{(s)} + 2Al_{(s)} \longrightarrow 3Ba_{(s)} + Ba_3Al_2O_{6(s)}$$

Calculate the mass of barium metal that could be produced from reduction of 500 g of barium oxide using this method.

Answer = ... g

(3 marks)

11. (a) Balance the following equation.



$$CaCO_{3(s)} + HNO_{3\,(aq)} \rightarrow Ca(NO_3)_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$

(b) What mass of calcium nitrate would be obtained from 40grams of calcium carbonate in the above reaction.

(4 marks)

Bridging Activity for September 2017

A level Chemistry

12. What mass of hydrogen is produced when 192 g of magnesium is reacted with hydrochloric acid?

$$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(aq)}$$

(3 marks)

13. The pollutant sulphur dioxide can removed from the air by reaction with calcium carbonate in the presence of oxygen. What mass of calcium carbonate is needed to remove 1 tonne of sulphur dioxide?

$$2CaCO_{3\,(s)} + 2SO_{2(g)} + O_{2(g)} \longrightarrow 2\,CaSO_{4(s)} + 2\,CO_{2(g)}$$

(4 marks)

Bridging Activity for September 2017

A level Chemistry

14. It takes 54 cm^3 of 0.1 mol dm^{-3} $NaOH_{(aq)}$ to neutralize 125 cm^3 of $HCl_{(aq)}$ solution. What is the concentration of the HCl in $moldm^{-3}{}_{(aq)}$?

$$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$$

(3 marks)

15. Zinc is similar to Group 2 metals and forms compounds containing Zn^{2+} ions.

Write an equation for the thermal decomposition of zinc carbonate to zinc oxide.

Calculate the percentage atom economy for the formation of zinc oxide from zinc carbonate in this reaction.

Equation

Percentage atom economy

(3 marks)

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16. A housing development requires 5000 kg of copper wiring.

A rock sample contains 1.5% $CuFeS_2$ by mass.

Calculate the mass in tonnes of rock needed to produce enough copper wiring for the housing development. (1 tonne = 1000 kg).

(4 marks)

Bridging Activity for September 2017

A level Chemistry

17. The equilibrium reaction below is carried out at 325°C in the presence of a nickel catalyst.

$$CO_{(g)} + 3H_{2(g)} \rightleftharpoons CH_{4(g)} + H_2O_{(g)} \qquad \Delta H = -206.1 \text{ kJ mol}^{-1}$$

(i) State and explain how the equilibrium position would change if:

- The temperature of the reaction was increased
- The total pressure was increased

(4 marks)

(ii) State the effect of the nickel catalyst on:

- The rate of the forward and backward reaction at equilibrium
- The equilibrium position

(2 marks)

(iii) State the effect on the equilibrium position of removing water from the reaction mixture. Explain your answer.

(2 marks)

(iv) Give one reason why, in practice, the reaction is carried out at a high temperature.

(1 mark)

18. Compare and explain the electrical conductivities of sodium and sodium oxide in the solid and liquid states.

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(Total 5 marks)

19. The non-metals chlorine and carbon have very different boiling points. Chlorine is a gas at room temperature but carbon does not boil until well over 4500 °C.

Explain this difference, in terms of bonding and structure.

In your answer, you should use appropriate technical terms, spelled correctly.

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(Total 3 marks)

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Table of common ions

+1		+2		+3		-3		-2		-1	
lithium	Li^+	beryllium	Be^{2+}	aluminium	Al^{3+}	nitride	N^{3-}	oxide	O^{2-}	fluoride	F^-
sodium	Na^+	magnesium	Mg^{2+}	iron(III)	Fe^{3+}	phosphide	P^{3-}	sulphide	S^{2-}	chloride	Cl^-
potassium	K^+	calcium	Ca^{2+}			phosphate	PO_4^{3-}	carbonate	CO_3^{2-}	bromide	Br^-
rubidium	Rb^+	strontium	Sr^{2+}					sulphate	SO_4^{2-}	iodide	I^-
caesium	Cs^+	barium	Ba^{2+}							hydroxide	OH^-
silver	Ag+	iron(II)	Fe^{2+}							nitrate	NO_3^-
copper(I)	Cu^+	zinc	Zn^{2+}							hydrogencarbonate	HCO_3^-
hydrogen	H^+	Copper(II)	Cu^{2+}							hydrogensulphate	HSO_4^-
ammonium	NH_4^+										

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
																	(18)
							1.0 H hydrogen 1										4.0 He helium 2
(1)	(2)		Key									(13)	(14)	(15)	(16)	(17)	
6.9 Li lithium 3	9.0 Be beryllium 4		relative atomic mass symbol name atomic (proton) number									10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	96.0 Mo molybdenum 42	[98] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La * lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac † actinium 89	[267] Rf rutherfordium 104	[268] Db dubnium 105	[271] Sg seaborgium 106	[272] Bh bohrium 107	[270] Hs hassium 108	[276] Mt meitnerium 109	[281] Ds darmstadtium 110	[280] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

140.1 Ce cerium 58	140.9 Pr praseodymium 59	144.2 Nd neodymium 60	[145] Pm promethium 61	150.4 Sm samarium 62	152.0 Eu europium 63	157.3 Gd gadolinium 64	158.9 Tb terbium 65	162.5 Dy dysprosium 66	164.9 Ho holmium 67	167.3 Er erbium 68	168.9 Tm thulium 69	173.1 Yb ytterbium 70	175.0 Lu lutetium 71
232.0 Th thorium 90	231.0 Pa protactinium 91	238.0 U uranium 92	[237] Np neptunium 93	[244] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[247] Bk berkelium 97	[251] Cf californium 98	[252] Es einsteinium 99	[257] Fm fermium 100	[258] Md mendelevium 101	[259] No nobelium 102	[262] Lr lawrencium 103

* **58 – 71** Lanthanides

† **90 – 103** Actinides