

Student Number: _____



CRANBROOK SCHOOL

YEAR 12

TERM 1, 2008

HSC COURSE EXAMINATION

Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 1.5 hours
- Write using blue or black pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- A Data Sheet and a Periodic Table are provided at the back of this paper
- Write your Student Number at the top of pages to be marked.

Total marks (75)

Section I

Pages 3 - 16

75 marks

This section has two parts, Part A and Part B

Part A - 10 marks

- Attempt Questions 1 - 10
- Allow about 12 minutes for this part

Part B - 65 marks

- Attempt Questions 11 - 23
- Allow about 1 hour and 18 minutes for this part

The content and format of this paper does not necessarily reflect the content and format of the HSC examination paper.

Student Number: _____

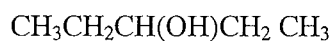
1. Use the tables below to answer the question.

Indicator	pH range	Colour Change
Phenolphthalein	8.3 – 10.0	Colourless – red
Bromothymol Blue	6.2 – 7.6	Yellow – blue
Litmus	5.0 – 8.0	Red – blue
Methyl orange	3.1 – 4.4	Red – yellow

Substance	COLOUR			
	Phenolphthalein	Bromothymol Blue	Litmus	Methyl Orange
A	Colourless	Blue	Blue	Yellow
B	Red	Blue	Blue	Yellow
C	Colourless	Green	Purple	Yellow
D	Colourless	Yellow	Purple	Yellow

Which substance A, B, C or D would have a pH closer to 7?

- (A)
(B)
(C)
(D)
2. What is the correct name for the following structure?



- (A) Pentanol
(B) 2-pentanol
(C) 3-pentanol
(D) Pentan-2-ol
3. Which of the following is a basic salt?

- (A) NH_4Cl
(B) NaCl
(C) $\text{NH}_4\text{CH}_3\text{COO}$
(D) CH_3COONa

4. What is the $[H^+]$ of a H_2SO_4 solution having a $pH = 3.6$?
- (A) $2.51 \times 10^{-4} \text{ mol L}^{-1}$
(B) $3.98 \times 10^{-4} \text{ mol L}^{-1}$
(C) 0.56 mol L^{-1}
(D) $5.02 \times 10^{-4} \text{ mol L}^{-1}$
5. Which substance is soluble in water and produces an acidic solution?
- (A) NO
(B) NO_2
(C) N_2O
(D) CO
6. Which equation correctly represents a β -decay?
- (A) ${}^{235}_{92}\text{U} \longrightarrow {}^4_2\text{He} + {}^{231}_{90}\text{Th}$
(B) ${}^{238}_{92}\text{U} + {}^1_0\text{n} \longrightarrow {}^{239}_{92}\text{U}$
(C) ${}^{241}_{94}\text{Pu} \longrightarrow {}^{241}_{95}\text{Am} + {}^0_{-1}\text{e}$
(D) ${}^{239}_{93}\text{Np} \longrightarrow \text{e}^- + {}^{239}_{94}\text{Pa}$
7. Which of the following is not a redox reaction?
- (A) $\text{NaOH} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$
(B) $\text{C}_2\text{H}_4 + 3\text{O}_2 \longrightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$
(C) $\text{Zn} + \text{Cu}(\text{NO}_3)_2 \longrightarrow \text{Cu} + \text{Zn}(\text{NO}_3)_2$
(D) $\text{ClO}_4^-(\text{aq}) + \text{CO}(\text{g}) \longrightarrow \text{ClO}_3^-(\text{aq}) + \text{CO}_2(\text{g})$

8. All four polymers below contain 3 monomer units. Which of the following would most likely be a condensation polymer?
- (A) $\{\text{CH}_2\text{CHClCH}_2\text{CHClCH}_2\text{CHCl}\}$
- (B) $\{\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}(\text{CH}_3)\}$
- (C) $\{\text{O}-\text{C}_6\text{H}_{10}\text{O}_4-\text{O}-\text{C}_6\text{H}_{10}\text{O}_4-\text{O}-\text{C}_6\text{H}_{10}\text{O}_4\}$
- (D) $\{\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\}$
9. Which polymer would most likely have the following properties of being stable to uv light, is crystalline and hard?
- (A) poly(vinyl chloride)
- (B) polystyrene
- (C) HDPE
- (D) LDPE
10. Which lists all the requirements for fermentation of sugars?
- (A) Oxygen, water, sugar, yeast, body temperature
- (B) Water, yeast, 37°C, oxygen excluded, vitamins
- (C) Sugar, 35°C, oxygen excluded, yeast, air
- (D) 35°C, oxygen excluded, water, yeast, fruit/sugar/grain etc.

Chemistry

Section 1 (continued)

Part B - 65 marks

Attempt Questions 11-23

Allow about 1 hour and 18 minutes for this part

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 11 (5 marks)

- (a) Name a recently developed biopolymer and name the specific enzyme(s) or organism used to synthesise it. **2**

- (b) Evaluate the use or potential use of the biopolymer in part (a) related to its properties. **3**

Marks

Question 14 (2 marks)

Describe a method used to produce a transuranic element.

2

Question 15 (4 marks)

Poly(vinyl chloride) and polystyrene are both common polymers. Evaluate the uses of each polymer in terms of their properties.

4

Question 16 (8 marks)

During your course you carried out an investigation to determine and compare the heats of combustion of at least 3 liquid alkanols per gram and per mole.

- (a) Describe your procedure, clearly stating the 3 alkanols used and listing your 3 alkanols in order of relative heat of combustion. 5

- (b) Give reasons why your calculated results (no specific values are necessary) being different to the published values and for each reason state how the problem may be reduced or overcome. 3

Question 18 (6 marks)

- (a) Name and give the formula of an amphiprotic species. 2

- (b) Show, using equations, why the species in part (a) above is amphiprotic. 2

- (c) In one of the equations in part (b) above, underline an acid-base conjugate pair. 1

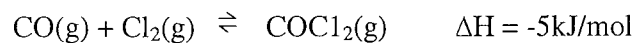
- (d) Whose acid-base theory is being illustrated in this question? 1

Question 19 (2 marks)

Clearly explain the difference between an equivalence point and an endpoint in a titration. 2

Question 20 (8 marks)

Consider the following equilibrium reaction.



Explain in equilibrium terms what effects each of the following have on the equilibrium system. Justify your answer.

- (a) An increase in temperature. 2

- (b) Removal of half the $\text{Cl}_2\text{(g)}$ 2

- (c) Increase in volume. 2

- (d) The addition of a catalyst. 2

Question 21 (6 marks)

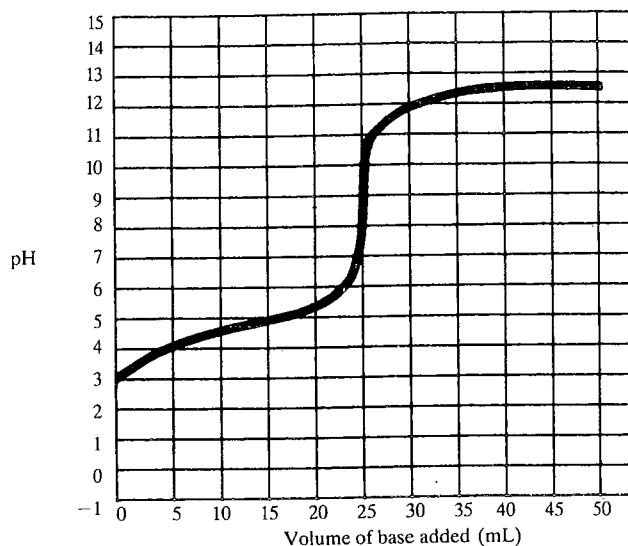
20.6 L of a gas was produced at 25°C and 100 kPa when copper(II) sulfide was roasted in oxygen.

- (a) Calculate the mass of copper(II) sulfide used. 2

- (b) Evaluate reasons for the concern about the release of the gas into the environment. Give relevant equations. 4

Question 22 (8 marks)

The diagram below illustrates the change in pH when 0.0500 molL^{-1} solution of potassium hydroxide was added to 10.0 mL of an unknown acid HA.



- (a) Write a balanced equation for the reaction above. 1

- (b) From the information above, calculate the concentration of the unknown acid. Justify your answer. 2

- (c) Explain whether the acid is weak or strong. Justify your answer. 1

(Question 22 continues on the next page)

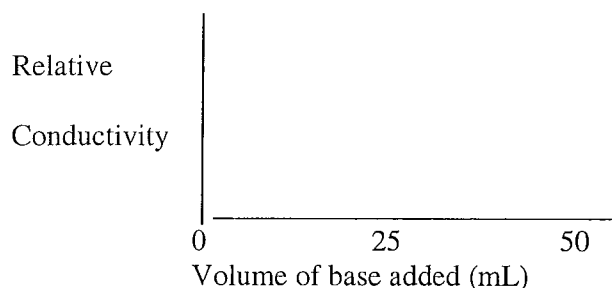
Marks

Question 22 (continued)

- (d) What is the pH of the original base? 1

- (e) Using equations, explain the acidity or basicity of the end products of the reaction. 2

- (f) In the space below, sketch what would happen to the conductivity of the solution during the whole titration. 1



Question 23 (2 marks)

- Qualitatively describe the effect of buffers with reference to a specific example in a natural system. 2

PERIODIC TABLE OF THE ELEMENTS

KEY		Atomic Number	Symbol of element	Name of element
79	Au	197.0	Gold	
26	Fe	55.85	Iron	
1	H	1.008	Hydrogen	2 He 4.003 Helium
3	Li	6.941	Lithium	10 Ne 20.18 Neon
4	Be	9.012	Beryllium	9 F 19.00 Fluorine
11	Na	22.99	Sodium	17 Cl 35.45 Chlorine
12	Mg	24.31	Magnesium	18 Ar 39.95 Argon
19	K	39.10	Potassium	36 Kr 83.80 Krypton
20	Ca	40.08	Calcium	35 Br 79.90 Bromine
37	Rb	85.47	Rubidium	54 Xe 131.3 Xenon
38	Sr	87.62	Strontium	53 I 126.9 Iodine
55	Cs	132.9	Caesium	86 Rn [222.0] Radon
56	Ba	137.3	Barium	
87	Fr	[223]	Francium	
88	Ra	[226]	Radium	
21	Sc	44.96	Scandium	
22	Ti	47.87	Titanium	
23	V	50.94	Vanadium	
24	Cr	52.00	Chromium	
25	Mn	54.94	Manganese	
26	Fe	55.85	Iron	
27	Co	58.93	Cobalt	
28	Ni	58.69	Nickel	
29	Cu	63.55	Copper	
30	Zn	65.41	Zinc	
31	Ga	69.72	Gallium	
32	Ge	72.64	Germanium	
33	As	74.92	Arsenic	
34	Se	78.96	Selenium	
35	Br	79.90	Bromine	
36	Kr	83.80	Krypton	
37	Rb	85.47	Rubidium	
38	Sr	87.62	Strontium	
39	Y	88.91	Yttrium	
40	Zr	91.22	Zirconium	
41	Nb	92.91	Niobium	
42	Mo	95.94	Molybdenum	
43	Tc	[97.91]	Technetium	
44	Ru	101.1	Ruthenium	
45	Rh	102.9	Rhodium	
46	Pd	106.4	Palladium	
47	Ag	107.9	Silver	
48	Cd	112.4	Cadmium	
49	In	114.8	Indium	
50	Sn	118.7	Tin	
51	Sb	121.8	Antimony	
52	Te	127.6	Tellurium	
53	I	126.9	Iodine	
54	Xe	131.3	Xenon	
55	Cs	132.9	Caesium	
56	Ba	137.3	Barium	
57-71	Lanthanoids			
72	Hf	178.5	Hafnium	
73	Ta	180.9	Tantalum	
74	W	183.8	Tungsten	
75	Re	186.2	Rhenium	
76	Os	190.2	Osmium	
77	Ir	192.2	Iridium	
78	Pt	195.1	Platinum	
79	Au	197.0	Gold	
80	Hg	200.6	Mercury	
81	Tl	204.4	Thallium	
82	Pb	207.2	Lead	
83	Bi	209.0	Bismuth	
84	Po	[209.0]	Polonium	
85	At	[210.0]	Astatine	
86	Rn	[222.0]	Radon	
87	Fr	[223]	Francium	
88	Ra	[226]	Radium	
89-103	Actinoids			
104	Rf	[261]	Rutherfordium	
105	Db	[262]	Dubnium	
106	Sg	[266]	Seaborgium	
107	Bh	[264]	Bohrium	
108	Hs	[277]	Hassium	
109	Mt	[268]	Meitnerium	
110	Ds	[271]	Darmstadtium	
111	Rg	[272]	Roentgenium	
63	Eu	152.0	Europium	
64	Gd	157.3	Gadolinium	
65	Tb	158.9	Terbium	
66	Dy	162.5	Dysprosium	
67	Ho	164.9	Holmium	
68	Er	167.3	Erbium	
69	Tm	168.9	Thulium	
70	Yb	173.0	Ytterbium	
71	Lu	175.0	Lutetium	
91	Pa	231.0	Protactinium	
92	U	238.0	Uranium	
93	Np	[237]	Neptunium	
94	Pu	[244]	Plutonium	
95	Am	[243]	Americium	
96	Cm	[247]	Curium	
97	Bk	[247]	Berkelium	
98	Cf	[251]	Californium	
99	Es	[252]	Einsteinium	
100	Fm	[257]	Fermium	
101	Md	[258]	Mendelevium	
102	No	[259]	Nobelium	
103	Lr	[262]	Lawrencium	

Lanthanoids

57	La	138.9	Lanthanum
58	Ce	140.1	Cerium
59	Pr	140.9	Praseodymium
60	Nd	144.2	Neodymium
61	Pm	[145]	Promethium
62	Sm	150.4	Samarium
63	Eu	152.0	Europium
64	Gd	157.3	Gadolinium
65	Tb	158.9	Terbium
66	Dy	162.5	Dysprosium
67	Ho	164.9	Holmium
68	Er	167.3	Erbium
69	Tm	168.9	Thulium
70	Yb	173.0	Ytterbium
71	Lu	175.0	Lutetium

Actinoids

89	Ac	[227]	Actinium
90	Th	232.0	Thorium
91	Pa	231.0	Protactinium
92	U	238.0	Uranium
93	Np	[237]	Neptunium
94	Pu	[244]	Plutonium
95	Am	[243]	Americium
96	Cm	[247]	Curium
97	Bk	[247]	Berkelium
98	Cf	[251]	Californium
99	Es	[252]	Einsteinium
100	Fm	[257]	Fermium
101	Md	[258]	Mendelevium
102	No	[259]	Nobelium
103	Lr	[262]	Lawrencium

For elements that have no stable or long-lived nuclides, the mass number of the nuclide with the longest confirmed half-life is listed between square brackets. The International Union of Pure and Applied Chemistry Periodic Table of the Elements (October 2005 version) is the principal source of data. Some data may have been modified.