Name	Register No	Class

QUESTION PAPER

SINGAPORE PIAGET ACADEMY MEDAN

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PRELIMINARY EXAMINATION 2008-2009

CHEMISTRY SECONDARY FOUR

PAPER 1 1 hour

Additional Materials: Optical Answer Sheet (OAS)
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS TO CANDIDATES

Read these instructions first.

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, Centre number and candidate number and the Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer **all** questions.
For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record our choice in soft pencil on the separate Answer Sheet.

Read the instructions on the answer sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on the last page.

Section A (40 marks)
Answer ALL questions.

1 What is the structure of the ion $^{90}_{28}Sr^{2+}$?

	protons	neutrons	electrons
A	38	52	36
B	38	52	38
C	38	90	36
D	52	38	36

2 Which statement explains why magnesium oxide has a high melting point?

A The crystal lattice of magnesium oxide resembles that of diamond.
B The reaction between magnesium and oxygen is very exothermic.
C Magnesium and oxygen atoms are joined together by strong double covalent bonds.
D There is a very strong force of attraction between magnesium ions and oxygen ions.

3 Element P has the electronic structure 2,8,6. Element Q has the electronic structure 2,8,8,2. What statement about the compound PQ is probably correct?

A It will have a low boiling point.
B It will conduct electricity when molten.
C An aqueous solution of the compound will not conduct electricity.
D It will have a macromolecular structure.

4 How does a magnesium atom form a bond with an oxygen atom?

A by giving one pair of electrons to the oxygen atom
B by sharing one pair of electrons, both electrons provided by the magnesium atom
C by sharing two pairs of electrons, both pairs provided by the oxygen atom
D by sharing two pairs of electrons, each atom donating one pair of electrons

5 The formula of talcum powder was given in old textbooks as 3MgO.4SiO2.H2O. This formula is rearranged in modern textbooks as Mg3Si4Ox(OH)y. What are the values of x and y in the modern
formula?

	x	y
A	8	2
B	10	1
C	10	2
D	11	2

6 The element X forms a gaseous molecule X_2. One volume of X_2 combines with one volume of hydrogen to form two volumes of a gaseous hydride.

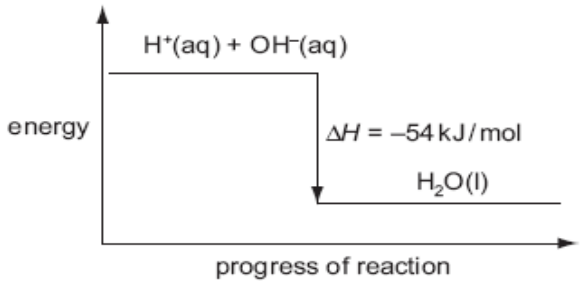
What is the formula for the hydride of X?

A HX **B** HX_2 **C** H_2X **D** H_2X_2

7 For which compounds are the empirical and molecular formulae the same?

A ethene, $H_2C{=}CH_2$
B hydrogen peroxide, H_2O_2
C ethanoic acid, CH_3CO_2H
D ethanol, C_2H_5OH

8 The energy diagram for the reaction between sodium hydroxide and hydrochloric acid is shown.



What can be deduced from the diagram?

A Heat is needed to start the reaction.
B The products contain less energy than the reactants.
C The reaction is rapid.
D The OH^- ions have more energy than the H^+ ions.

9 In which change is the nitrogen reduced?

A NH_3 to NO **B** NH_3 to NO_3^- **C** N_2 to NH_3 **D** N^{3-} to N_2

10 A sample of 1.00g of a pesticide is analysed for its arsenic content by precipitation of the arsenic as the sulfide, AS_2S_3. If 0.123g of the sulfide is obtained, the percentage by mass of arsenic in the pesticide is

A 3.75%
B 7.50%
C 37.5%
D 75.0%

11 A sample of a pure hydrocarbon is burnt in pure oxygen and yields 13.2 g of $CO_2(g)$ and 5.40 g of $H_2O(l)$.
The empirical formula of the hydrocarbon is

A CH
B CH_2
C CH_3
D CH_4

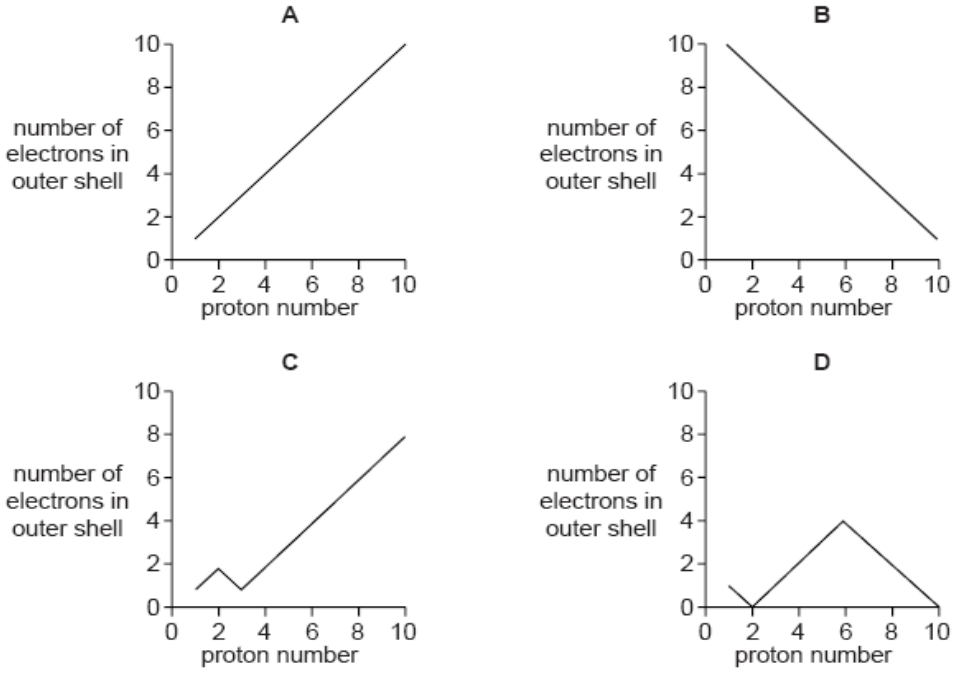
12 A sample of fertiliser was analysed and found to contain 80% by mass of ammonium nitrate (NH_4NO_3) and 20% by mass of potassium chloride (KCl). The mass of nitrogen in a 1.00 kg packet of the fertiliser is

A 140g
B 175g
C 280g
D 350g

13 The element sulphur, S, is in Group VI of the Periodic Table.
Which formula is incorrect?

A S_{2-} **B** S_2O_3 **C** SO_{2-4} **D** SO_3

14 Which graph shows the number of electrons in the outer shell of an atom, plotted against the proton (atomic) number for the first ten elements in the Periodic Table?



15 Which cation, on reaction with aqueous sodium hydroxide, forms a precipitate that dissolves in excess sodium hydroxide?

A Ca^{2+} **B** Cu^{2+} **C** Fe^{3+} **D** Zn^{2+}

16 Rubidium is in Group I of the Periodic Table.

What are properties of rubidium chloride?

	formula	approximate melting point / °C	solubility in water
A	RbCl	70	insoluble
B	RbCl	700	soluble
C	$RbCl_2$	70	soluble
D	$RbCl_2$	700	insoluble

17 From your knowledge of the manufacture of both aluminium and iron, what is the order of chemical reactivity of aluminium, carbon and iron towards oxygen?

	most reactive ⟶ least reactive		
A	aluminium	carbon	iron
B	aluminium	iron	carbon
C	carbon	aluminium	iron
D	carbon	iron	aluminium

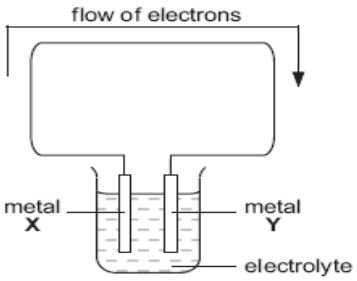
18 Dilute sulphuric acid is electrolysed using inert electrodes.
Which equation represents the reaction at the anode (+ve)?

A $O^{2-}_2 \rightarrow O_2 + 2e^-$
B $2H^+ + 2e^- \rightarrow H_2$
C $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$
D $SO^{2-}_4 \rightarrow O_2 + SO_2 + 2e^-$

19 In a titration, 25.0 cm^3 barium hydroxide solution reacted with 20.0 cm^3 of 0.1 mol/dm^3 hydrochloric acid.
The equation for the reaction is: Ba(OH)2(aq) + 2HCl(aq) → BaCl2(aq) + 2H2O(l)
What was the concentration of the barium hydroxide?

A 0.04 mol/dm^3
B 0.08 mol/dm^3
C 0.125 mol/dm^3
D 0.25 mol/dm^3

20 The apparatus was set up as shown.



For which pair of metals would electrons flow in the direction shown?

	metal **X**	metal **Y**
A	copper	zinc
B	iron	aluminium
C	iron	magnesium
D	zinc	silver

21 Which series of changes includes both oxidation and reduction?

A $C \rightarrow CO \rightarrow CO_2$
B $PbO_2 \rightarrow PbO \rightarrow Pb$
C $N_2 \rightarrow NH_3 \rightarrow NO$
D $C_2H_2 \rightarrow C_2H_4 \rightarrow C_2H_6$

22 Which oxide reacts with an alkali to form a salt, but does not react with an acid to form a salt?

A aluminium oxide
B copper (II) oxide
C sulphur dioxide
D zinc oxide

23 The oxidation number of Cl in $HClO_4$ is

A +7 **B** +5 **C** +3 **D** -1

24 Which one of the following does not react with dilute hydrochloric acid?

A magnesium sulphate
B magnesium hydroxide
C magnesium oxide
D magnesium metal

25 The following equations represent reactions of dilute sulphuric acid.
Which reaction is not 'typical' of a dilute acid?

A $2KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$

B $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$

C $Pb(NO_3)_2(aq) + H_2SO_4(aq) \rightarrow PbSO_4(s) + 2HNO_3(aq)$

D $ZnCO_3(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + CO_2(g) + H_2O(l)$

26 All ammonium salts on heating with sodium hydroxide produce ammonia gas.
From which ammonium salt can the greatest mass of ammonia be obtained?

A 0.5 mol $(NH_4)_3PO_4$
B 0.5 mol $(NH_4)_2SO_4$
C 1.0 mol NH_4Cl
D 1.0 mol NH_4NO_3

27 X and Y are diatomic elements. X is less reactive than Y.

What are elements X and Y?

	X	Y
A	bromine	iodine
B	iodine	bromine
C	potassium	sodium
D	sodium	potassium

28 The equation shows a reaction in the Contact process.

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g) \quad \Delta H = -98 \text{ kJ / mol}$$

Which change would move the position of equilibrium to the left?

A adding more O_2
B increasing the pressure
C increasing the temperature
D removing SO_3 from the reacting mixture

29 Which of the following reactions is a redox reaction?

A $2NaH_2PO_4(aq) \rightarrow Na_2H_2P_2O_7(aq) + H_2O(l)$

B $H_2SO_4(aq) + SO_3(g) \rightarrow H_2S_2O_7(aq)$

C $NH_4NO_3(s) \rightarrow N_2O(g) + 2H_2O(g)$

D $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s)$

30 Which deduction about the element astatine, At, can be made from its position in Group VII?

A It forms covalent compounds with sodium.
B It is displaced from aqueous potassium astatide, KAt, by chlorine.
C It is a gas.
D It is more reactive than iodine.

31 Element Z reacts in the following ways:

$Z + 2HCl \rightarrow ZCl_2 + H_2$
$2Z + O_2 \rightarrow 2ZO$

$ZO + H_2 \rightarrow$ no reaction

Which of the following could be **Z**?

A aluminium
B copper
C magnesium
D iron

32 Which reaction does not involve neutralisation?

A $H_2SO_4(aq) + 2NH_3(aq) \rightarrow (NH_4)_2SO_4(aq)$
B $H_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2HCl(aq)$
C $H_2SO_4(aq) + CuO(s) \rightarrow CuSO_4(aq) + H_2O(l)$
D $H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$

33 Which substance leaves a black solid when heated?

A calcium carbonate
B copper(II) carbonate
C potassium carbonate
D zinc carbonate

34 'Cracking' of hydrocarbons breaks them into smaller molecules.
Which example of 'cracking' would produce the largest volume of products from one mole of hydrocarbon? Assume that all measurements are made at the same temperature and pressure.

A $C_6H_{14}(g) \rightarrow 3C_2H_4(g) + H_2(g)$
B $C_8H_{18}(g) \rightarrow 2C_3H_8(g) + C_2H_2(g)$
C $C_{10}H_{22}(g) \rightarrow C_8H_{18}(g) + C_2H_4(g)$
D $C_{12}H_{26}(g) \rightarrow C_8H_{18}(g) + 2C_2H_4(g)$

35 Propene, C_3H_6, undergoes an addition reaction with bromine, Br2. The molecular formula of the product is C3H6Br2. The semi-structural formula of this product is

A $BrCH_2CH_2CH_2Br$
B CH_3CH_2CHBr
C $CH_3CBr_2CH_3$
D $CH_3CHBrCH_2Br$

36 Compound **Q** is produced when C_2H_5OH reacts with acidified potassium dichromate (VI). Q reacts with C_2H_5OH to produce an ester. What is the formula of Q?

A CH_3CO_2H
B CH_3CO_2CH
C $CH_3CH_2CH_2CO_2H$
D $CH_3CO_2CH_2CH_3$

37 Titanium (IV) oxide reacts with sulphuric acid:
$TiO2 + H2SO4 \rightarrow (TiO)SO4 + H2O$
In what way is the sulphuric acid behaving in this reaction

A as an acid
B as an oxidising agent
C as a reducing agent
D as a catalyst

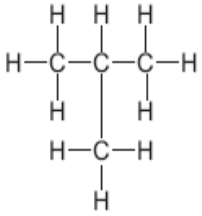
38 Compound X has the molecular formula C_2H_6O.

• X can be made by a fermentation process.
• X can be oxidised to Y.
• X can react with Y to form Z and water.
To which homologous series do X, Y and Z belong?

	X	Y	Z
A	alcohols	carboxylic acids	esters
B	alcohols	esters	carboxylic acids
C	carboxylic acids	alcohols	esters
D	carboxylic acids	esters	alcohols

39 The diagrams show four structures.

1



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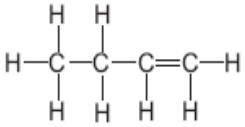

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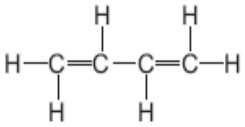

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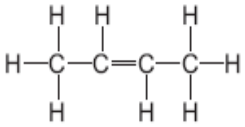

Which structures are isomeric butenes?

A 1 and 2 **B** 2 and 3 **C** 3 and 4 **D** 2 and 4

40 Which reaction will **not** occur using cold, dilute sulphuric acid?

A formation of copper(II) sulphate from copper(II) oxide
B formation of copper(II) sulphate from copper
C formation of hydrogen from magnesium metal
D formation of carbon dioxide from sodium carbonate

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

Question Number	Key	Question Number	Key
1	A	21	C
2	D	22	C
3	B	23	A
4	A	24	A
5	A	25	C
6	B	26	A
7	D	27	B
8	B	28	C
9	C	29	C - change in oxidation number -3 n +5 to -1
10	B	30	B
11	B	31	C
12	C	32	
13	C	33	
14	C	34	A
15	D	35	A
16	B	36	B
17	A	37	A
18	C	38	A
19	A	39	A
20	D	40	B