ANDERSON JUNIOR COLLEGE

2016 JC2 PRELIMINARY EXAMINATIONS

CHEMISTRY **8872/01**

Higher 1 **22 September 2016**

Paper 1 Multiple Choice **50 minutes**

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.

There are **thirty** 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 your choice in **soft pencil** on the Multiple Choice Answer Sheet.

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.

Multiple Choice Answer Sheet

Write your name, PDG and NRIC / FIN number, **including** the reference letter.

Shade the NRIC / FIN number.

Exam Title: JC2 Prelim

Exam Details: H1 Chemistry / Paper 1

Date: 22/09/2016

This document consists of **13** printed pages.

Section A

For each question there are four possible answers, **A**, **B**, **C** and **D**. Choose the **one** you consider to be correct.

1 Most elements contain more than one isotope. Isotopes are atoms of the same element that have the same chemical properties but different atomic masses.

Which expression **incorrectly** defines the term *relative isotopic mass* of an element?

A The mass of 1 mol of isotopes divided by 6.02×10^{23}.

B The mass of 1 atom of the isotope relative to the mass of 1 atom of ^{12}C.

C The mass of 1 atom of the isotope on a scale on which a ^{12}C atom has a mass of exactly 12 units.

D The mass of 1 atom of the isotope relative to 1/12 the mass of a ^{12}C atom.

2 Chlorine gas is a severe irritant to the eyes and respiratory system. The maximum safe toleration level of chlorine gas in the air is 0.005 mg dm^{-3}.

How many molecules of chlorine gas are present in 2 dm^3 of air at this toleration level?

A $\frac{0.005}{6\times10^{23}}\times71\times\frac{1}{2}$

B $\frac{0.010}{1000}\times\frac{1}{71}\times6\times10^{23}$

C $\frac{0.010}{71}\times6\times10^{23}$

D $\frac{0.005}{1000}\times\frac{1}{71}\times6\times10^{23}$

3 The relative atomic mass of boron, which consists of the isotopes $^{10}_{5}B$ and $^{11}_{5}B$ is 10.8. What is the percentage of the $^{10}_{5}B$ atoms in the isotopic mixture?

A 0.8 % **B** 8.0 % **C** 20 % **D** 80 %

4 Antimony (Sb) can be produced in a two–stage process from its ore stibnite, Sb_2S_3.

The ore is first roasted in oxygen, producing Sb_4O_6 and SO_2.

The Sb_4O_6 is then reduced by carbon, producing Sb and CO_2.

What volume of CO_2, measured at room temperature and pressure, is produced from 20 moles of Sb_2S_3?

A 360 dm^3 **B** 670 dm^3 **C** 720 dm^3 **D** 1440 dm^3

5 0.518 g sample of impure $CaCO_3$ was dissolved in water and the calcium is precipitated out as CaC_2O_4. After filtering and washing, the CaC_2O_4 required 25.0 cm^3 of 0.020 mol dm^{-3} acidified $KMnO_4$ for complete reaction.

What is the percentage of $CaCO_3$ in the sample?
(Mole ratio of $C_2O_4^{2-}$ to MnO_4^- is 5 : 2)

A 96.1 %

B 75.9 %

C 24.1 %

D 13.5 %

6 The successive ionisation energies (I.E.), in kJ mol^{-1}, of two elements **X** and **Y** are shown below.

I.E.	1st	2nd	3rd	4th	5th	6th	7th
X	**a**	2856	4578	7475	9445	53267	64360
Y	1314	3388	5301	7469	10989	13327	**b**

Y has an atomic number greater by one than **X**. What are the expected approximate values of **a** and **b**?

	a	**b**
A	1500	20000
B	1400	70000
C	1300	85000
D	1200	85000

7 Which of the following sets contains substances of different types of structure and bonding?

A sulfur, silicon dioxide, carbon dioxide, magnesium

B aluminium chloride, beryllium, diamond, sodium fluoride

C phosphorous, aluminium, silicon tetrachloride, sulfur dioxide

D magnesium chloride, graphite, nitrogen dioxide, boron trichloride

8 The interhalogen compound BrF_3 is a volatile liquid which autoionises.

$$2BrF_3 \rightleftharpoons BrF_2^+ + BrF_4^-$$

The electrical conductivity of BrF_3 decreases with increasing temperature.

Which statement is correct?

A The autoionisation process is endothermic and the shape of the cation is linear.

B The autoionisation process is endothermic and the shape of the cation is non–linear.

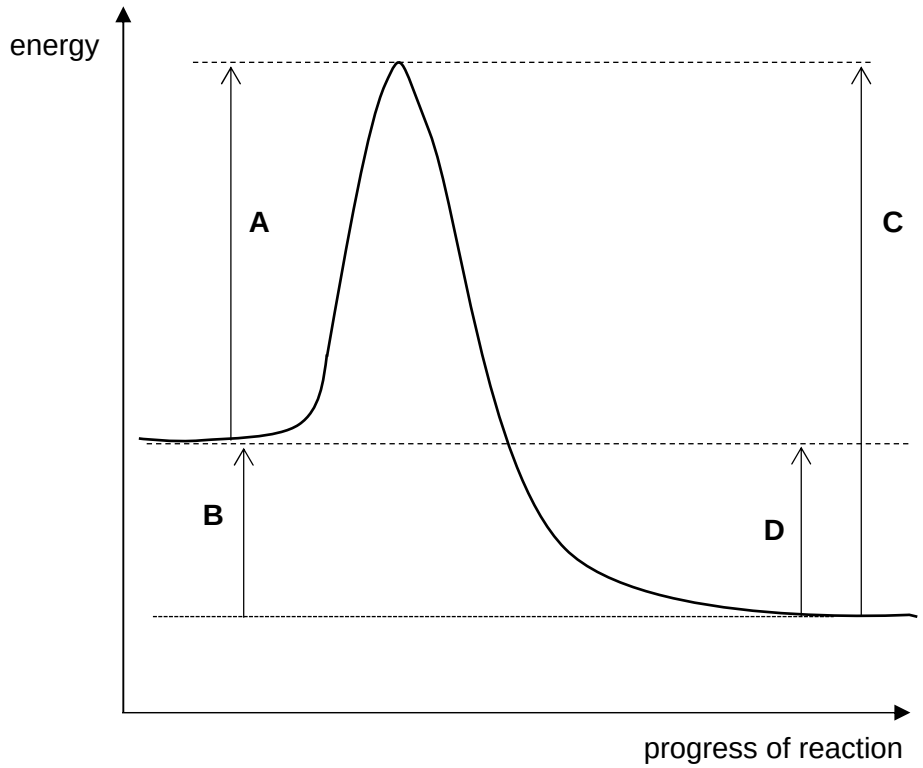
C The autoionisation process is exothermic and the shape of the cation is linear.

D The autoionisation process is exothermic and the shape of the cation is non–linear.

9 For which compound is the lattice energy likely to have the greatest numerical value?

A NaC*l* **B** NaBr **C** MgO **D** MgS

10 The reaction pathway diagram for a reversible reaction is shown below.



Which arrow is labeled **incorrectly**?

A Activation energy of the forward reaction

B Enthalpy change for the forward reaction

C Activation energy of the reverse reaction

D Enthalpy change for the reverse reaction

11 Which equation below does **not** represent the standard enthalpy change for the stated substance?

	standard enthalpy change of	equation
A	formation of fluorine gas atoms	$F_2(g) \longrightarrow 2F(g)$
B	formation of sulfuric acid	$H_2(g) + 1/8S_8(s) + 2O_2(g) \longrightarrow H_2SO_4(l)$
C	combustion of hydrogen sulfide	$H_2S(g) + 3/2O_2(g) \longrightarrow H_2O(l) + SO_2(g)$
D	neutralisation of ethanoic acid	$CH_3COOH(aq) + NaOH(aq) \longrightarrow CH_3COONa(aq) + H_2O(l)$

12 The reaction shown is reversible.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H^{\ominus} < 0$$

Which of the following changes would affect both the equilibrium concentration of ammonia and the value of the equilibrium constant, K_c?

A Adding finely divided iron catalyst

B Increasing the amount of N_2

C Increasing the total pressure

D Decreasing the temperature

13 In which reaction is the underlined substance acting as a base?

A $HNO_3 + \underline{H_2SO_4} \longrightarrow H_2NO_3^+ + HSO_4^-$

B $HSiO_3^- + \underline{HCN} \longrightarrow CN^- + H_2O + SiO_2$

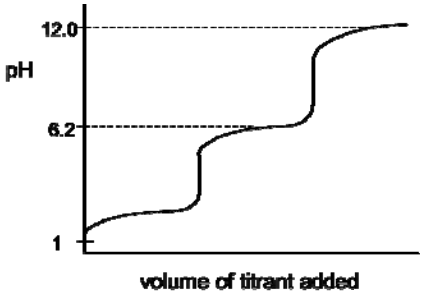
C $HNO_2 + \underline{HCO_3^-} \longrightarrow H_2O + CO_2 + NO_2^-$

D $C_6H_5O^- + \underline{CH_2ClCO_2H} \longrightarrow C_6H_5OH + CH_2ClCO_2^-$

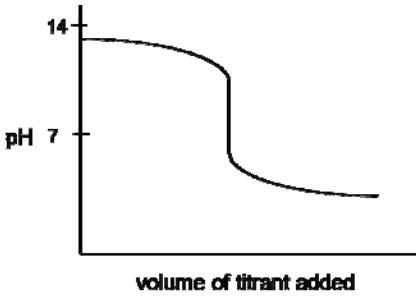
14 The change of colour for an indicator occurs over a limited range of pH that falls between ±1.00 of the pK_a value of the indicator.

Which is the **most** suitable indicator that can be used to determine the end point of the corresponding titration?

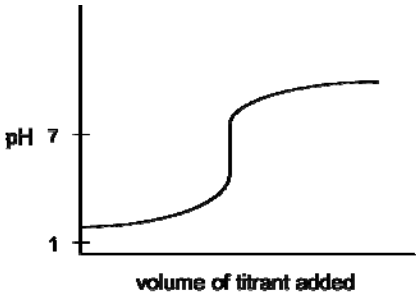
A alizarin yellow (pK_a = 11.0)



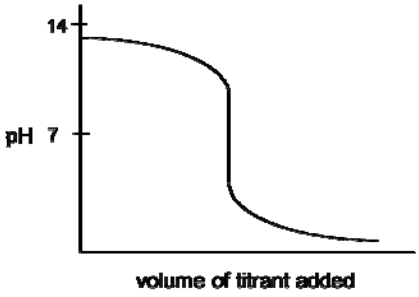
B bromothymol blue (pK_a = 7.1)



C methyl yellow (pK_a = 3.3)



D thymol blue (pK_a = 1.6)

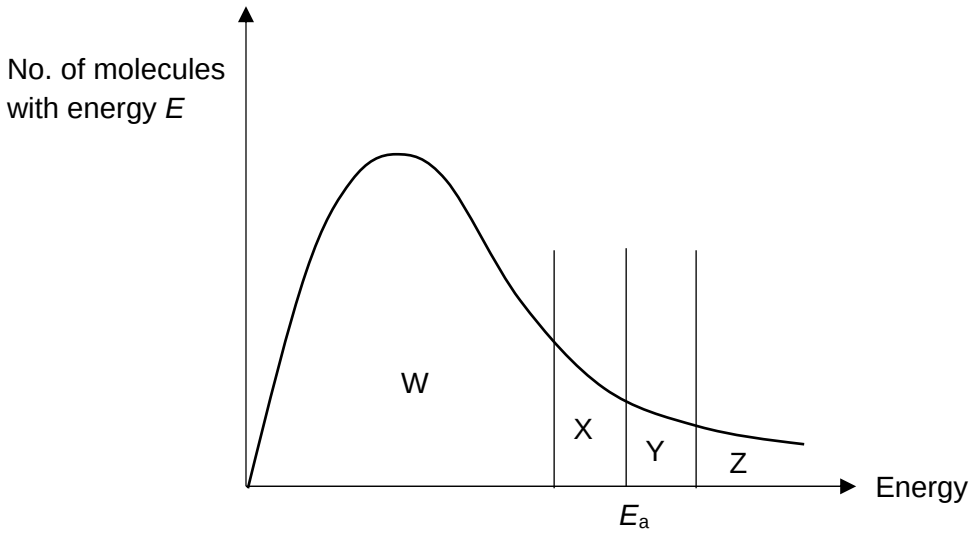


15 The hydrolysis of 2–bromo–2–methylpropane is a first order kinetics process.

If 5 % of a 0.10 mol dm^{-3} solution of 2–bromo–2–methylpropane hydrolyses in *t* minutes at a certain temperature, what percentage of a 0.20 mol dm^{-3} solution of 2– bromo–2–methylpropane would hydrolyse in *t* minutes at the same temperature?

A 5 % **B** 10 % **C** 15 % **D** 20 %

16 The distribution of the number of molecules with energy E for a given reaction with a given activation energy, E_a, is shown in the diagram below.



Which expression gives the fraction of the molecules present when a catalyst is added at the start of the same reaction?

A

$$\frac{X+Y+Z}{W}$$

B

$$\frac{Z}{W+X+Y}$$

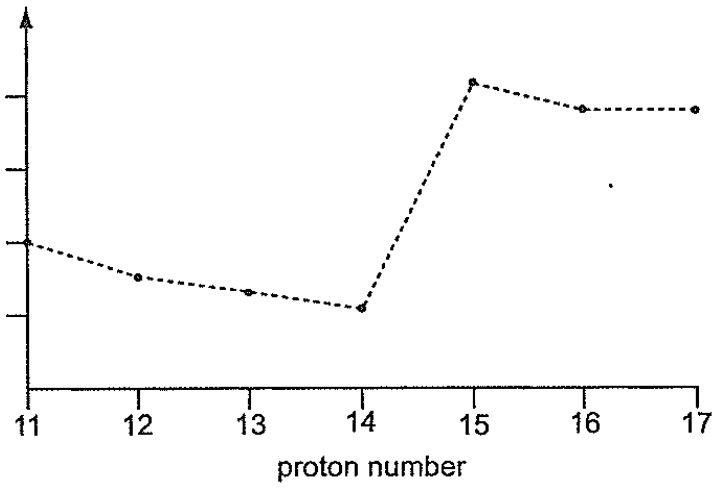
C

$$\frac{X+Y+Z}{W+X+Y+Z}$$

D

$$\frac{Z}{W+X+Y+Z}$$

17 The graph shows how a property of the elements Na to C*l* varies with proton number.



What is the property?

A electronegativity

B 1st ionisation energy

C ionic radius

D melting point

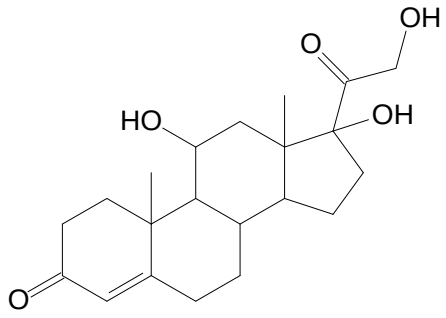
18 Which oxide does **not** react with dilute sodium hydroxide to produce a salt?

A Al_2O_3 **B** P_4O_{10} **C** SO_2 **D** SiO_2

19 Which molecular formula will only give **three** structural isomers?

A C_4H_8 **B** C_4H_{10} **C** C_8H_{10} **D** C_7H_8

20 Cortisol is a steroid hormone which is released in response to stress and low blood glucose. Its structure is shown in the diagram below.



Cortisol is reduced with hydrogen in the presence of a platinum catalyst, and then oxidised by heating with acidified $KMnO_4$. The product formed is further reacted with excess sodium to give an organic ion.

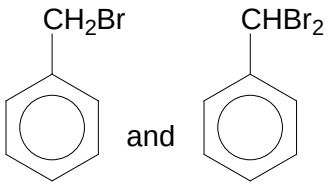
What is the charge on the organic ion produced?

A 1– **B** 2– **C** 3– **D** 5–

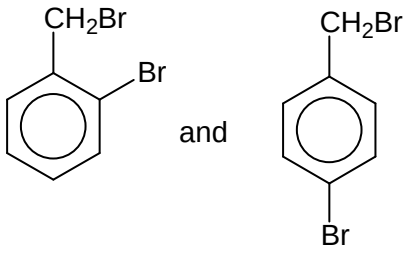
21 Iron filings were added to a solution containing equimolar quantities of methylbenzene and bromine. The mixture was immediately placed in the dark until no further change took place.

Which of the following are likely to have been the main products?

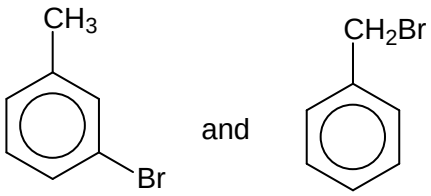
A



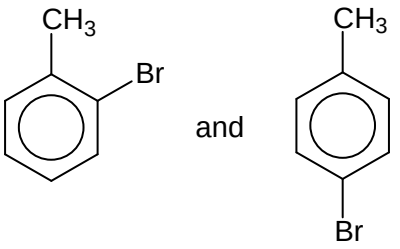
B



C



D



22 1,1–dichloropropane reacts with excess hot aqueous sodium hydroxide in a series of steps to give propanal.

$$CH_3CH_2CHCl_2 \xrightarrow{NaOH(aq)} CH_3CH_2CHO$$

Which term describes the **first** step of this reaction?

A addition

B elimination

C oxidation

D substitution

23 Chlorotrifluoroethane is an example of chlorofluorocarbons, CFCs, which are responsible for the depletion of the ozone layer.

Which of the following statements is **false**?

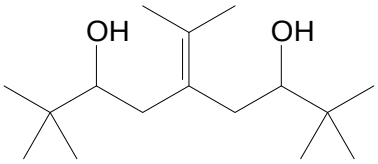
A Ultraviolet rays can break down CFCs into chlorine radicals which will react with ozone.

B Both the fluorine and chlorine radicals act as the catalyst for the breakdown of ozone.

C When CFCs reach the stratosphere, bonds will be broken to form free radicals that are responsible for the breakdown of ozone.

D When ozone is depleted, a harmless gas, O_2, is formed.

24 Compound **L** has the following structure.



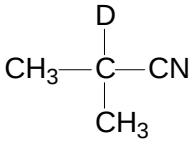
What is the total number of geometrical isomers that can be formed from the product of the reaction of compound **L** with excess concentrated sulfuric acid at 170 ^oC?

A 8 **B** 7 **C** 4 **D** 3

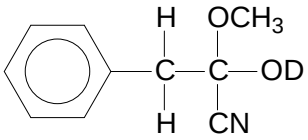
25 Deuterium, D, is an isotope of hydrogen, H.

Which compound can be formed by the reaction of deuterium cyanide, DCN, with a carbonyl compound?

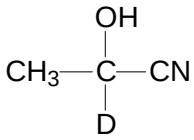
A



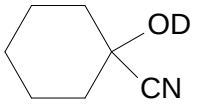
B



C



D



Section B

For each of the questions in this section, one or more of the three numbered statements **1** to **3** may be correct.

Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements that you consider to be correct.)

The responses **A** to **D** should be selected on the basis of

A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

No other combination of statements is used as a correct response.

26 In an experiment, 10 cm^3 of an organic compound in the gaseous state were sparked with an excess of oxygen. 20 cm^3 of carbon dioxide and 5 cm^3 of nitrogen gas were obtained among the products. All gas volumes were measured at the same temperature and pressure.

Which of the following molecular formulae would fit these data?

1 C_2H_7N

2 C_2H_3N

3 $C_2H_6N_2$

27 Which of the following ions has more electrons than protons and more protons than neutrons?
[H = ^1_1H ; D = ^2_1H ; C = $^{12}_6C$; O = $^{16}_8O$]

1 OH^-

2 HCO_3^-

3 DCO_3^-

28 When two liquids are mixed, heat may be evolved if the intermolecular bonds or inter–particle interactions formed are stronger than those broken.

Which pairs of liquids, when mixed, will give out heat?

1 HC*l* and H_2O

2 CCl_4 and CH_3CH_2OH

3 CHCl_3 and C_6H_{14}

29 Elements **Q** and **R** are in the third period of the Periodic Table. Element **Q** forms an oxide that is insoluble in water but soluble in aqueous alkali. Element **R** forms an oxide that is both soluble in aqueous acid and aqueous alkali.

Which of the following statements are correct?

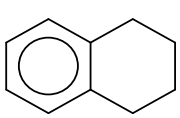
1 The oxide of **R** does not conduct electricity in the solid state, is hard and has a high melting point.

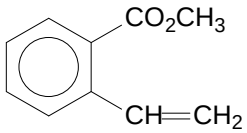
2 When an aqueous solution of the chloride of **Q** is added to a carbonate, CO_2 is liberated.

3 When an aqueous solution of the chloride of **R** is added to aqueous sodium carbonate, a white precipitate is formed.

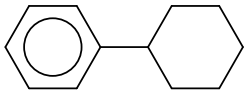
30 Which of the following pairs will give similar organic products when heated with concentrated $KMnO_4$ and dilute sulfuric acid?

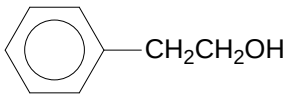
1





2





3