

RAFFLES INSTITUTION
2016 YEAR 6 PRELIMINARY EXAMINATION

Higher 1



CHEMISTRY

Paper 1 Multiple Choice

8872/01

26 September 2016

50 minutes

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and civics tutorial group in the spaces provided on the Answer Sheet.

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 shade your 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.

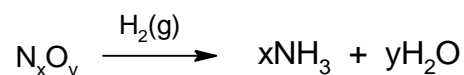
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **11** 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.

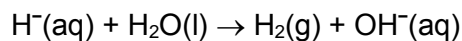
- 1 2400 cm³ of nitrogen oxide, measured at room temperature and pressure, produced 7.20 g of water and 4800 cm³ of ammonia gas, as shown in the equation below:



What is the formula of the nitrogen oxide, N_xO_y?

- A** N₂O **B** NO **C** NO₂ **D** N₂O₄

- 2 Group I and Group II ionic hydrides react with water:



In an experiment, 1 g samples of each of the following four ionic hydrides are treated with an excess of water.

Which sample produces the greatest mass of hydrogen?

- A** CaH₂ **B** MgH₂ **C** NaH **D** KH

- 3 The successive ionisation energies, in kJ mol⁻¹, of an element **Z** are given below.

1000 2260 3390 4540 7004 8500 27100

What is **Z**?

- A** P **B** S **C** Cl **D** Ar

- 4 Use of the Data Booklet is relevant to this question.

X and Y are atoms of different elements.
 X has four protons less than Y.
 X has two more unpaired electrons than Y.

What are the identities of X and Y?

	X	Y
A	silicon	chlorine
B	boron	oxygen
C	phosphorus	potassium
D	fluorine	aluminium

- 5 Which of the following **cannot** be explained by hydrogen bonds?

- A CH_3COCH_3 is miscible with water.
 B CH_3COOH has a M_r of 120 in benzene.
 C HF has a higher boiling point than HCl.
 D CH_3CHO has a higher boiling point than C_2H_6 .

- 6 The boiling points of pentane and 2,2-dimethylpropane are 36°C and 9°C respectively.

Which statement best explains the difference in their boiling points?

- A There are more electrons in pentane than in 2,2-dimethylpropane.
 B Pentane is a polar molecule whereas 2,2-dimethylpropane is non-polar.
 C The covalent bonds in pentane are stronger than those in 2,2-dimethylpropane.
 D Pentane molecules have a larger surface area than 2,2-dimethylpropane molecules.

- 7 Which of the following statements explains why copper conducts electricity when a potential difference is applied?

A The crystal lattice breaks down.
B Copper(II) ions move to the cathode.
C The atoms of copper become ionised.
D Bonding electrons in the crystal lattice move.

- 8 The bond dissociation energy of H–F is 565 kJ mol^{-1} .

Which equation correctly describes the reaction whereby 565 kJ of energy is released?

A $\text{HF(l)} \rightarrow \text{HF(g)}$
B $\text{HF(g)} \rightarrow \text{H(g)} + \text{F(g)}$
C $\text{H(g)} + \text{F(g)} \rightarrow \text{HF(g)}$
D $\frac{1}{2}\text{H}_2\text{(g)} + \frac{1}{2}\text{F}_2\text{(g)} \rightarrow \text{HF(g)}$

- 9 The conversion of diamond into graphite is exothermic by 2 kJ mol^{-1} . Diamond does not readily change into graphite.

Which statement is correct?

A Diamond is more stable than graphite.
B The conversion of diamond into graphite has high activation energy.
C Thermal energy is absorbed when diamond is converted to graphite.
D The enthalpy change for the conversion of graphite into diamond is -2 kJ mol^{-1} .

- 10 The radioactive decay of elements **J** and **K** is a first order process. The decay of **J** is known to be twice as fast as that of **K**.

It takes 64 seconds for 8 g of **J** to decay to 2 g.

How long will it take 0.5 g of **K** to decay to 0.25 g?

A 16 seconds
B 32 seconds
C 64 seconds
D 128 seconds

- 11 The rate equation for the reaction between P and Q is

$$\text{rate} = k[\text{P}][\text{Q}]^3$$

If the concentration of P is halved, what must be done to the concentration of Q to make the reaction proceed at four times its former rate?

- A keep [Q] constant
 B double [Q]
 C triple [Q]
 D quadruple [Q]
- 12 The reaction between two reagents, X and Y, in aqueous solution follows the general rate equation shown below.

$$\text{rate} = k[\text{X}][\text{Y}]^a$$

In a kinetic study, the following values were obtained.

$[\text{X}]_0 / \text{mol dm}^{-3}$	$[\text{Y}]_0 / \text{mol dm}^{-3}$	initial rate / $\text{mol dm}^{-3} \text{s}^{-1}$
0.040	2.40	2.63×10^{-3}
0.040	4.80	5.25×10^{-3}
0.020	9.60	<i>b</i>

$[\text{X}]_0$: initial concentration of X

$[\text{Y}]_0$: initial concentration of Y

What are the values of ***a*** and ***b***?

	<i>a</i>	<i>b</i>
A	1	5.25×10^{-3}
B	1	2.10×10^{-2}
C	2	5.25×10^{-3}
D	2	2.10×10^{-2}

- 13 An equilibrium is represented by the following equation.



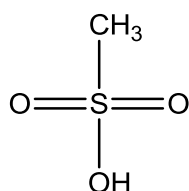
Which change, when applied to the system, will **not** result in an increase of proportion of product formed?

- A decrease temperature
 - B increase pressure
 - C addition of catalyst
 - D addition of oxygen
- 14 Values for the ionic product of water, K_w , at two different temperatures are given below.

temperature / °C	value of K_w
25	1.0×10^{-14}
62	1.0×10^{-13}

Which statement is correct?

- A When water is heated to 62 °C, $[\text{OH}^-]$ decreases.
 - B When water is heated to 62 °C, the pH is more than 7.
 - C The ionic dissociation of water is an exothermic process.
 - D Pure water at temperatures greater than 25 °C is neutral.
- 15 Methanesulfonic acid is a non-volatile strong acid which is used to remove calcium carbonate from kettles.



Methanesulfonic acid

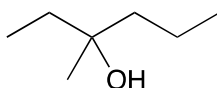
Which statement about methanesulfonic acid is **incorrect**?

- A The K_a value of methanesulfonic acid is very small.
- B 0.1 mol dm^{-3} methanesulfonic acid has a pH value of 1.
- C The Brønsted-Lowry conjugate base of methanesulfonic acid is the CH_3SO_3^- ion.
- D The gas evolved when methanesulfonic acid reacts with calcium carbonate is CO_2 .

- 16 An element **M** does not react with cold water. However, **M** reacts vigorously with chlorine to give a chloride which reacts readily with water forming a solution with a pH of 2.

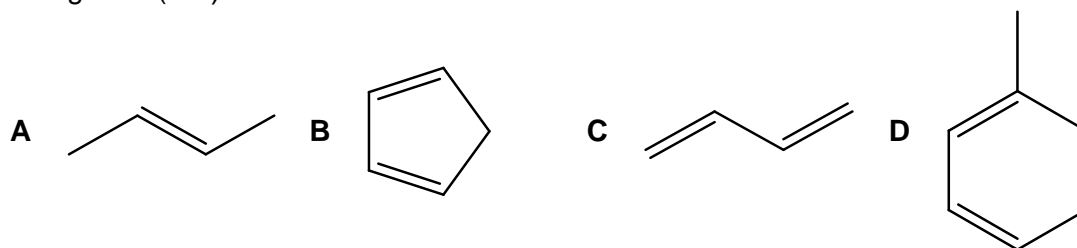
What element is **M**?

- A Phosphorus
 - B Aluminium
 - C Magnesium
 - D Sodium
- 17 What is formed when solid sodium oxide is added to water?
- A sodium ions and oxide ions in solution
 - B sodium ions and hydroxide ions in solution
 - C sodium oxide solution and hydrogen gas
 - D sodium hydroxide solution and oxygen gas
- 18 How many different alkenes, including geometric isomers, could be produced by the removal of water from the alcohol shown below when it is heated with concentrated sulfuric acid at 170 °C?



- A 2
 - B 3
 - C 4
 - D 5
- 19 Catalytic converters are fitted on the exhaust systems of cars.
- Which statement regarding the reactions in the catalytic converter is **incorrect**?
- A Unburnt hydrocarbons are removed.
 - B The reactions undergone are redox reactions.
 - C Carbon monoxide reacts with oxides of nitrogen.
 - D Nitrogen dioxide gas is one of the products of the reactions.

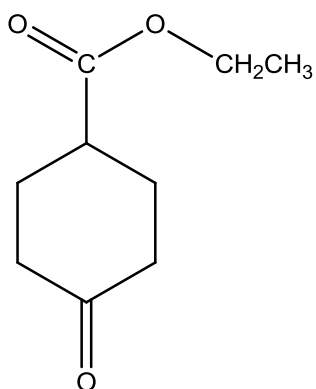
- 20 Which hydrocarbon would **not** give $\text{CO}_2(\text{g})$ on treatment with hot acidified potassium manganate(VII)?



- 21 When one propene molecule undergoes electrophilic addition with one bromine molecule to form 1,2-dibromopropane, how many bonds are broken and formed?

	number of σ bonds broken	number of π bonds broken	number of new σ bonds formed
A	1	1	2
B	1	0	2
C	1	1	1
D	0	1	2

22

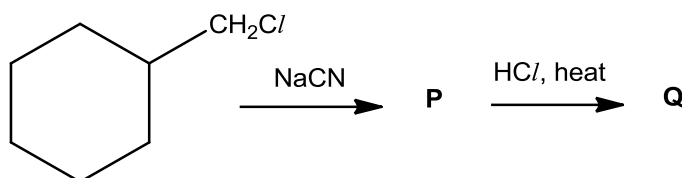


Compound T

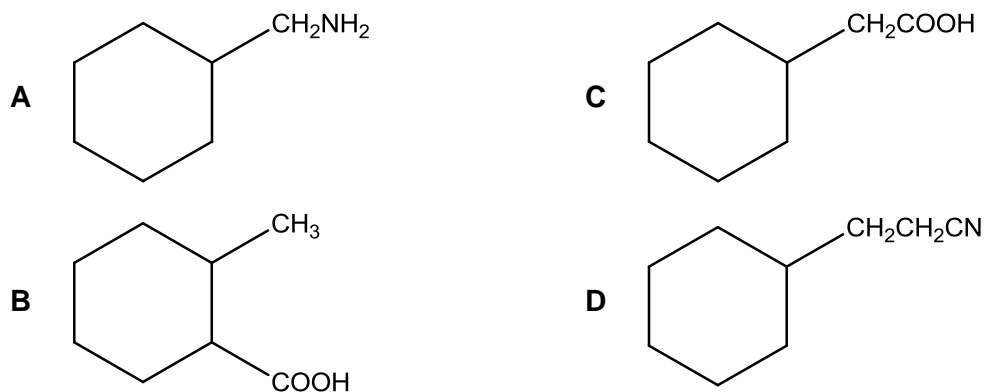
Which reagent, when added to compound **T**, would **not** give a positive test?

- A Fehling's solution
 B 2,4-dinitrophenylhydrazine
 C hot alkaline aqueous iodine
 D hot acidified dichromate(VI)

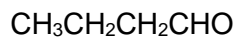
- 23 The diagram shows a reaction sequence.



What would be the product **Q**?

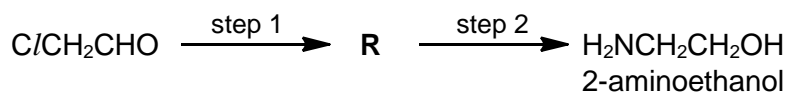


- 24 Compounds **D** and **E** are isomers.



Which of the following reagents will distinguish **D** from **E**?

- | | |
|--|---|
| <p>A Na_2CO_3</p> <p>B hot acidified $\text{K}_2\text{Cr}_2\text{O}_7$</p> | <p>C PCl_5</p> <p>D hot alkaline KMnO_4</p> |
|--|---|
- 25 2-aminoethanol can be used to adjust the pH in cosmetics. It can be synthesised via the following two-step process.



What are the identities of the reagents for step 1 and step 2, and the organic intermediate **R**?

	step 1	R	step 2
A	LiAlH_4 , dry ether	$\text{C}/\text{CH}_2\text{CH}_2\text{OH}$	NH_3
B	NaOH(aq) , heat	HOCH_2CHO	NH_3
C	HCN	$\text{C}/\text{CH}_2\text{CH}_2\text{CN}$	NaOH(aq) , heat
D	KCN	NCCH_2CHO	LiAlH_4 , dry ether

Section B

For each of the following questions, 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 Which of the following statements are correct?

- 1** 1 mol of O^{2-} ions contains 6.02×10^{24} electrons.
- 2** 2.25 g of methyl free radicals ($\bullet\text{CH}_3$) contains 3.61×10^{23} atoms.
- 3** The nucleon number of an element is the number of neutrons in one atom of an element.

27 In the presence of MnO_2 , the rate of decomposition of hydrogen peroxide to form water and oxygen gas is increased.

Which of the following statements regarding the decomposition are correct?

- 1** MnO_2 provides an alternative pathway with a lower activation energy for the decomposition to occur.
- 2** The decomposition is a disproportionation reaction.
- 3** At the end of the reaction, MnO_2 is consumed.

28 A bromoalkane **X** has the molecular formula of $\text{C}_5\text{H}_{11}\text{Br}$. On warming **X** with alcoholic KOH, only one alkene is formed. After heating the alkene with acidified potassium manganate(VII), the product formed gives a yellow precipitate with alkaline aqueous iodine.

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

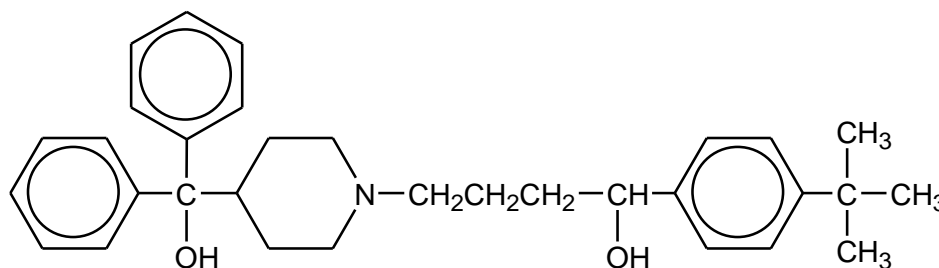
- 1** $\text{CH}_3\text{CH}(\text{CH}_2\text{Br})\text{CH}_2\text{CH}_3$
- 2** $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
- 3** $\text{CH}_3\text{CHBrCH}_2\text{CH}_2\text{CH}_3$

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.

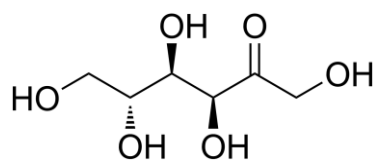
- 29** Terfenadine alleviates seasickness and asthma in the same way as the older drugs, but it does not cause drowsiness as a side effect.



Terfenadine

Which statements about Terfenadine are correct?

- 1** One mole of Terfenadine will produce one mole of hydrogen gas on reaction with sodium metal.
 - 2** The product of the reaction between Terfenadine and acidified dichromate(VI) will give an orange precipitate with 2,4-dinitrophenylhydrazine.
 - 3** It is soluble in aqueous sodium hydroxide.
- 30** Fructose is a sweet, white, odourless crystalline solid that can be extracted from many plants.



fructose

Which statements about fructose are correct?

- 1** 1 mol of fructose reacts with 5 mol of ethanoic acid in the presence of concentrated sulfuric acid.
- 2** It can undergo substitution with sodium cyanide.
- 3** It reacts with aqueous sodium carbonate to give bubbles of carbon dioxide.