HWA CHONG INSTITUTION
C1 Promotional Examination
Higher 2

CANDIDATE NAME | | CT GROUP | 17S

CHEMISTRY

9729/01

Paper 1 Multiple Choice

27 September 2017

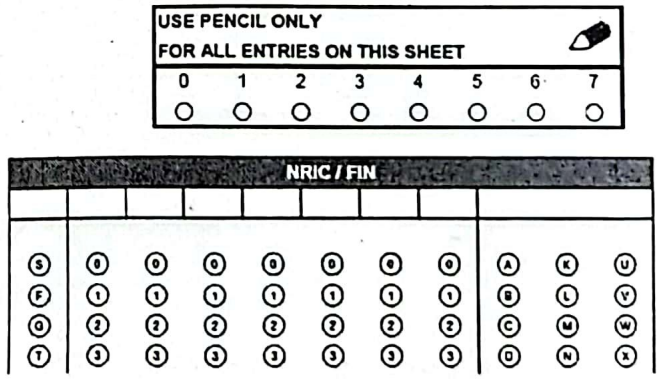
Additional Materials: Multiple Choice Answer Sheet
Data Booklet

40 min

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Complete the information on the Multiple Choice Answer Sheet as shown below.

1. Enter your **NAME** (as in NRIC).
2. Enter the **PAPER NUMBER**.
3. Enter your **CT GROUP**.
4. Enter your **NRIC NUMBER** or **FIN Number**
5. Now **SHADE** the corresponding circles in the grid for **EACH DIGIT** or **LETTER**



There are **twenty** 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.

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

1 In 1964, Murray Gell-Mann and George Zweig proposed that protons and neutrons are made up of tiny particles known as quarks.

The table shows the relative charges for two types of quarks.

quark	relative charge
up	$+\frac{2}{3}$
down	$-\frac{1}{3}$

Which combination of quarks would make up one proton and one neutron?

	proton	neutron
A	one up and one down	one up and two down
B	one up and two down	two up and one down
C	two up and one down	one up and two down
D	two up and one down	two up and one down

2 A radioactive atom X undergoes alpha decay to form Y.

$$X \rightarrow Y + {}^{4}_{2}He^{2+}$$

Another identical radioactive atom X undergoes beta decay to form Z.

$$X \rightarrow Z + {}^{0}_{-1}e^{-}$$

Which of the following correctly describes the nucleon number of Y and atomic number of Z, when compared to X?

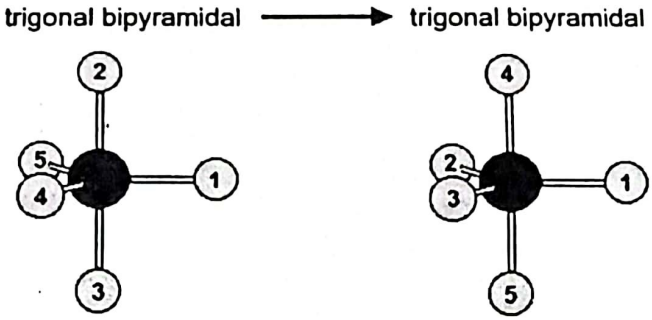
	nucleon number of Y	atomic number of Z
A	lower than X	lower than X
B	lower than X	greater than X
C	greater than X	lower than X
D	greater than X	greater than X

3 A substance is termed paramagnetic when it contains at least one unpaired electron.

Which substance is **not** paramagnetic?

A Al(s) **B** Cl_2(g) **C** Mn(s) **D** Ti(s)

4 Berry pseudorotation is the interconversion between two trigonal bipyramidal forms as shown below.



Which species **cannot** undergo Berry pseudorotation?

1 BrF_4^- 2 $SF_3Cl_2^+$ 3 $SiF_2Cl_3^-$ 4 XeO_3F_2

A 1 only

B 1 and 4 only

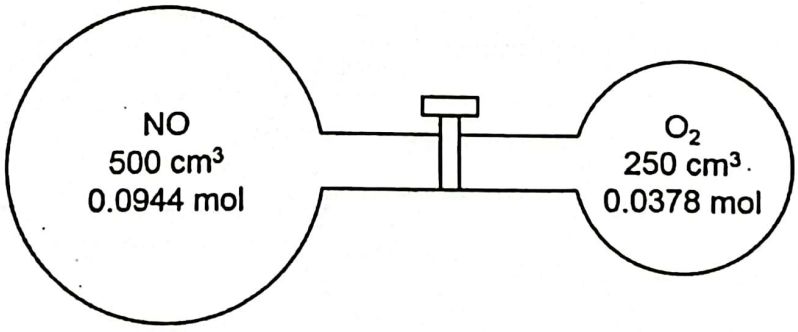
C 2 and 3 only

D 2, 3 and 4 only

5 Nitric oxide, NO, reacts with oxygen to give nitrogen dioxide, NO_2.

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

In an experiment, two evacuated flasks, filled separately with NO and O_2, are connected together.



When the gas tap joint is opened, the two gases are allowed to mix and react.

What is the final pressure of the remaining gases at 71 °C?

A 288 kPa B 307 kPa C 360 kPa D 504 kPa

6 *Use of the Data Booklet is relevant to this question.*

Jupiter, Saturn, Uranus and Neptune are known as Jovian planets because of their gigantic Jupiter-like appearance. They are also sometimes known as gas giants.

The approximate percentage composition of the atmosphere on the gas giants is given in the table below.

The density of a gas may be defined as the mass of 1 dm^3 of the gas measured at s.t.p.

Which mixture of gases has the lowest density?

	planet	major gases / % by number of molecules
A	Jupiter	H_2 89.8, He 10.2
B	Saturn	H_2 96.3, He 3.25, CH_4 0.45
C	Uranus	H_2 82.5, He 15.2, CH_4 2.3
D	Neptune	H_2 80.0, He 19.0, CH_4 1.0

7 Which enthalpy terms represent processes where ΔS is always positive?

1 enthalpy change of combustion

2 enthalpy change of solution

3 enthalpy change of vaporisation

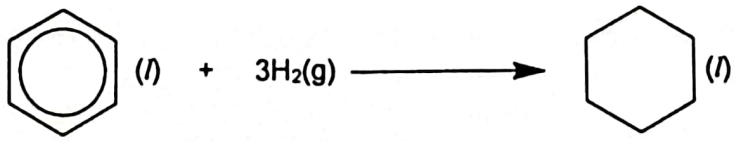
A 1 only

B 1 and 3 only

C 1, 2 and 3

D 3 only

8 Which statement describes the spontaneity of the following reaction at various temperatures?



$\Delta H = -208$ kJ mol^{-1}

A The reaction is not spontaneous at all temperatures.

B The reaction is spontaneous at all temperatures.

C The reaction is spontaneous at high temperatures but not at low temperatures.

D The reaction is spontaneous at low temperatures but not at high temperatures.

9 XY decomposes according to the following reaction.

$$XY(g) \rightarrow X(g) + Y(g)$$

Given that the rate constant is 6.93 min^{-1}, what is the time taken for concentration of XY to decrease to 12.5% of its original concentration?

A 0.2 min B 0.3 min C 0.4 min D 0.5 min

10 An aqueous solution of chlorine dioxide undergoes the following reaction in an alkaline solution.

$$2ClO_2(aq) + 2OH^-(aq) \rightarrow ClO_3^-(aq) + ClO_2^-(aq) + H_2O(l)$$

The results of a kinetics study of the reaction is shown in the table below.

experiment	$[ClO_2]$ / mol dm^{-3}	$[OH^-]$ / mol dm^{-3}	initial rate / mol dm^{-3} s^{-1}
1	0.050	0.020	5.75×10^{-3}
2	0.050	0.040	1.15×10^{-2}
3	0.10	0.010	1.15×10^{-2}

Which statements about the reaction are correct?

1 ClO_2 undergoes disproportionation in this reaction.

2 The rate constant is 115 mol^{-2} dm^6 s^{-1}.

3 The rate equation for the reaction can be written as rate = $k[ClO_2][OH^-]$.

A 1 only

B 2 only

C 1 and 2 only

D 1 and 3 only

11 In which reaction does K_c have units?

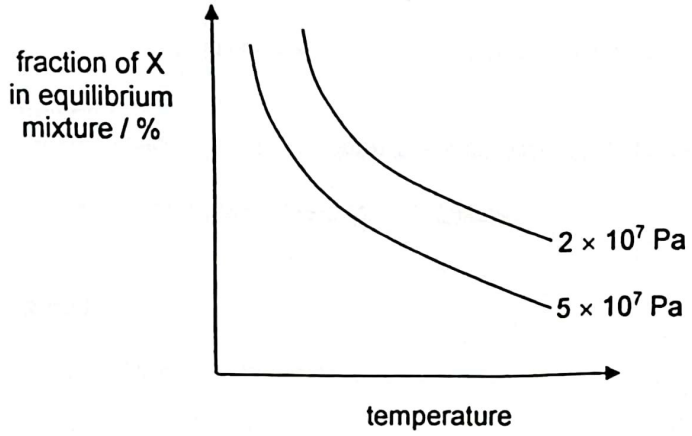
A $CO_2(g) + CF_4(g) = 2COF_2(g)$

B $3Fe(s) + 4H_2O(g) = Fe_3O_4(s) + 4H_2(g)$

C $CH_3CO_2H(l) + CH_3CH_2OH(l) = CH_3CO_2CH_2CH_3(l) + H_2O(l)$

D $CH_3CONHCH_3(aq) + H_2O(l) = CH_3CO_2H(aq) + CH_3NH_2(aq)$

12 The graph below shows how the fraction of a substance, X, produced in an equilibrium mixture varies with temperature at pressures of 2×10^7 Pa and 5×10^7 Pa.



In which reaction would the underlined species represent X?

A	$4NH_3(g) + 3O_2(g) = 2N_2(g) + 6\underline{H_2O}(g)$	$\Delta H = -1267$ kJ mol^{-1}
B	$CO(g) + 2H_2(g) = \underline{CH_3OH}(g)$	$\Delta H = -92$ kJ mol^{-1}
C	$H_2(g) + I_2(g) = 2\underline{HI}(g)$	$\Delta H = +54$ kJ mol^{-1}
D	$N_2O_4(g) = 2\underline{NO_2}(g)$	$\Delta H = +57$ kJ mol^{-1}

13 The reaction in the Haber process is as shown below.

$$N_2(g) + 3H_2(g) = 2NH_3(g)$$

Which statements are true about the Haber process?

1 Increasing pressure increases the value of equilibrium constant.

2 Adding an iron catalyst leads to higher yield of ammonia.

3 Adding an iron catalyst increases the rate constant of both the forward and backward reactions.

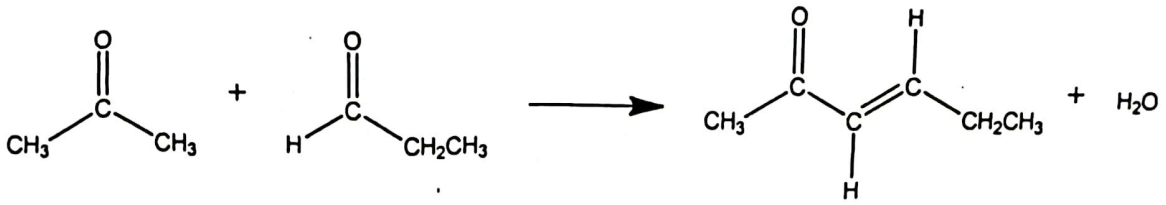
A 1 only

B 1 and 2 only

C 2 and 3 only

D 3 only

14 What type of reaction has occurred for the reaction,shown below?



A condensation

B substitution

C addition

D hydrolysis

15 Gaseous samples of CH_3Cl and Br_2 are mixed together and irradiated with *uv* light.

Which compound could be obtained in trace amounts in a termination reaction?

A H_2

B HBr

C $CH_2ClCHBrCl$

D $CHCl_2CHBrCl$

16 Which substance results from incomplete combustion of a hydrocarbon fuel in the vehicle exhaust?

A N_2

B NO

C CO

D CO_2

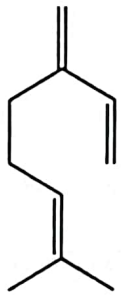
17 Reaction of ethene with bromine in the presence of aqueous sodium chloride gives a mixture of products.

Which pair of products will be included in this mixture?

A CH_2BrCH_2Br CH_2BrCH_2Cl

B	CH_2BrCH_2Br	CH_2ClCH_2OH
C	CH_2BrCH_2Br	CH_2ClCH_2Cl
D	CH_2BrCH_2OH	CH_2ClCH_2OH

18 Some termites produce a chemical defence secretion which contains the following compound.



Which statements are correct?

1 The compound reacts with Br_2 as well as BrCl.

2 When the compound is treated with excess hot acidified manganate(VII) ions, two organic products are obtained.

3 When the compound is treated with excess cold alkaline manganate(VII) ions, the organic product obtained has 3 chiral centres.

A 1, 2 and 3

B 1 and 2 only

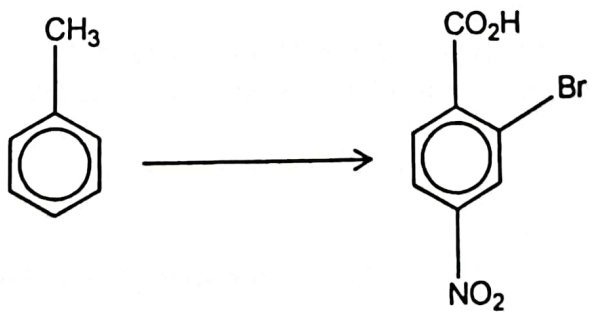
C 2 and 3 only

D 3 only

19 *Use of the Data Booklet is relevant to this question.*

Which reaction sequence will produce the best yield of 2-bromo-4-nitrobenzoic acid from methylbenzene?

methylbenzene → 2-bromo-4-nitrobenzoic acid



A bromination → oxidation → nitration

B nitration → bromination → oxidation

C nitration → oxidation → bromination

D oxidation → nitration → bromination

20 Which statements about benzene and ethene are correct?

1 Benzene contains delocalised electrons and so it conducts electricity while ethene does not.

2 Three of the carbon-carbon bonds in benzene have the same bond length as the carbon-carbon bond in ethene.

3 Both benzene and ethene can react with electrophiles but benzene undergoes substitution while ethene undergoes addition.

4 Both benzene and ethene can react with electrophiles but benzene undergoes addition while ethene undergoes substitution.

A 1, 2 and 3 only

B 2 and 3 only

C 2 and 4 only

D 3 only

– END OF PAPER –