Name:		Index Number:		Class:	

DUNMAN HIGH SCHOOL
Preliminary Examination 2017
Year 6

H1 CHEMISTRY

8872/01

Paper 1 Multiple Choice

25 September 2017
50 minutes

Additional Materials: Data Booklet
Optical Mark Sheet

INSTRUCTIONS TO CANDIDATES

1 Write your **name**, **index number** and **class** on this question paper and the OTAS Mark Sheet.

2 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 separate Optical Mark Sheet.

3 Each correct answer will score one mark. A mark will not be deducted for wrong answer.

4 Any rough working should be done in this booklet.

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

6 On the OTAS Mark Sheet, please shade the code as “Class/Index number”.

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

Which of these samples of gas contains twice the number of atoms as 4 g of helium gas, He?

A 22 g of carbon dioxide, CO_2

B 8 g of methane, CH_4

C 4 g of hydrogen, H_2

D 12 g of steam, H_2O

2 Bones contain a complex mixture of calcium salts, protein and other material.

When a sample of 50.0 g bone is strongly heated in air, the only residue formed is calcium oxide and its mass is determined to be 14.0 g.

What is the percentage by mass of calcium in the bone?

A 10%

B 14%

C 20%

D 23%

3 Ethanedioate ions, $C_2O_4^{2-}$, are oxidised by acidified aqueous potassium manganate (VII) to give carbon dioxide. What volume of 0.020 mol dm^{-3} potassium manganate (VII) is required to completely oxidise 2.0 x 10^{-3} mol of the salt $NaHC_2O_4.H_2C_2O_4$?

The half equation for MnO_4^- is given below:

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

A 20 cm^3 **B** 40 cm^3

C 80 cm^3 **D** 100 cm^3

4 Which of the following corresponds to the electronic configuration of 3 electrons of highest energy for a Group 13 element at its ground state?

A $3s^23p^3$ **B** $1s^12s^12p^1$

C $4s^24p^1$ **D** $3s^13p^2$

5 The hydrogen molecule contains a covalent bond.

What holds the atoms together in this covalent molecule?

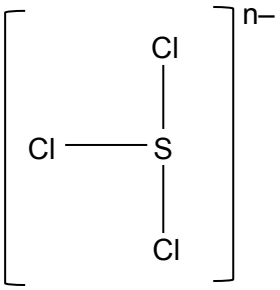
A The electrostatic attraction between the electrons in the bond pair and the two nuclei.

B The electrostatic attraction between the electron of one hydrogen atom and the nucleus of the other hydrogen atom.

C The electrostatic attraction between the atoms in the molecule.

D The energy released in the formation of the covalent bond.

6 SCl_3^{n-} has a T–shaped structure as shown below.



What is the value of n?

A 0 **B** 1

C 2 **D** 4

7 When 5 mol of nitrogen gas and 9 mol of hydrogen gas were put into a 2 dm^3 container and heated, the equilibrium mixture contained 2 mol of ammonia gas.

The equilibrium is represented by the following equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

What is the numerical value of the equilibrium constant, K_c, at the temperature of the experiment?

A $\frac{1}{2(3^3)}$ **B** $\frac{2^2}{1(3^3)}$ **C** $\frac{2^2}{4(6^3)}$ **D** $\frac{2^2}{3(2\times 3)^3}$

8 Which statement can be deduced from the following information?

$$2CO\,(g) + O_2(g) \rightleftharpoons 2CO_2(g) \qquad \Delta H = -566\ kJ\ mol^{-1}$$

A Increasing the pressure at constant temperature increases the value of the equilibrium constant.

B Decreasing the volume of the container containing the reaction mixture at constant temperature decreases the amount of CO and O_2 at equilibrium.

C Increasing the temperature decreases the rate of the forward reaction.

D Adding a catalyst increases the yield and rate of production of CO_2.

9 The value of the ionic product of water, K_w, varies with temperature as shown.

Temperature / °C	K_w / $mol^2\ dm^{-6}$
25	1.0×10^{-14}
62	1.0×10^{-13}

Which statement is true?

A The ionic dissociation of water is exothermic.

B The pH of water is higher at 62°C than 25°C.

C Water is acidic at 62°C.

D $[OH^-] = 3.16 \times 10^{-7}$ mol dm^{-3} at 62°C.

10 A 2.0 cm^3 solution of a strong acid has pH 1. What additional volume of water is needed to increase the pH of the solution to pH 3?

A 98 cm^3
B 100 cm^3
C 198 cm^3
D 200 cm^3

11 Using bond energy values from the *Data Booklet*, what is the enthalpy change of formation of N_2H_4 (g)?

A –250 kJ mol^{-1}

B –146 kJ mol^{-1}

C +146 kJ mol^{-1}

D +250 kJ mol^{-1}

12 250 cm^3 of 0.50 mol dm^{-3} KOH(aq) at 29.0 °C was mixed in a polystyrene cup, with an equal volume of 0.50 mol dm^{-3} H_2SO_4(aq) at the same initial temperature. The final temperature was 32.4 °C.

What is the enthalpy change of neutralisation of the reaction?

Given heat capacity of the mixture and polystyrene cup = 1.7 kJ K^{-1}

A – 3760 kJ mol^{-1}

B – 57.1 kJ mol^{-1}

C – 46.2 kJ mol^{-1}

D – 28.6 kJ mol^{-1}

13 Which compound has the most exothermic lattice energy?

A Magnesium chloride

B Sodium bromide

C Aluminium fluoride

D Lead (II) iodide

14 Which statement **does not** explain why addition of a catalyst leads to a significant increase in the rate of a reaction?

A The average kinetic energy of the molecules is slightly greater in the presence of a catalyst.

B The activation energy of the forward and backward reaction is lowered when a catalyst is added.

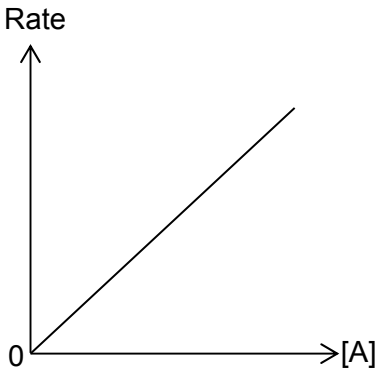
C The frequency of effective collisions between molecules with kinetic energy greater than the activation energy is greater with the presence of a catalyst.

D The number of reactant molecules with at least activation energy increases.

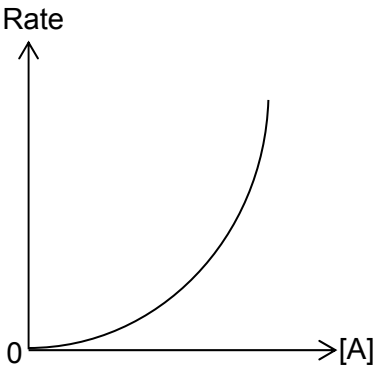
15 Consider the hypothetical reaction: $2A \rightarrow B + C$.

Given that the rate constant, *k*, of the reaction is 0.188 mol dm^{-3} s^{-1}, which of the following graphs correctly reflects the reaction kinetics of the reaction?

A



B



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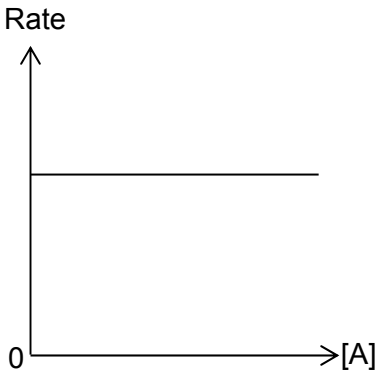
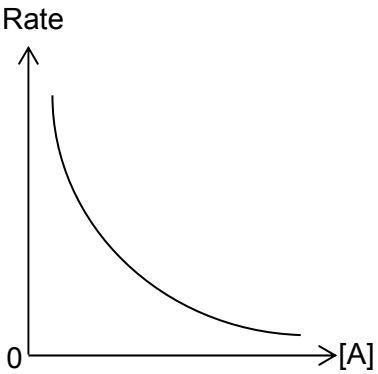


D



16 Elements can form chlorides by reacting them with Cl_2. The chlorides formed by elements **R** and **S** can conduct electricity in the molten state.

Which are the possible identities of **R** and **S**?

A magnesium, phosphorus

B sodium, aluminium

C silicon, phosphorus

D magnesium, sodium

17 Which compound can undergo a substitution reaction to form 2–chloropropane?

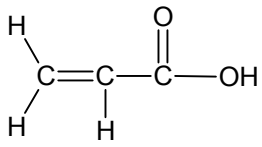
A $CH_3CH(OH)CH_3$

B $CH_3CH{=}CH_2$

C CH_3CH_2CHO

D $CH_3CH(NH_2)CH_3$

18 Acrylic acid is co–polymerised with other monomers to make sticky coatings.



acrylic acid

What are the numbers of σ and π bonds present in one molecule of acrylic acid?

	σ	π
A	7	1
B	8	1
C	7	2
D	8	2

19 How many different products, including stereoisomers, are formed when $CH_3C(CH_3)_2CH(OH)CH_2CH_3$ is treated with hot concentrated sulfuric acid?

A 0 **B** 1 **C** 2 **D** 3

20 Which statement **best** explains why iodoalkanes are the most reactive halogenoalkane?

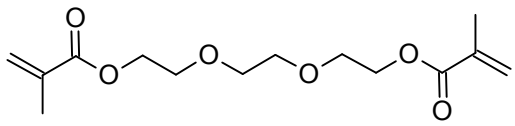
A Iodine has the most number of electrons.

B Iodine is the least electronegative halogen.

C The C–I bond is the longest.

D The iodide ion is the most stable halide.

21 The following compound is used to make light–cured dental fillings.



How many hydrogen atoms are present in one of these molecules?

A 20 **B** 22 **C** 24 **D** 26

22 Which pure compound would give only one positive test result with the following reagents?

- alkaline aqueous iodine
- phosphorous pentachloride
- 2,4–dinitrophenylhydrazine

A butanal

B butanone

C butan–2–ol

D ethanol

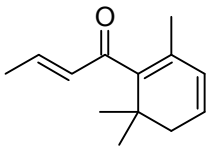
23 The diagram shows a reaction pathway.

1–bromobutane $\xrightarrow{\text{step 1}}$ intermediate $\xrightarrow{\text{step 2}}$ propanoic acid

Which reagents are suitable for steps 1 and 2?

	reagent for step 1	reagent for step 2
A	HCN, trace NaOH	dilute H_2SO_4
B	alcoholic KCN	dilute H_2SO_4
C	aqueous NaOH	$KMnO_4$
D	alcoholic NaOH	$KMnO_4$

24 Beta–damascenone is a major contributor to the aroma of roses.



beta–damascenone

Which statement is true of this compound?

A All the C–C–C bond angles are 120°.

B It forms hydrogen bonds with water.

C It undergoes substitution with aqueous bromine.

D It reduces alkaline Cu^{2+} to Cu_2O.

25 An organic compound on complete combustion produces equal volumes of carbon dioxide and water vapour.

What is a possible identity of the compound?

A CH_4

B CH_3OH

C $CH_3CH_2CH_3$

D CH_3COCH_3

Section B

For each question, 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 which 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 The successive ionisation energies, in kJ mol^{-1}, of an elements **X** and **Y** are given below.

X	580	1820	2740	11600	14840	18380	23320
Y	940	2050	2970	4140	6590	7880	14900

Which of the following statements are true about element **X** and **Y**?

1 The first ionisation energy of **X** is lower than that of the element preceding it in the Periodic Table.

2 **X** and **Y** forms a compound with the formula $\mathbf{X_2Y_3}$.

3 When oxides of **X** and **Y** are added separately to water containing Universal Indicator solution, the solution turns blue and red respectively.

27 Which of the following statements describe a phenomenon which can be explained by hydrogen bonding?

1 2–nitrobenzoic acid is more volatile than 4–nitrobenzoic acid.

2 Ice has a lower density than water at 0°C.

3 The boiling point of alcohol increases with increasing relative molecular mass.

28 Element **X** is one of the elements in the third period of the Periodic Table. The oxide of **X** has a giant ionic structure while the chloride of **X** has a simple molecular structure.

Which statements are **correct**?

1 The oxide of **X** has a higher melting point than that of magnesium oxide.

2 The oxide of **X** reacts with excess aqueous potassium hydroxide to form a colourless complex ion.

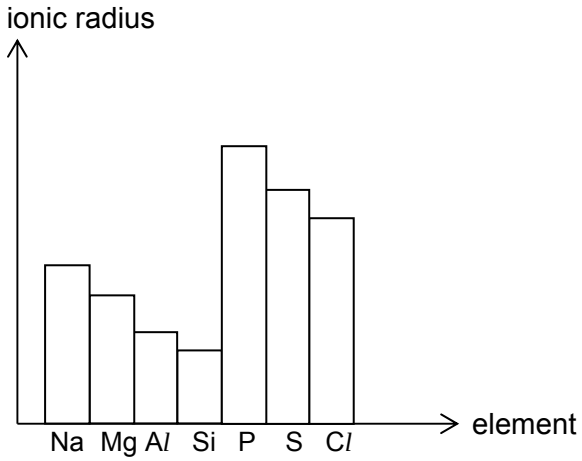
3 The third ionisation energy of **X** is lower than the second ionisation energy of sodium.

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 The graph below shows the ionic radii of seven elements found in Period 3.



Which statements correctly explain the trend shown in the graph?

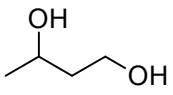
1 The ionic radius decreases from P^{3-} ion to Cl^- ion due to increasing nuclear charge.

2 The ionic radius decreases from Na^+ ion to Si^{4+} ion due to decreasing shielding effect by inner shell electrons.

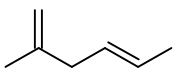
3 The ionic radius of P^{3-} ion is greater than that of Si^{4+} ion due to less attraction between electrons.

30 Which compounds will form CH_3COCH_2COOH upon treatment with hot alkaline $KMnO_4$, followed by acidification?

1



2



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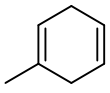

2017 DHS YEAR 6 H2 CHEMISTRY (8872) PRELIMINARY EXAMINATION
Paper 1 MCQ – Answers

1	2	3	4	5	6	7	8	9	10
D	**C**	**C**	**C**	**A**	**B**	**A**	**B**	**D**	**C**

11	12	13	14	15	16	17	18	19	20
C	**C**	**C**	**A**	**C**	**D**	**A**	**D**	**C**	**C**

21	22	23	24	25	26	27	28	29	30
B	**A**	**D**	**B**	**D**	**B**	**B**	**C**	**D**	**A**