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DUNMAN HIGH SCHOOL Preliminary Examination Year 6

H1 CHEMISTRY

Paper 1 Multiple Choice

8872/01

30 September 2014

50 minutes

Additional Materials: Optical Mark Sheet
Data Booklet

INSTRUCTIONS TO CANDIDATES

- 1 Write your **name**, **index number** and **class** on this question paper.
- 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 a wrong answer.
- 4 Any rough working should be done in this booklet.
- 5 You may use a calculator.

Section A

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

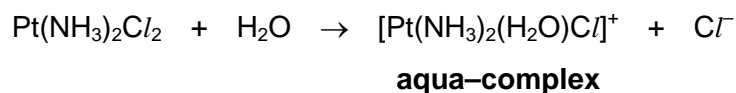
- 1 When 10 cm³ of a gaseous hydrocarbon was completely burnt in excess oxygen, 30 cm³ of carbon dioxide and 40 cm³ of water vapour were formed.

Given that all volumes were measured at the same temperature and pressure, what is the formula of the hydrocarbon?

- A** C₂H₂ **B** C₂H₆ **C** C₃H₄ **D** C₃H₈

- 2 The anti-cancer drug *cisplatin* has the formula Pt(NH₃)₂Cl₂.

In the human body, one of the chloride ions of *cisplatin* is replaced by one water molecule to form an aqua-complex.



What is the oxidation number of platinum in each of these substances?

	<i>cisplatin</i>	aqua-complex
A	+2	+1
B	+2	+2
C	+4	+3
D	+4	+4

- 3 Hot concentrated nitric acid, HNO₃, is a powerful oxidising agent.

In its reaction with carbon, the oxidation number of carbon increases by 4 and the oxidation number of nitrogen decreases by 1.

How many moles of nitric acid are needed to oxidise one mole of carbon in the reaction described above?

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

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

Nuclear theories predict the number of protons or the number of neutrons that give especially stable nuclei. These numbers are known as the nuclear magic numbers. These numbers include

2, 8, 20, 28, 50, 82, 126.

The most stable nuclei are the 'doubly magic' ones that have a magic number of protons and a magic number of neutrons.

Using this theory, which isotope is the most stable?

- A ${}^2\text{He}$ B ${}^8\text{Be}$ C ${}^{40}\text{Ca}$ D ${}^{210}\text{Pb}$

- 5 The relative atomic mass of boron, which consists of the isotopes ${}^{10}_5\text{B}$ and ${}^{11}_5\text{B}$, is 10.8. What is the percentage of ${}^{11}_5\text{B}$ atoms in the isotopic mixture?

- A 92 % B 80 % C 8.0 % D 0.8 %

- 6 Which statement about bond formation is **not** correct?

- A A triple bond consists of one σ bond and two π bonds.
 B A π bond restricts rotation about the σ bond axis.
 C Bonds formed from atomic s orbitals are always σ bonds.
 D End-to-end orbital overlap results in a bond with electron density above and below the bond axis.

- 7 The table shows the charge and radius of each of six ions.

ion	J^+	L^+	M^{2+}	F^-	G^-	H^{2-}
radius / nm	0.14	0.18	0.15	0.14	0.18	0.15

The ionic solids **JF**, **LG** and **MH** are of the same lattice type.

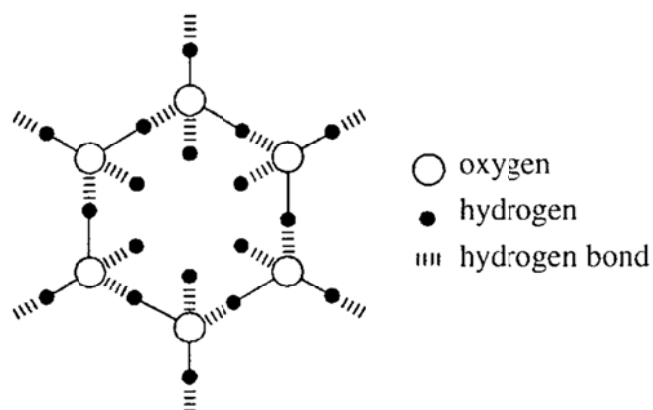
What is the correct order of their lattice energies, placing the most exothermic first?

- A **JF, MH, LG** C **MH, JF, LG**
 B **LG, MH, JF** D **MH, LG, JF**

- 8 Which of the following molecules will **not** form a hydrogen bond with another of its own molecules?

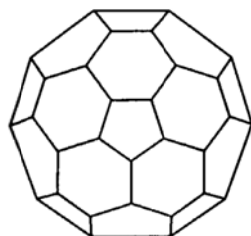
- A CH_3CHO B CH_3NH_2 C CH_3OH D NH_3

- 9 The diagram shows part of the structure of ice.



Which statement is **correct**?

- A Four electrons from each oxygen are involved in forming hydrogen bonds.
 - B All bond angles surrounding each oxygen atom are 120° .
 - C The open structure of ice causes ice to be denser than water.
 - D The hydrogen bonds, shown by the dash lines, are stronger than the O–H covalent bonds.
- 10 Buckminsterfullerene has the formula, C_{60} . Its structure is shown below.



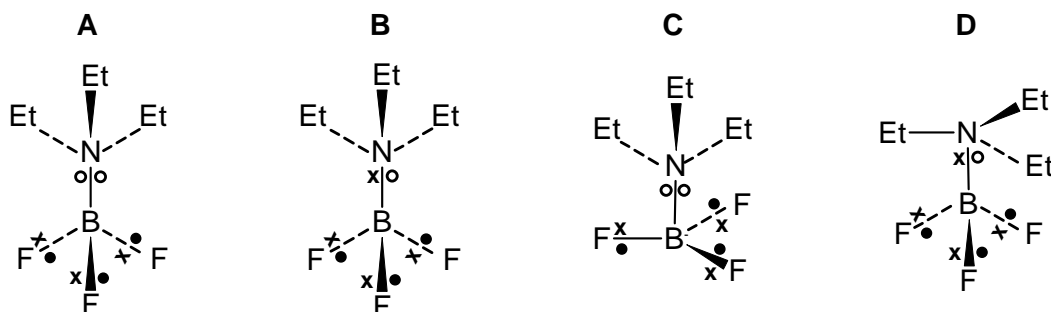
The bonding in buckminsterfullerene is similar to that in graphite.

Which of the following is **correct**?

- A All the bond angles in buckminsterfullerene are 120° .
- B There are delocalised electrons in buckminsterfullerene.
- C The melting point of buckminsterfullerene is higher than that of graphite.
- D On complete combustion, buckminsterfullerene forms carbon dioxide and water.

- 11 Triethylamine, Et_3N , reacts with boron trifluoride, BF_3 , to form a compound of formula $\text{Et}_3\text{N}.\text{BF}_3$.
[the symbol $\text{Et} = \text{CH}_2\text{CH}_3$]

In the following diagrams, \times , \bullet and \circ represent electrons from B, F and N respectively. Which diagram correctly illustrates **both** the structure of $\text{Et}_3\text{N}.\text{BF}_3$, and electron pairs around the boron atom?



- 12 An element **P** in Period 3 is a metalloid and semiconductor and has a chloride which reacts with water to form an acidic solution.

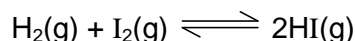
An element **Q** has an atomic number one less than element **P**.

What is a property of the oxide of element **Q**?

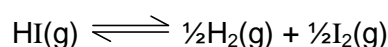
- A It is a gas at room temperature.
B It is amphoteric.
C It is covalent.
D Its formula is QO_2 .
- 13 Molecule **R** is made up from two elements from period 3 of the Periodic Table. One of the elements has the highest melting point and the other element has the lowest melting point (excluding argon) in the period.

What is the formula of molecule **R**?

- A AlCl_3 B Al_2S_3 C SiCl_4 D SiS_2
- 14 If the equilibrium constant for the reaction below is K at 440°C ,

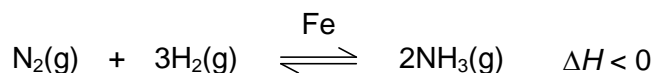


what is the equilibrium constant for the following reaction at 440°C ?



- A K^{-2} B K^2 C $\frac{1}{\sqrt{K}}$ D \sqrt{K}

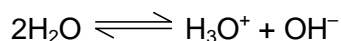
- 15 Ammonia is manufactured industrially via the Haber process where nitrogen and hydrogen is passed through an iron catalyst at high temperature and pressures.



Which of the following statements is **true** for the above reaction?

- A An increase in temperature increases the rate constant but decreases the equilibrium constant.
 - B The reaction is carried out at high temperatures because it will favour the formation of ammonia.
 - C Increasing the concentration of H_2 and N_2 causes the equilibrium constant of the reaction to increase as more ammonia is formed.
 - D The activation energy of the forward and backward reaction is the same.
- 16 Use of the Data Booklet is relevant to this question.

Water dissociates as shown.



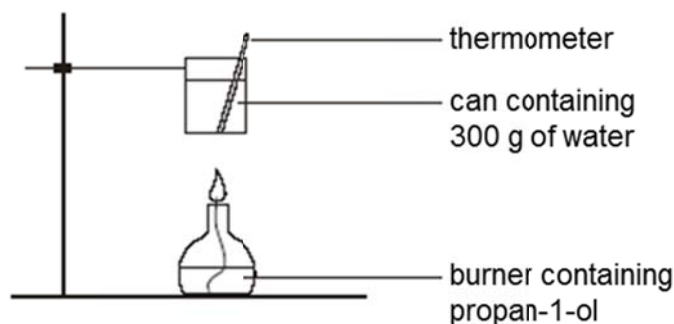
At 25 °C, the equilibrium value of $[\text{H}_3\text{O}^+]$ in pure D_2O is $10^{-7} \text{ mol dm}^{-3}$;

$$[\text{H}_2\text{O}] = \frac{1000}{18} \text{ mol dm}^{-3}.$$

What is the order of increasing numerical value of pH, $\text{p}K_{\text{a}}$ and $\text{p}K_{\text{W}}$ for this equilibrium at this temperature?

	smallest		largest
A	pH	$\text{p}K_{\text{W}}$	$\text{p}K_{\text{a}}$
B	pH	$\text{p}K_{\text{a}}$	$\text{p}K_{\text{W}}$
C	$\text{p}K_{\text{W}}$	$\text{p}K_{\text{a}}$	pH
D	$\text{p}K_{\text{a}}$	$\text{p}K_{\text{W}}$	pH

- 17 A student used the set-up below to heat a can containing 300 g of water.



The following data were recorded:

$$\begin{aligned}\text{mass of propan-1-ol burnt} &= m \text{ g} \\ \text{change in temperature of water} &= \Delta T ^\circ\text{C}\end{aligned}$$

Given that:

$$\begin{aligned}\text{relative molecular mass of propan-1-ol} &= 60.0 \\ \text{enthalpy change of combustion of propan-1-ol} &= -2021 \text{ kJ mol}^{-1} \\ \text{specific heat capacity of water} &= c \text{ J g}^{-1} \text{ K}^{-1}\end{aligned}$$

What percentage of the heat produced from the burning is used to raise the temperature of water by $T ^\circ\text{C}$?

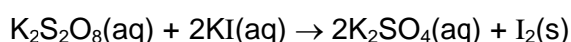
A $\frac{m \times 2021 \times 1000}{300 \times c \times \Delta T \times 60.0} \times 100\%$

B $\frac{m \times c \times \Delta T \times 60.0}{300 \times 2021 \times 1000} \times 100\%$

C $\frac{300 \times c \times \Delta T \times 60.0}{m \times 2021} \times 100\%$

D $\frac{300 \times c \times \Delta T \times 60.0}{m \times 2021 \times 1000} \times 100\%$

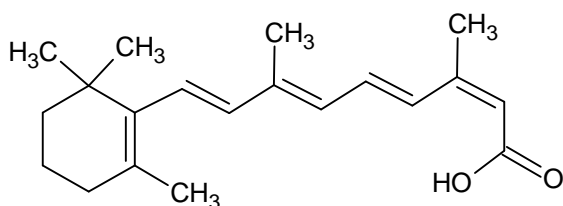
- 18 At room temperature, potassium peroxydisulfate, $\text{K}_2\text{S}_2\text{O}_8$, reacts very slowly with potassium iodide ions, KI , according to the equation.



Which statement **correctly** explains the result of carrying out this decomposition in the presence of a catalyst such as Fe^{3+} ions?

- A** The reaction rate increases because the collision frequency increases due to a decrease in the activation energy.
- B** The reaction rate increases because the collision frequency increases due to an increase in the average energy of the molecules.
- C** The reaction rate increases because the proportion of successful collisions increases due to a decrease in the activation energy.
- D** The reaction rate increases because the proportion of successful collisions increases due to an increase in the average energy of the molecules.

- 19 Isotretinoin, a common drug used in the treatment of severe acne has the following structure.

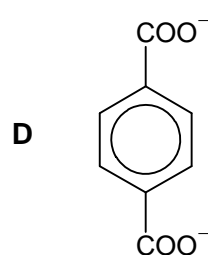
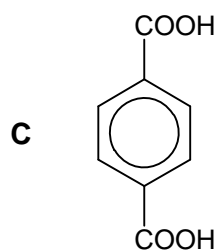
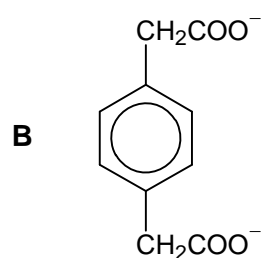
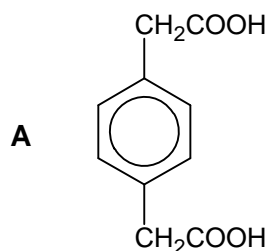


What is the total number of geometric isomers in isotretinoin?

- A 8 B 16 C 32 D 64
- 20 Chlorofluorocarbons, CFCs are widely used but can deplete the ozone layer.
A typical CFC is CHF_2CHClF . Which covalent bond in this CFC is the weakest?
- A C–C B C–F
C C–H D C–Cl
- 21 A sample of propene was added to a solution of aqueous Br_2 . The product formed was passed through hot alcoholic potassium hydroxide. Which of the following statement about the reaction is **correct**?
- A Substitution occurred in the first reaction.
B Substitution reaction occurred in the second reaction.
C FeBr_3 is required for the first reaction.
D $\text{CH}_2(\text{OH})\text{CHCH}_2$ is formed.

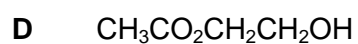
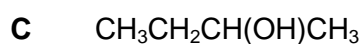
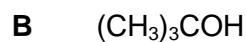
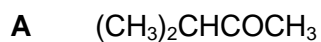
22 A sample of 1,4-diethylbenzene was treated with hot, concentrated alkaline KMnO_4 .

What compound could be formed?



23 Which compound

- is unaffected by hot alkaline potassium manganate(VII);
- gives hydrogen gas when treated with sodium?



24 Which reagent could be used to distinguish between $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CHO}$ and $\text{CH}_3\text{COCH}_2\text{CH}_2\text{OH}$?

- A** Fehling's reagent
B dilute sulfuric acid
C 2,4-dinitrophenylhydrazine
D acidified potassium dichromate(VI)

25 Which sequence shows the correct order of increasing value of $\text{p}K_{\text{a}}$?

- A** $\text{CH}_3\text{CH}_2\text{OH}$, $\text{C}/\text{CH}_2\text{CH}_2\text{OH}$, CH_3COOH
B $\text{CH}_3\text{CF}_2\text{COOH}$, $\text{FCH}_2\text{CHFCH}_2\text{COOH}$, $\text{F}_2\text{CHCH}_2\text{COOH}$
C $\text{CH}_3\text{CH}_2\text{COOH}$, $\text{C}/\text{CH}_2\text{CH}_2\text{COOH}$, $\text{CH}_3\text{CHClCOOH}$
D BrCH_2COOH , $\text{C}/\text{CH}_2\text{COOH}$, FCH_2COOH

Section B

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

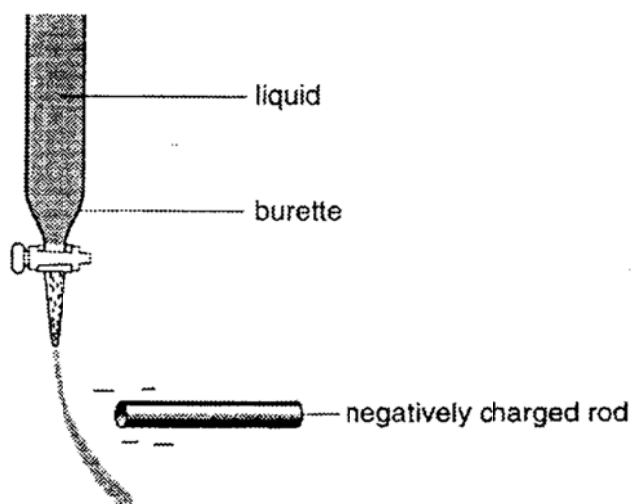
Decide whether each of the statements is or is not correct (you may find it helpful to put a tick against the statements which you consider to be correct).

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

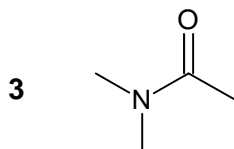
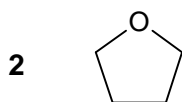
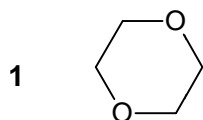
A	B	C	D
1, 2 and 3 are correct	1 and 2 only are correct	2 and 3 only are correct	1 only is correct

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

- 26** The diagram shows a liquid flowing from a burette and a charged rod being brought near the flow.



Which liquids would be deflected as shown?

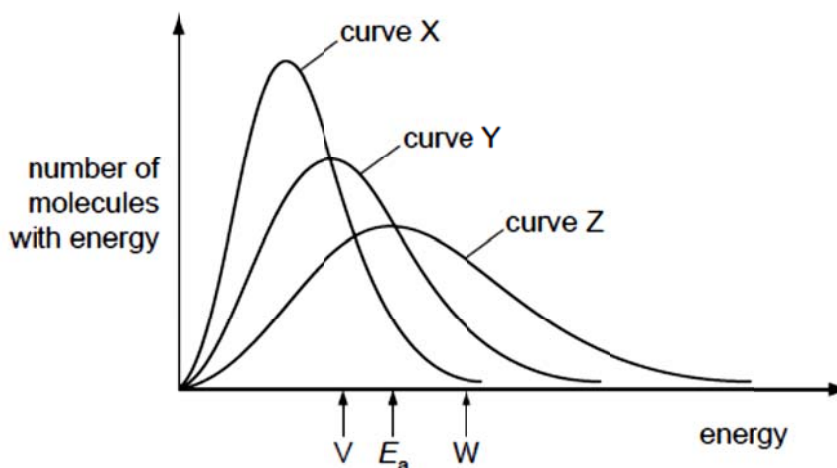


The responses **A** to **D** should be selected on the basis of

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.

- 27** Curve **Y** and the value E_a represent the energy distribution of molecules and the activation energy for a gaseous reaction at 298 K respectively.



Which of the following statements are **correct**?

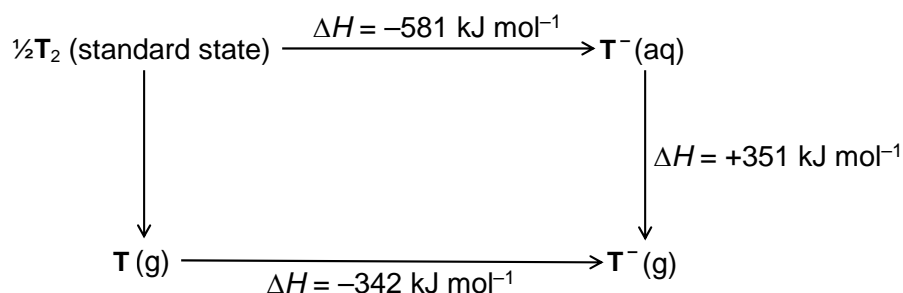
- 1** When temperature increases, the distribution of energies will be given by curve **Z** and the activation energy by value **W**.
- 2** When temperature decreases, the distribution of energies will be given by curve **X** and the activation energy by value E_a .
- 3** When a catalyst is used, the distribution of energies will be given by curve **Y** and the activation energy by value **V**.

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.

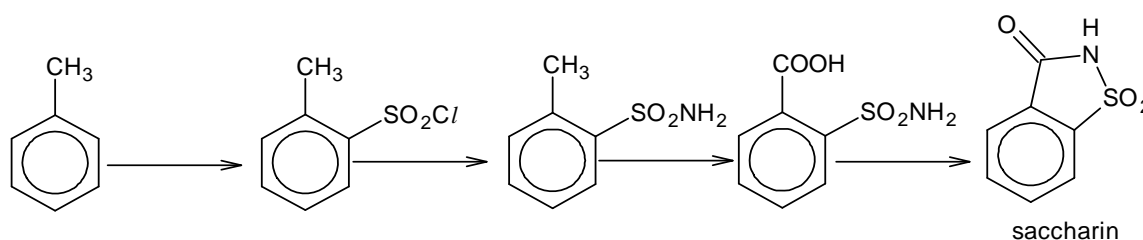
28 The diagram illustrates the energy changes of a set of reactions.



Which of the following can be deduced from this diagram?

- 1 The enthalpy change for the transformation $\text{T}(\text{g}) \rightarrow \text{T}^-(\text{aq})$ will be exothermic.
- 2 The enthalpy change for the transformation $\text{T}^-(\text{g}) \rightarrow \frac{1}{2}\text{T}_2(\text{standard state})$ is $+230 \text{ kJ mol}^{-1}$.
- 3 The enthalpy change for the reaction $\frac{1}{2}\text{T}_2(\text{standard state}) \rightarrow \text{T}(\text{g})$ is -112 kJ mol^{-1} .

29 Saccharin is an artificial sweetening agent used in some soft drinks and is manufactured from methylbenzene by the following series of reactions.



What types of reactions are involved in the series?

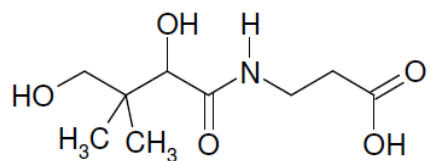
- 1 condensation
- 2 substitution
- 3 oxidation

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.

30 Vitamin B5 has the following structure.



Which of the following statements about Vitamin B5 is **not** correct?

- 1** Vitamin B5 reacts with 2,4–dinitrophenylhydrazine to form an orange precipitate.
- 2** One mole of Vitamin B5 completely reacts with three moles of Na_2CO_3 .
- 3** One mole of Vitamin B5 completely reacts with three moles of KOH at room temperature and pressure.

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