RIVER VALLEY HIGH SCHOOL
YEAR 6 COMMON TEST

H2 CHEMISTRY 9647

PAPER 1
5 JUL 2012

1 HOUR

NAME _____

CLASS 6 ( )

INDEX NO. _____

INSTRUCTIONS TO CANDIDATES

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Read these notes carefully.
Write your name, class and index number in the spaces at the top of this page.

*There are **forty** questions in 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 **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 on the Question Paper.

The total number of marks for this paper is **40**.

A *Data Booklet* is provided.

This Question Paper consists of **17** printed pages.

Section A (20 marks)

Part 1

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

1. 4 dm^3 of ethene was burned completely in 16 dm^3 of oxygen and the resulting mixture cooled to room temperature. The residual gas would contain

A equal volume of carbon dioxide and water vapour.

B equal volume of carbon dioxide and oxygen.

C twice the volume of carbon dioxide as oxygen.

D twice the volume of oxygen as carbon dioxide.

2. Chlorine gas is toxic to human health. The maximum safe tolerance level of chlorine gas in air is 0.003 mg dm^{-3}.

How many chlorine atoms are present in 1 dm^3 of air at this tolerance level?

A 2.55×10^{16} **B** 1.02×10^{17}

C 5.10×10^{16} **D** 5.10×10^{19}

3. **FA 1** contains Fe^{2+} ions. In an experiment, it was found that 25.0 cm^3 of **FA 1** required 18.00 cm^3 of 0.200 mol dm^{-3} acidified $KMnO_4(aq)$ for complete reaction. What is the volume of 0.150 mol dm^{-3} acidified $K_2Cr_2O_7(aq)$ needed to react with 25.0 cm^3 of **FA 1**?

A 18.00 cm^3

B 20.00 cm^3

C 24.00 cm^3

D 30.00 cm^3

4. The nickel-cadmium rechargeable battery functions on the following reaction.

$$Cd + 2NiO(OH) + 4H_2O \rightarrow Cd(OH)_2 + 2Ni(OH)_2.2H_2O$$

What is the oxidation number of nickel at the beginning and the end of the reaction?

	Beginning	End
A	+1.5	+2
B	+2	+3
C	+3	+2
D	+3	+4

5. Elements **P** and **Q** have the following successive ionisation energies (in kJ mol^{-1}).

	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*
P	580	1817	2745	11577	14842	18379	23326
Q	1314	3388	5300	7469	10990	13326	71330

What could be the formula of the compound formed by these two elements?

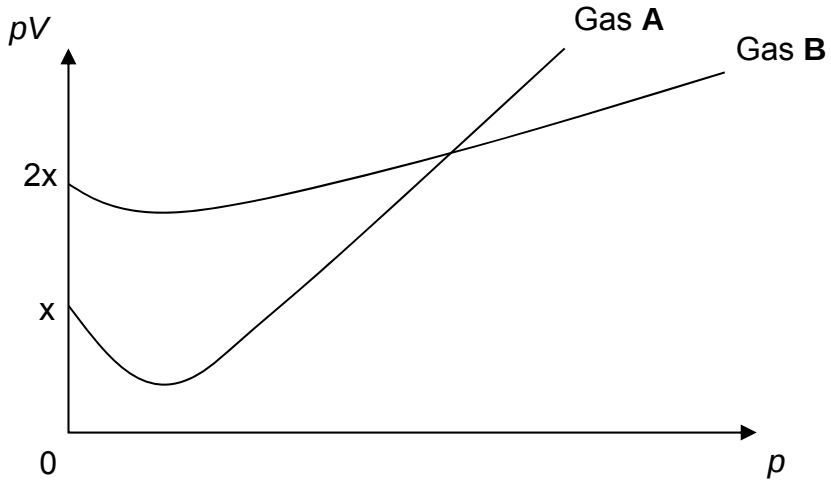
A PQ

B PQ_2

C P_2Q

D P_2Q_3

6. The value of *pV* is plotted against *p* for 2 gases, **A** and **B**, where *p* is the pressure and *V* is the volume of the gas.



Which of the following could be the identities of the gases?

	Gas **A**	Gas **B**
A	0.50 mol of O_2	0.50 mol of O_2
B	0.50 mol of O_2	1.00 mol of SO_2
C	0.25 mol of SO_2	0.50 mol of O_2
D	1.00 mol of SO_2	0.50 mol of O_2

7. **X** and **Y** are cations.

X contains *n* protons and has a charge of +2.
Y contains (*n*–*1*) protons and has the same number of electrons as **X**.

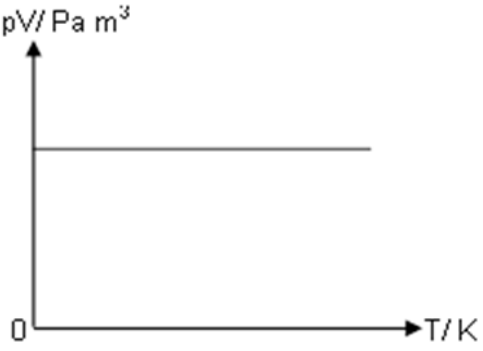
What is the formula of the oxide formed by **Y**?

A Y_2O **B** YO

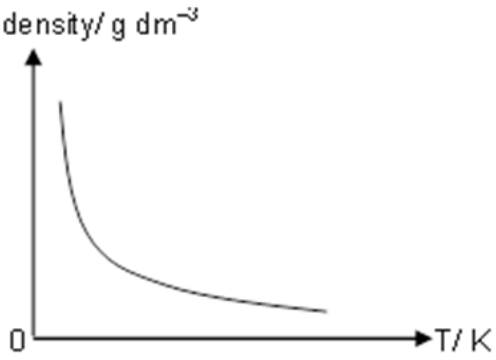
C Y_2O_3 **D** YO_2

8. Which of the following diagrams correctly describes the behaviour of a fixed mass of an ideal gas?

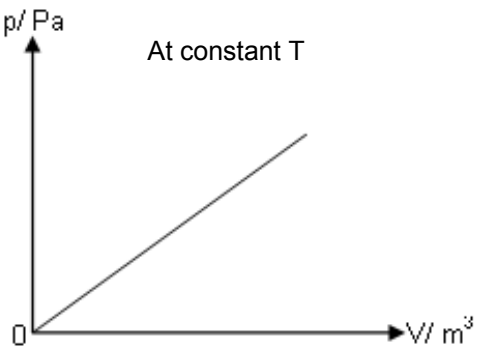
A



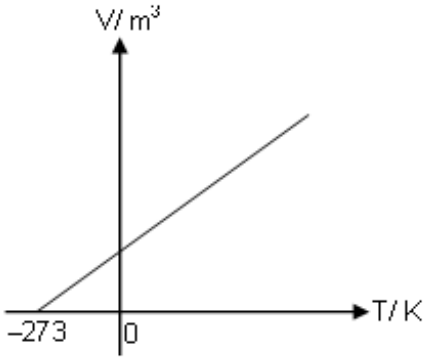
B



C



D



9. When 20 cm^3 of aqueous potassium hydroxide containing 0.04 mol of KOH is added to 20 cm^3 of a solution containing 0.04 mol of H_2SO_4 in a plastic cup of negligible heat capacity, the temperature is found to rise by 15°C. Both solutions have the same initial temperature.

Given that the heat capacity of the final solution is 4.2 $JK^{-1}cm^{-3}$, what is the enthalpy change of neutralization?

A $+\frac{20\times4.2\times15}{0.04}$ J mol^{-1}

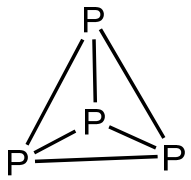
B $-\frac{40\times4.2\times15}{0.08}$ J mol^{-1}

C $-\frac{40\times4.2\times15}{0.02}$ J mol^{-1}

D $-\frac{40\times4.2\times15}{0.04}$ J mol^{-1}

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

Phosphorus, P_4, has the following molecular structure:



Imagine that nitrogen were to form a similar molecule N_4:

$$2N_2(g) \rightarrow N_4(g)$$

What would be the ΔH for the above reaction in $kJmol^{-1}$?

A −1028

B +1348

C +1028

D −1328

11. The Claus process is a significant gas desulfurizing process that recovers elemental sulfur, S(s) from gaseous hydrogen sulfide, H_2S. The Claus process is an oxidative process and produces steam as a by-product.

Given the following information, find the enthalpy change of reaction per mole of H_2S in $kJmol^{-1}$:

$$2H_2S + O_2 \rightarrow 2S + 2H_2O$$

	$H_2S(g)$	$H_2O(g)$
Enthalpy change of formation / $kJmol^{-1}$	−20.5	−243.0

A -445.0

B -222.5

C -263.5

D -202.0

12. The ozone layer absorbs ultraviolet (UV) rays from the sun, which potentially damages exposed life forms on Earth.

Ozone is formed as follows:

$$\frac{3}{2}\,O_2(g) \rightarrow O_3(g)$$

Given that $\Delta H_f(O_3) = +142.67\ kJmol^{-1}$ and $\Delta S^{\ominus} = -68.7\ JK^{-1}mol^{-1}$, calculate ΔG at standard conditions.

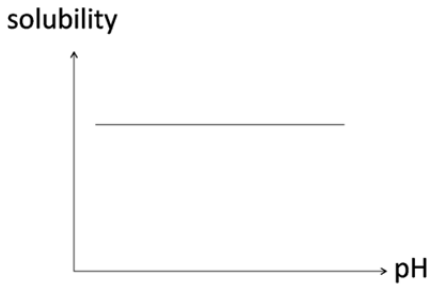
A $+163000\ Jmol^{-1}$ **B** $+20600\ Jmol^{-1}$

C $-20600\ Jmol^{-1}$ **D** $+109000\ Jmol^{-1}$

13. The numerical value of the solubility product of calcium fluoride is 3.9×10^{-11}.

Given that HF is a readily soluble weak acid, which diagram shows how the solubility of CaF_2 will vary with pH at constant temperature?

A



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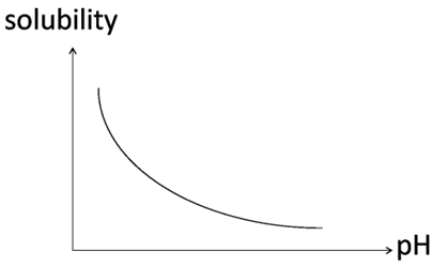
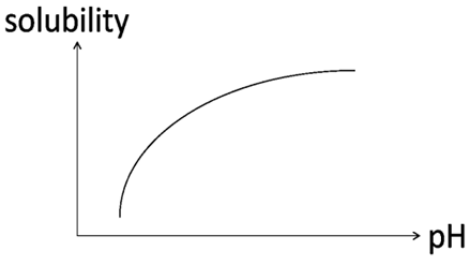
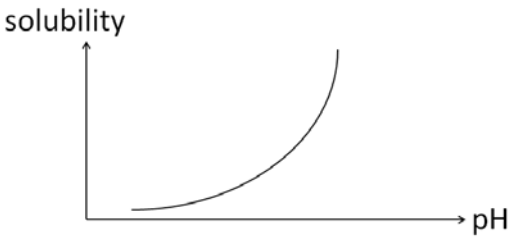


C



D



14. The pH of human blood is constant at about pH 7.40.

Which ion or molecule present in the human body will restore the pH of the blood when there is presence of contaminating alkali?

A CO_3^{2-}

B HCO_3^-

C H_2CO_3

D CO_2

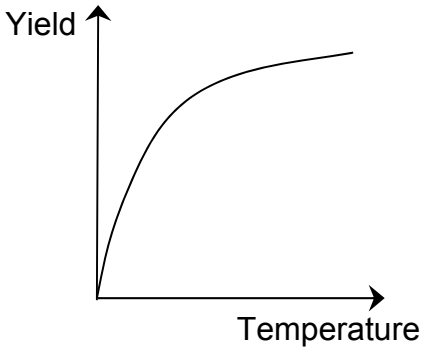
15. *Use of the Data Booklet is relevant to this question.*

Hydrogen iodide can be synthesized directly using a mixture of hydrogen gas and iodine gas in a reversible reaction as shown:

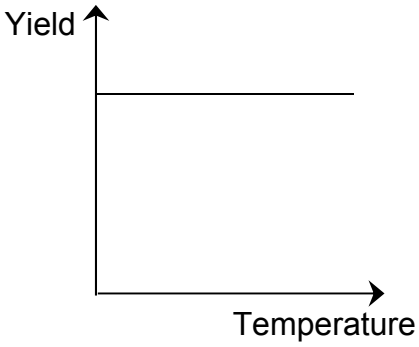
$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Which one of the following describes the yield of hydrogen iodide at equilibrium as temperature increases?

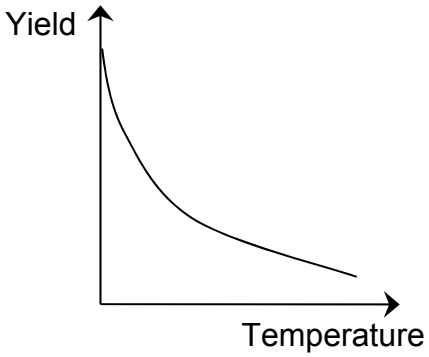
A



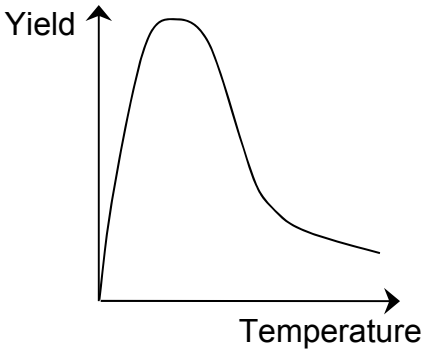
B



C



D



16. Given the following equilibrium:

$$\mathbf{X}(aq) + 2\mathbf{Y}(aq) \rightleftharpoons \mathbf{P}(s) + 2\mathbf{Q}(aq) \qquad \Delta H = +ve$$

The forward and backward rate constants are given as k_1 and k_{-1} respectively. What happens to the equilibrium constant K_p, k_1, k_{-1}, if at equilibrium, the temperature of the reaction mixture is increased?

	k_1	k_{-1}	K_c
A	Increase	Increase	Unchanged
B	Unchanged	Unchanged	Unchanged
C	Increase	Increase	Increase
D	Decrease	Increase	Decrease

17. A solution was made from mixing 50.0 cm^3 of 0.150 mol dm^{-3} of $NH_3(aq)$ with 50.0 cm^3 of 0.150 mol dm^{-3} of $HNO_3(aq)$.

Which of the following statement best describes this mixture?

A The salt solution formed is acidic.

B The salt solution formed is alkaline.

C The solution formed is an acidic buffer.

D The solution formed is an alkaline buffer.

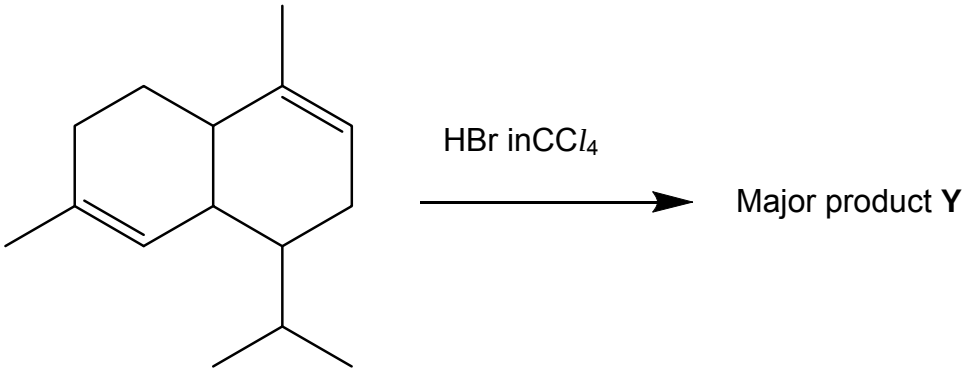
18. Given the following reaction:

$$\mathbf{A}(g) + \mathbf{B}(g) \rightleftharpoons 3\mathbf{C}(g) + 2\mathbf{D}(g) \qquad K_p = 1.08 \times 10^2 \text{ atm}^3$$

An equimolar mixture of **A** and **B** is allowed to reach equilibrium at 350 K. Determine the total pressure at equilibrium if the partial pressure of **C** at equilibrium was found to be 3.00 atm.

A 1.00 atm **B** 3.00 atm **C** 5.00 atm **D** 7.00 atm

19. α-Candinene can be found in juniper berries.



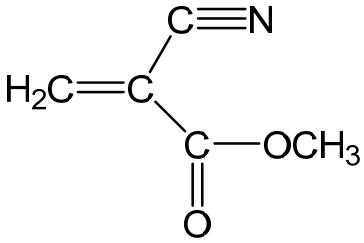
α-Candinene

Compound **Y** is the major product formed when α-Candinene is reacted with HBr in tetrachloromethane.

How many stereoisomers does **Y** have?

A 8 **B** 16 **C** 32 **D** 64

20. 'Superglue' contains the compound



Which one of the following statements is correct?

A It exhibits geometric isomerism.

B It can react with hot, acidified potassium dichromate(VI) to form a green solution.

C It can react with 2,4-dinitrophenylhydrazine to form bright orange crystals.

D It can react with lithium aluminium hydride to form a saturated compound with 2 chiral centres.

21. A two-steps synthesis is carried out on an alkene.

Step 1: Add cold, dilute potassium manganate(VII) to the alkene.

Step 2: Add sulfuric acid to the resultant mixture from Step 1 and warm.

The final oxidised product is a diketone.

What is the formula of the alkene?

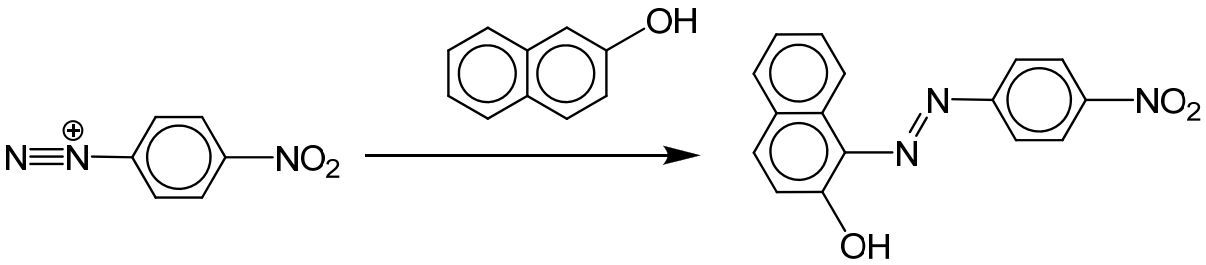
A $CH_2=CHCH=CH_2$

B $C_6H_5CH=CHCH=CHC_6H_5$

C $(CH_3)_2C=C(CH_3)_2$

D $C_6H_5CH=CHC_6H_5$

22. Para Red, an azo dye, is prepared by diazotisation of *para*-nitroaniline at ice-cold temperatures, followed by coupling with β-naphthol. The diagram below shows the final step in the mechanism.



What is the type of reaction for the reaction shown above?

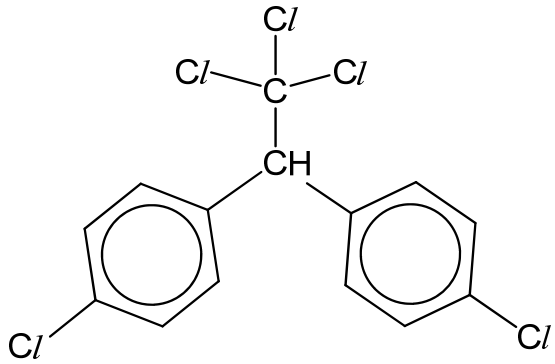
A electrophilic substitution

B electrophilic addition

C nucleophilic substitution

D nucleophilic addition

23. DDT was widely used in the period from 1945 to 1980 to combat malaria by killing insects which spread the disease.



Which of the following statements about DDT is **incorrect**?

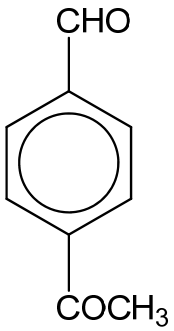
A Its molecule is strongly polar.

B It does not react with aqueous bromine readily.

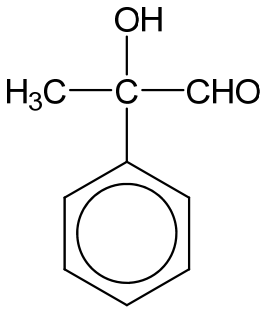
C It reacts with hot aqueous sodium hydroxide to form the salt of a carboxylic acid.

D It gives an immediate precipitate when mixed with aqueous silver nitrate.

24.



P



Q

Which of the following reagents can be used to distinguish between compound **P** and **Q**?

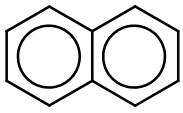
A alkaline aqueous iodine

B 2,4-dinitrophenylhydrazine

C silver(I) diammine complex, $[Ag(NH_3)_2]^+$

D acidified potassium dichromate(VI)

25. Naphthalene, the main ingredient of traditional mothballs, is an aromatic compound with the molecular formula $C_{10}H_8$. It has similar reactions and reactivity as benzene.



Naphthalene

Which of the following statements about naphthalene and its derivative is correct?

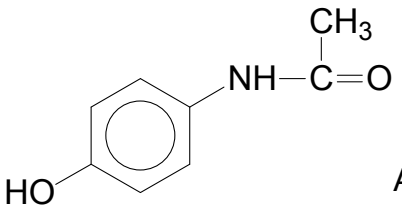
A Naphthalene has 12π electrons.

B Naphthalene undergoes electrophilic addition reactions.

C Naphthalene decolourises bromine in the presence of UV light.

D There are a total of ten aromatic isomers of molecular formula $C_{10}H_6Br_2$ with the naphthalene ring structure.

26. Acetaminophene is a drug used in headache remedies.



Acetaminophene

Which of the following statements about acetaminophene is **incorrect**?

A It forms violet colouration with neutral aqueous iron(III) chloride.

B It reacts with hot aqueous NaOH to give sodium ethanoate.

C It gives an orange precipitate with 2,4-dinitrophenylhydrazine.

D It reacts with sodium metal to give hydrogen gas.

27. A sample of a peptide of an unknown sequence was treated with enzymes. The sequences of the smaller peptides produced were

Lys – Ser

Leu – Lys

Ser – Tyr – Lys

Lys – Ala – Phe – Gln

What was the sequence of the original peptide?

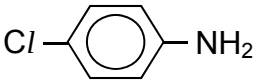
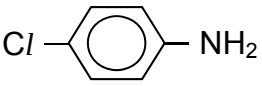
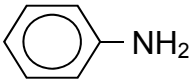
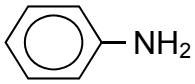
A Ser – Tyr – Lys – Ala – Phe – Gln – Leu – Lys

B Leu – Lys – Ala – Phe – Gln – Ser – Tyr – Lys

C Leu – Lys – Ser – Tyr – Lys – Ala – Phe – Gln

D Lys – Ser – Tyr – Lys – Ala – Phe – Gln – Leu

28. Which one of the following is correct?

	Stronger base	Weaker base
A	CH_3CONH_2	$CH_3CH_2NH_2$
B	CH_3CONH_2	
C		
D	$CH_3CH_2NH_2$	

29. Beryllium dichloride, $BeCl_2$, reacts with methylamine, CH_3NH_2 to form a compound. Which one of the statements is **incorrect**?

A The compound is formed from 1 mole of $BeCl_2$ and 2 moles of CH_3NH_2.

B The Be-N bond formed is chemically similar to a covalent bond.

C The compound forms a maximum of two hydrogen bonds per molecule.

D The beryllium atom in beryllium dichloride is electron deficient.

30. Which of the following statements regarding Group II elements or their compounds is correct?

A Beryllium chloride has a higher melting point than magnesium chloride.

B Calcium hydroxide is less soluble in water than barium hydroxide.

C Magnesium is a stronger reducing agent than strontium.

D Strontium reacts more readily with oxygen that radium.

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.

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.

31. For which of the following reactions does the value of $\Delta H^{\ominus}$ represent both a standard enthalpy change of combustion and a standard enthalpy change of formation?

1 $C(s) + O_2(g) \rightarrow CO_2(g)$

2 $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$

3 $N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$

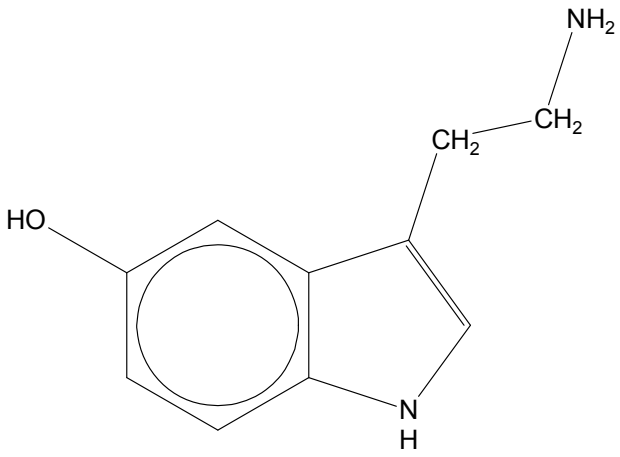
32. In which of the following processes are both the $\Delta H^{\ominus}_{reaction}$ and $\Delta S^{\ominus}_{system}$ positive?

1 $H_2O(s) \rightarrow H_2O(g)$

2 $NH_4NO_3(s) + aq \rightarrow NH_4^+(aq) + NO_3^-(aq)$

3 $C_2H_4(g) + H_2(g) \rightarrow C_2H_6(g)$

33. The following is the molecular structure of serotonin, which is a biomolecule that is thought to contribute to a feeling of happiness and well-being:



Which of the following statement(s) is/are true with regards to this molecule?

1 Serotonin is sparingly soluble in water but will dissolve readily in NaOH(aq).

2 When serotonin is heated with acidified $KMnO_4$, the product formed forms an orange ppt when tested with 2,4-DNPH.

3 When serotonin is added to PCl_5, it will give off white fumes of gas that dissolve in water to produce a strongly acidic solution.

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

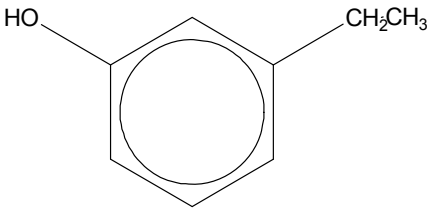
34. This question involves the reactions of compound **X**, an organic molecule.

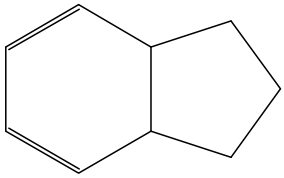
When compound **X** is added to aqueous Br_2, the solution decolourised.

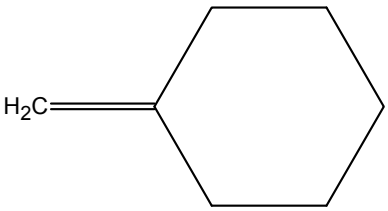
When compound **X** is heated under reflux with acidified $KMnO_4$, the solution decolourised and a gas that forms a white ppt with limewater is formed together with compound **Y**.

There is no visible changes when compound **Y** is added to 2,4-DNPH.

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

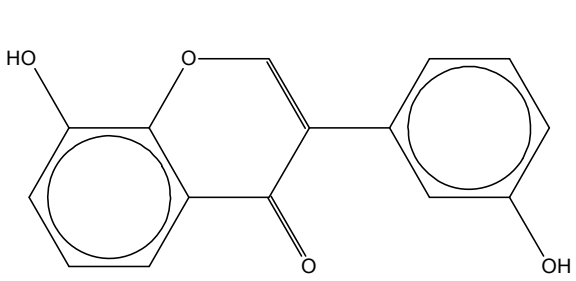
1 

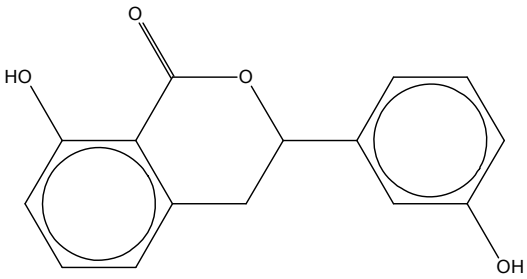
2 

3 

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

35. What of the following reagents can be used to distinguish between the following compounds under suitable conditions?





1 2,4-DNPH

2 Acidified $KMnO_4$

3 Aqueous bromine

36. The table shows experimental results obtained for the following reaction.

$2XO(g) + O_2(g) \rightarrow 2XO_2(g)$

Partial pressure of XO (in arbitrary units)	100	100	50	50
Partial pressure of O_2 (in arbitrary units)	100	25	100	–
Relative rate	1.0	0.25	0.50	0.125

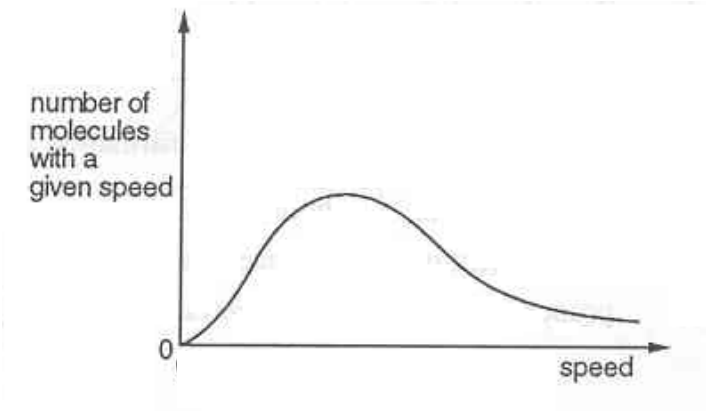
1 The missing O_2 value in the table is 25.

2 Overall order for the reaction is 2.

3 The units for rate constant of the rate equation is s^{-1}.

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

37. The graph shows the Boltzmann distribution of molecular speeds.



Which of the following statements is/are correct?

1 Raising the temperature always decreases the number of molecules with a given speed.

2 The areas under the curve is proportional to the number of molecules Present.

3 Raising the temperature moves the maximum of the curve to the right.

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

The AgC*l* / Ag reference electrode is based on the following reaction:

$$AgCl + e^- \rightleftharpoons Ag + Cl^-$$

The reduction potential of the Fe^{2+} / Fe half cell was found to be –0.64 V when measured using the AgC*l* / Ag reference electrode.

Which of the following statement(s) is/are true?

1 Reduction potential of AgC*l* / Ag electrode with respect to the standard hydrogen electrode equals to +0.20 V

2 The reduction potential of Fe^{3+} / Fe^{2+} half cell will be +0.57 V when measured against the AgC*l* / Ag reference electrode.

3 Fe^{2+} is a weaker oxidising agent compared to AgC*l*.

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

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

Which of the following reactants will be expected to undergo a redox reaction when mixed?

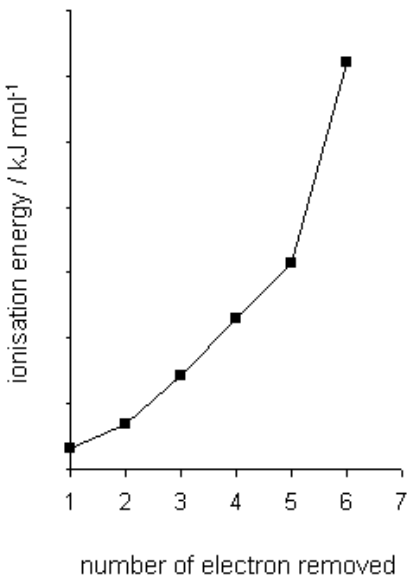
1 Acidified $KMnO_4$ and $VO^{2+}(aq)$

2 Acidified $H_2O_2(l)$ and Zn^{2+}

3 Acidified $K_2Cr_2O_7$ and $Co^{3+}(aq)$

40. An element **X** in Period 4 is an electrical conductor at room temperature.

The graph on the right shows the ionisation energies for the first six electrons in an atom of an element **X**.



Which of the following statements are correct?

1 **X** is a Group V element.

2 **X** can form coloured **X**Cl_3 and **X**Cl_5.

3 X^+ ion has four unpaired electrons.