



CHEMISTRY

9647/01

Paper 1 Multiple Choice

Thursday

18th September 2014

1 hour

Candidates answer on separate paper.

Additional materials: Multiple Choice Answer Sheet

Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, Civics Group and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

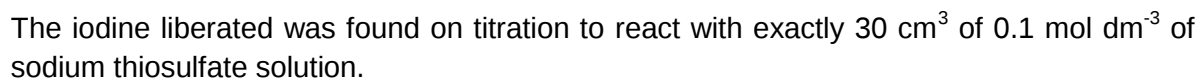
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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.

This document consists of **15** printed pages and **1** blank page

1 In an experiment, 10 cm³ of a solution containing a known concentration of iodate(V) ions, IO₃⁻, was run into an acidified solution containing an excess of iodide ions.



A 0.05

B 0.10

C 0.15

D 0.20

2 How will the volume of a 1.0 dm^3 sample of gas change when it is heated from 20°C to 80°C at constant pressure?

A Increase to about 4.0 dm^3

B Increase to about 1.2 dm^3

C Decrease to about 0.5 dm^3

D Decrease to about 0.2 dm^3

3 An element shows oxidation states of +4 and +6 in forming compounds with both fluorine and oxygen. What is the most likely outer electronic configuration for the element?

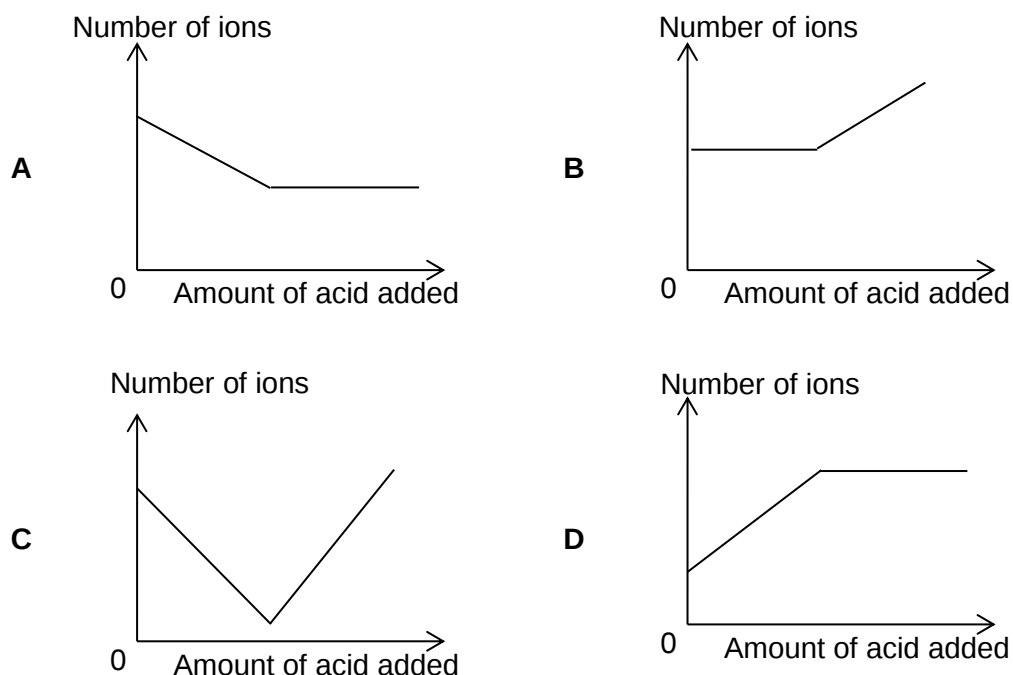
A $2s^2 2p^4$

B $2s^2 2p^6$

C $3s^2 3p^4$

D $3s^2 3p^6$

- 4 Dilute sulfuric acid was added to aqueous barium hydroxide until the acid was in excess. Which graph shows the variation in the total number of ions in solution?



- 5 Aqueous acidified potassium manganate(VII) is used to oxidise iron(II) ethanedioate, FeC_2O_4 , to Fe^{3+} and CO_2 .

What is the concentration in mol dm^{-3} of 25 cm^3 aqueous acidified potassium manganate(VII) required to completely oxidise 0.05 mole of FeC_2O_4 ?

- A** 0.4 **B** 0.8 **C** 1.2 **D** 3.33
- 6 In which set of species do the species all have the same shape?
- A** BCl_3 , NH_3 , PCl_3
- B** BeCl_2 , H_2O , SO_2
- C** CH_4 , NH_4^+ , SiF_4
- D** CO_2 , H_2O , SO_2
- 7 Given that the ΔH_f^θ of $\text{H}_2\text{O}(\text{l})$ is -285 kJ mol^{-1} and the ΔH_f^θ of $\text{CO}_2(\text{g})$ is -394 kJ mol^{-1} , what is the ratio of the heat generated by hydrogen gas to that of carbon if the same mass of each substance is burned?
- A** 1:5 **B** 7:5
- C** 13:3 **D** 43:5

- When iodine sublimates, 62.4 kJ mol^{-1} of heat enthalpy is required.
- What is the entropy change when 508 g of iodine sublimates at 80°C ?

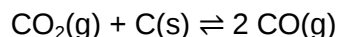
A $+177 \text{ J K}^{-1}$

B $+356 \text{ J K}^{-1}$

C $+707 \text{ J K}^{-1}$

D $+1560 \text{ J K}^{-1}$

- 9** An evacuated vessel containing a small amount of powdered graphite is heated to 1080 K, and then CO_2 is added at a pressure of 0.458 atm. CO_2 reacts with graphite according to the following equation:



After equilibrium has been reached, the total pressure inside the vessel is 0.757 atm. Calculate the equilibrium constant, K_p .

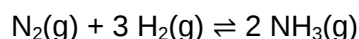
A 0.25

B 2.25

C 3.76

D 14.1

- 10** Haber process involves the formation of ammonia gas from nitrogen and hydrogen gases.



The value of equilibrium constant, K_p , is 3.56×10^{-7} at 1000 K.

Which of the following statements is true?

- A** Equilibrium constant increases when pressure is increased by reducing the volume.
- B** Equilibrium constant increases when temperature of the system is increased.
- C** Partial pressure of NH_3 increases when temperature of the system is increased.
- D** Number of moles of NH_3 decreases when an inert gas is added at constant pressure.

- 11** Chlorophenol red is an acid–base indicator with a pH range of 4.8 to 6.4. The acidic colour of the indicator is yellow and the alkaline colour is red.

Two drops of the indicator are added to each of the four aqueous solutions listed below.

Which solution has its colour correctly stated?

- | | | |
|----------|--|--------|
| A | Aqueous solution of MgCl_2 | yellow |
| B | Equal proportions of sodium ethanoate and ethanoic acid
[pK_a of ethanoic acid = 4.7] | orange |
| C | 0.1 mol dm^{-3} of CH_3COOH ($K_a = 1.8 \times 10^{-5} \text{ mol dm}^{-3}$) | orange |
| D | Aluminium oxide in aqueous solution | red |

- 12** The pH of pure water is 6.85 at 35 °C. The pH of a saturated solution of a Group III hydroxide is 11.30 at the same temperature.

What is the numerical value of the solubility product of this hydroxide at 35 °C?

- A** 7.9×10^{-12} **B** 4.0×10^{-12}
C 8.4×10^{-11} **D** 3.6×10^{-11}

- 13** For the reaction $2\text{X}(\text{aq}) + \text{Y}(\text{aq}) \longrightarrow \text{Z}(\text{aq})$ at room temperature, the rate equation is

$$\text{Rate} = k [\text{H}^+][\text{X}]^2$$

Which of the following statements is **not** correct?

- A** H^+ is a catalyst in the reaction.
- B** The reaction involves the formation of an intermediate.
- C** When the concentration of Y is halved at 15°C , the rate decreases.
- D** If the concentrations of H^+ and X are doubled, the rate increases by six times.

- 14** When 0.10 mol of chloride of Period 3 element **A** is reacted with limited amount of water, white fumes are observed. Upon dissolving the white fumes in water, the resultant solution is found to react with 0.20 mol of aqueous sodium hydroxide.

To which Group of the Periodic Table does **A** belong?

- A** II **B** III **C** IV **D** V

- 15** A cobalt(III) compound has the formula of $\text{Co}(\text{H}_2\text{O})_6\text{Cl}_3$.

1 mole of this compound forms 2 moles of silver chloride precipitate when aqueous silver nitrate is added. What is the identity of this compound?

- A** $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$
B $[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$
C $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$
D $[\text{Co}(\text{H}_2\text{O})_3\text{Cl}_3] \cdot 3\text{H}_2\text{O}$

- 16** Some complex ions show geometric isomerism, and have cis- and trans- forms, similar to alkenes. Which of the following species is likely to display cis-trans isomerism?

	Complex ion	Shape
A	$[\text{Ag}(\text{NH}_3)_2]^+$	linear
B	$[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$	square planar
C	$[\text{Zn}(\text{NH}_3)_2\text{Cl}_2]$	tetrahedral
D	$[\text{Fe}(\text{H}_2\text{O})_5\text{SCN}]^{2+}$	octahedral

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

Excess zinc was added to acidified potassium dichromate(VI) solution in a conical flask. Effervescence was observed until all the zinc had been fully reacted. The resulting solution was then left to stand for a long time. What is the final colour of the resulting solution?

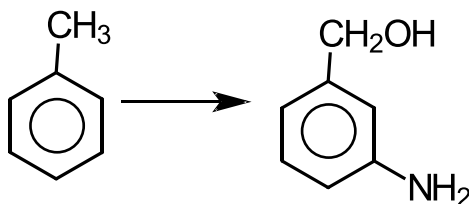
- A** Orange **B** Yellow
C Green **D** Sky-blue

- 18** When a mixture of a white solids, **X**, is treated with an excess dilute hydrochloric acid, a colourless acidic gas is evolved and a white precipitate is obtained.

Which mixture could be **X**?

- A** $\text{Ba}(\text{NO}_3)_2$ and MgCO_3
- B** BaSO_3 and CaCO_3
- C** $\text{Ca}(\text{NO}_2)_2$ and $\text{Pb}(\text{OH})_2$
- D** $\text{Pb}(\text{NO}_3)_2$ and MgSO_3

- 19 (3-Amino-phenyl)methanol can be produced from methylbenzene in four steps.



Which is the best method for this synthesis?

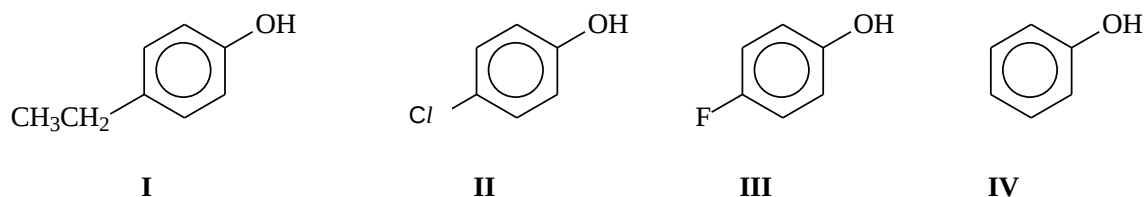
	Step 1	Step 2	Step 3	Step 4
A	Concentrated HNO ₃ , Concentrated H ₂ SO ₄ , heat	Dilute H ₂ SO ₄ , KMnO ₄ , heat	Concentrated HCl, Sn, heat	H ₂ with Pt catalyst, room temp
B	Concentrated HNO ₃ , Concentrated H ₂ SO ₄ , heat	Concentrated HCl, Sn, heat	Dilute H ₂ SO ₄ , KMnO ₄ , heat	LiAlH ₄ , in dry ether, room temperature
C	Dilute H ₂ SO ₄ , KMnO ₄ , heat	Concentrated HNO ₃ , Concentrated H ₂ SO ₄ , heat	Concentrated HCl, Sn, heat	H ₂ (g) with Pt catalyst, room temp
D	Dilute H ₂ SO ₄ , KMnO ₄ , heat	Concentrated HNO ₃ , Concentrated H ₂ SO ₄ , heat	Concentrated HCl, Sn, heat	LiAlH ₄ , in dry ether, room temperature

- 20 An organic compound **X** reacts with sodium to produce an organic ion with a charge of -3 . **X** reacts with cold NaOH(aq) to produce an organic ion with a charge of -1 .

What could be the structural formula of **X**?

- A** HCO₂CH(OH)CH₂CO₂H
B HO₂CCH(OH)CH₂CHO
C HOCH₂CH(OH)CH₂CO₂H
D HOCH₂COCH₂CHO

21 Which sequence shows the compounds in **decreasing** order of acidity?



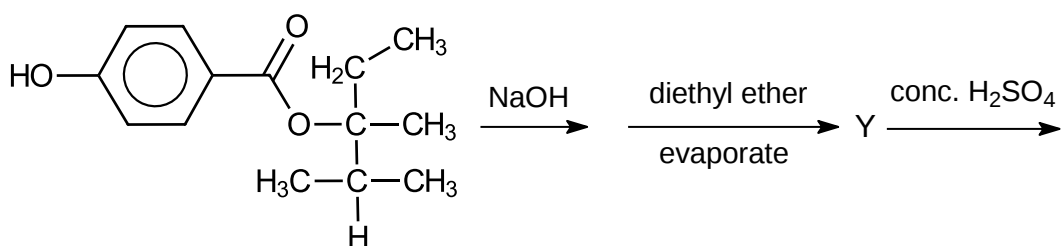
- A** I, IV, II, III **B** II, III, IV, I
C III, II, I, IV **D** III, II, IV, I

22 In the 2-step synthesis to convert propan-1-ol to 2-chloropropane, which of the following pairs of reaction is involved?

- A** Elimination , Nucleophilic substitution
- B** Elimination , Electrophilic addition
- C** Free radical substitution, Reduction
- D** Free radical substitution, Nucleophilic addition

23 The following ester was hydrolysed by boiling with aqueous sodium hydroxide, and the resulting organic products were shaken with diethyl ether (an organic solvent) in a separating funnel. After allowing the mixture to stand, the organic layer was separated. The diethyl ether was then evaporated to leave a residual liquid, **Y**.

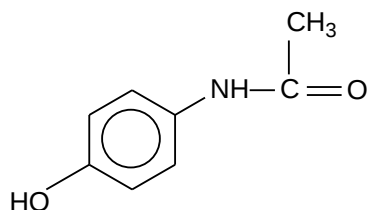
Y was subjected to a reaction using excess concentrated H_2SO_4 at $180\text{ }^\circ\text{C}$ and a final product mixture was obtained.



What is the number of isomers present in the final mixture?

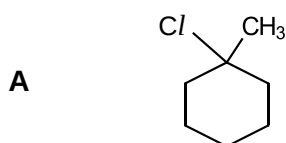
- | | |
|----------|---|
| A | 1 |
| B | 2 |
| C | 3 |
| D | 4 |

- 24 Paracetamol is used to relief headaches and fever, the structure of which is shown below.



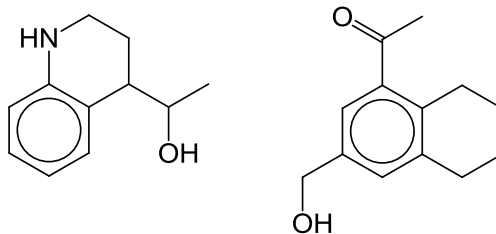
Which of the following statements about Paracetamol is **not** correct?

- A It reacts with hot, aqueous sodium hydroxide to give sodium ethanoate.
- B There is a yellow precipitate observed on adding aqueous, alkaline iodine.
- C An aqueous solution of Paracetamol is acidic.
- D On adding sodium metal, a colourless gas evolved extinguished a lighted splinter with a “pop” sound.
- 25 Which of the following compounds, when warmed separately with ethanolic AgNO_3 , would not give a precipitate?



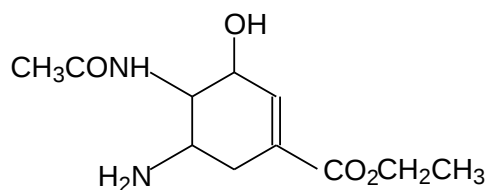
- B $\text{CH}_3\text{C}(\text{Cl})=\text{CH}_2$
- C $\text{ClCH}_2\text{CH}=\text{CH}_2$
- D $\text{C}(\text{CH}_3)_3\text{CH}=\text{CHCH}_2\text{Cl}$

- 26 Which of the following reagents and conditions can be used to distinguish between the two compounds below?



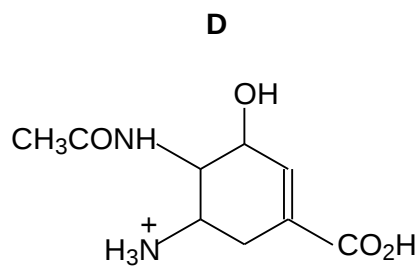
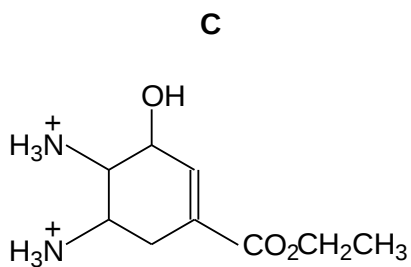
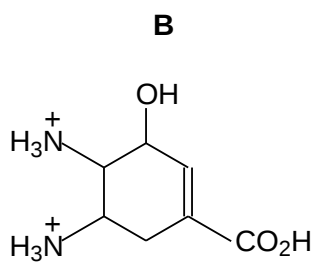
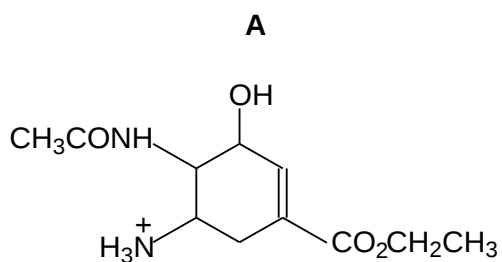
- A PCl_5 , solid
- B Acidified $\text{K}_2\text{Cr}_2\text{O}_7$, heat
- C Aqueous bromine
- D Fehling's solution, warm

- 27 Compound **W** is a newly discovered anti-viral drug.

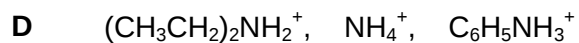
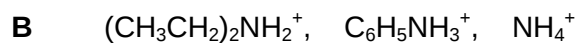
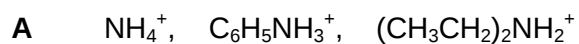


W

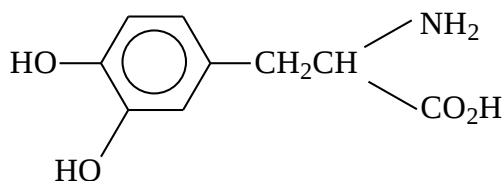
What is the product when compound **W** is heated with HCl(aq) ?



- 28 Which one of the following shows the given ions arranged in order of increasing pK_a values?



- 29 *Dopamine* is a drug used in the treatment of Parkinson's disease.



Dopamine

Which of the following statements about *dopamine* is **not** correct?

- A It can exist in optically active forms.
- B One mole of *dopamine* can react with two moles of sodium hydroxide to form a salt
- C It migrates to the anode of an electrolytic cell at pH 12.
- D Its aqueous solution is acidic.
- 30 In the study of the polypeptide structure of **Y**, it was digested using two different enzymes. The fragments obtained were separated using electrophoresis. Analysis of the fragments from each digestion gave the following results:

Digestion using the first enzyme

gly-pro-val

ser-pro-gly

asp-gly

thr-phe-leu

Digestion using the second enzyme

val-asp-gly-thr

pro-gly

phe-leu-ser

gly-pro

What is the correct sequence of the polypeptide structure of **Y**?

- A pro-gly-pro-val-asp-gly-thr-phe-leu-ser-pro-gly
- B gly-pro-val-ser-pro-gly-asp-gly-thr-phe-leu
- C gly-pro-val-asp-gly-thr-phe-leu-ser-pro-gly
- D ser-pro-gly-pro-val-asp-gly-thr-phe-leu-ser

Section B

For each of the questions in this section, one or more of the 3 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.

31 Which of the following statements about the nitrate(V) ion, NO_3^- , are correct?

- 1** It has the same bond angle as nitrogen trifluoride, NF_3 .
- 2** The hybridisation of the nitrogen atom is sp^2 .
- 3** The nitrogen in NO_3^- has an octet electronic configuration.

32 Which of the equations correctly define the standard enthalpy change of formation of a compound?

- 1** $2\text{C(s)} + 3\text{H}_2\text{(g)} + \frac{1}{2}\text{O}_2\text{(g)} \longrightarrow \text{C}_2\text{H}_5\text{OH(l)}$
- 2** $2\text{H}_2\text{(g)} + \text{O}_2\text{(g)} \longrightarrow 2\text{H}_2\text{O(l)}$
- 3** $\text{Na(s)} + \text{Cl(g)} \longrightarrow \text{NaCl(s)}$

33 Which of the following solutions are able to maintain a fairly constant pH when a small amount of acid is added to it?

- 1** 20 cm^3 of $0.2\text{ mol dm}^{-3}\text{ CH}_3\text{CO}_2\text{Na}$ with 30 cm^3 of $0.1\text{ mol dm}^{-3}\text{ HCl}$
- 2** 40 cm^3 of $0.1\text{ mol dm}^{-3}\text{ HCl}$ is added to 20 cm^3 of $0.3\text{ mol dm}^{-3}\text{ CH}_3\text{NH}_2$
- 3** 0.25 mol KHCO_3 with $0.30\text{ mol K}_2\text{CO}_3$

34 Which of the following factors would always affect the rate of a reaction?

- 1** concentration of reactants
- 2** temperature
- 3** catalyst

- 35** Elements **X**, **Y** and **Z** are from the same period. Element **X** has the highest melting point and smallest ionic radius among the 3 elements. The chloride and oxide of element **Y** has the highest pH compared to the chlorides and oxides of elements **X** and **Z**.

Which of the following can be the correct identities of elements **X**, **Y** and **Z**?

	X	Y	Z
1	Al	Na	Mg
2	Mg	Na	P
3	Mg	Al	P

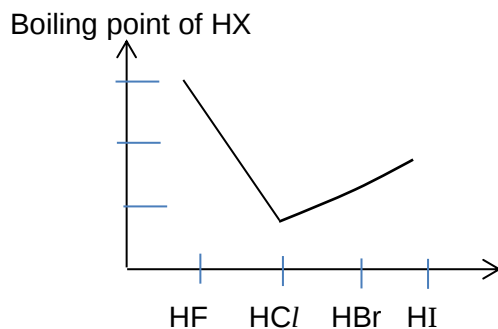
- 36** *Use of the Data Booklet is relevant to this question.*

An Ag^+/Ag half-cell is connected to a Cu^{2+}/Cu half-cell, with the circuit completed by a salt bridge. Which of the following statements are true?

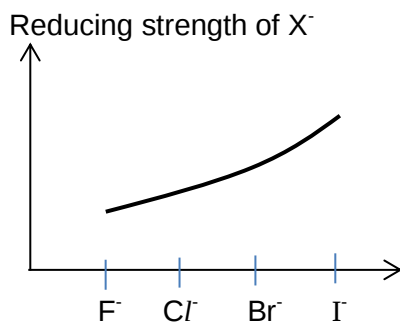
- 1** The standard cell potential is +0.46 V.
- 2** Dissolving solid sodium hydroxide in the copper half-cell will make the cell potential more positive.
- 3** Dissolving solid sodium hydroxide in the silver half-cell will make the cell potential less positive.

37 Which of the following graphs correctly describe a trend found in the halogen group?

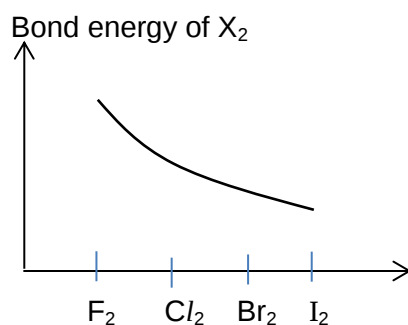
1



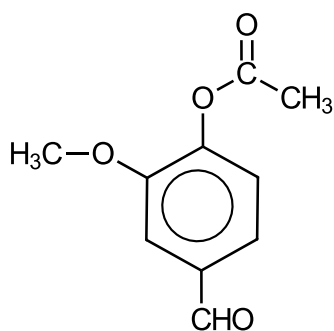
2



3



38 Vanillin ethanoate is a flavouring material which is present in fermented soya hydrolysate (shoyu).

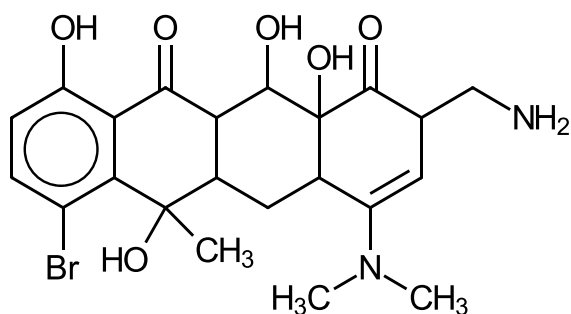


Vanillin ethanoate

Which of the following statements about vanillin ethanoate are correct?

- 1 Vanillin ethanoate turns hot acidified potassium dichromate(VI) from orange to green.
- 2 Vanillin ethanoate forms a yellow precipitate with aqueous alkaline iodine.
- 3 Vanillin ethanoate gives a red precipitate with Fehling's solution.

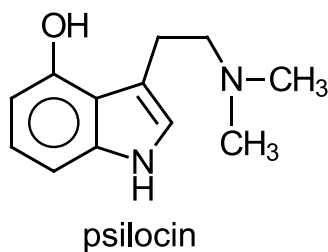
- 39** Compound **D** which is a structural isomer of the antibiotic Aureomycin is shown below.



Compound D

Which of the following statements are true for the above compound **D**?

- 1 There are 7 chiral carbon atoms in compound **D**.
 - 2 1 mole of compound **D** reacts with 3 moles of hydrogen gas in the presence of Ni catalyst at 140°C.
 - 3 1 mole of compound **D** reacts with excess Na to produce 2 moles of hydrogen gas, in the presence of excess Na metal.
- 40 *Psilocin* is the active compound found in “magic mushroom”. It is only mildly hallucinogenic causing slight alteration of perception and distortion of the senses together with feelings of exhilaration.



Which of the following statements are true about *psilocin*?

- 1 It gives white fumes with CH_3COCl .
- 2 It dissolves in both aqueous acid and alkali.
- 3 The nitrogen-containing group in the ring has a lower $\text{p}K_{\text{b}}$ than the nitrogen-containing group in the side chain.

2014 H2 Chemistry Preliminary Exam MCQ Solution

1	2	3	4	5	6	7	8	9	10
A	B	C	C	C	C	C	B	B	D
11	12	13	14	15	16	17	18	19	20
D	C	D	D	B	B	C	D	D	C
21	22	23	24	25	26	27	28	29	30
D	B	D	B	B	C	B	C	B	C
31	32	33	34	35	36	37	38	39	40
C	D	A	C	B	A	B	D	A	B