Calculator Model / No.

Name _____ Class: _____ Reg Number: _____

MERIDIAN JUNIOR COLLEGE
JC2 Preliminary Examination
Higher 2

Chemistry 9647/1

Paper 1 Multiple Choice **20 September 2012**

1 hour

Additional Materials: *OMR Sheet*
Data Booklet

INSTRUCTIONS TO CANDIDATES

Write your name, class and register number in the spaces provided at the top of this page.
Write your calculator brand and model/number in the box provided above.

There are **forty** questions in this section. Answer **all** questions. For each question, there are four possible answers labelled **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the OMR answer sheet.

Read very carefully the instructions on the use of the OMR answer sheet.

You are advised to fill in the OMR Answer Sheet as you go along; no additional time will be given for the transfer of answers once the examination has ended

Use of OMR Answer Sheet

Ensure you have written your name, class register number and class on the OMR Answer Sheet.

Use a **2B** pencil to shade your answers on the OMR sheet; erase any mistakes cleanly. Multiple shaded answers to a question will not be accepted.

For shading of class register number on the ***OMR sheet***, please follow the given examples:
If your register number is **1**, then shade **01** in the index number column.
If your register number is **21**, then shade **21** in the index number column.

This document consists of **19** printed pages and **1** blank page.

Section A

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

1 Which of the following statements contains one mole of the stated particle?

A Molecules in 19.0 g of fluorine gas.

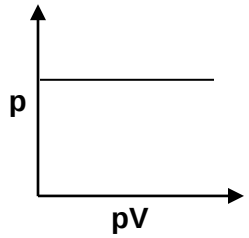
B Electrons in 24.0 dm^3 of hydrogen gas at room temperature and pressure.

C Neutrons in 1.00 g of helium gas.

D Protons in 2.02 g of neon gas.

2 Which of the following diagrams correctly describes the behaviour of a fixed mass of an ideal gas at constant **T**?

A



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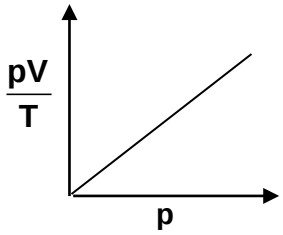

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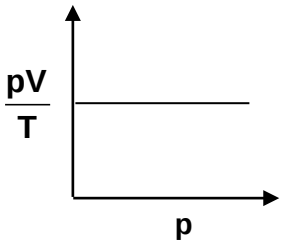

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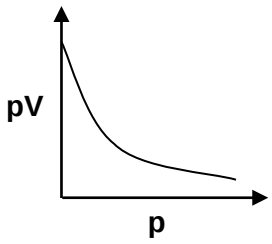


3 Two elements **X** and **Y** have the following properties.

- **X** and **Y** form ionic compounds Na_2**X** and Na_2**Y** respectively.
- Element **Y** forms **Y**F_6 molecule whereas **X** is unable to do so.

Which pair of electronic configurations of **X** and **Y** is correct?

	X	**Y**
A	$[He]2s^2 2p^2$	$[Ne]3s^2 3p^2$
B	$[He]2s^2 2p^2$	$[Ne]3s^2 3p^4$
C	$[He]2s^2 2p^4$	$[Ne]3s^2 3p^2$
D	$[He]2s^2 2p^4$	$[Ne]3s^2 3p^4$

4 Ions of the two most common isotopes of zinc are shown below:

$^{64}_{30}Zn^{2+}$ $^{66}_{30}Zn^{2+}$

Which of the following statements is correct?

A Both these Zn^{2+} ions have the same number of electrons but different number of protons.

B Both these Zn^{2+} ions have the same electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$.

C The $^{64}_{30}Zn^{2+}$ ion has fewer neutrons in its nucleus than the $^{66}_{30}Zn^{2+}$ ion.

D The $^{66}_{30}Zn^{2+}$ ion will be deflected more than the $^{64}_{30}Zn^{2+}$ ion in an electric field of the same strength.

5 For the pairs of species shown below, in which does the first species have a larger bond angle than the second?

A PH_3, NH_3

B CH_2Cl_2, OCl_2

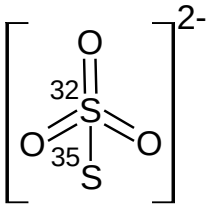
C SO_3^{2-}, CO_3^{2-}

D BrF_2^-, $BeCl_2$

6 In an experiment, a radioactive sample of the sodium thiosulfate, $Na_2S_2O_3$ was prepared by boiling solid sulfur containing ^{35}S with sodium sulfite, $Na_2{}^{32}SO_3$. Adding HC*l* (aq) to this sample causes all the ^{35}S to precipitate as sulphur, leaving a resulting solution that contains non-radioactive sulfite ions.

Which of the following depicts the correct displayed formula of the thiosulfate ion produced?

A



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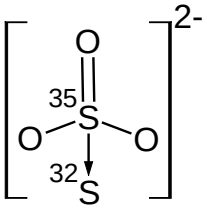

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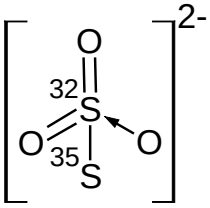

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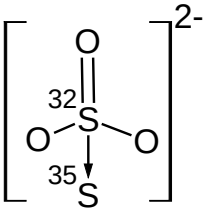


7 An experiment is conducted to investigate the kinetics of reaction between bromopropane and 0.1 mol dm^{-3} sodium hydroxide.

The rate equation is as follows:

$$\text{Rate} = k\,[\text{bromopropane}]\,[OH^-]$$

The half-life of bromopropane in one of the experiments is *t* minutes.

What is the new half-life (in minutes) of bromopropane when the concentration of bromopropane is doubled and concentration of sodium hydroxide is reduced to 0.01 mol dm^{-3}?

A 0.05*t*

B 0.1*t*

C 5*t*

D 10*t*

8 Consider the following equilibrium system:

$$H_2\,(g) + I_2\,(g) \rightleftharpoons 2HI\,(g) \qquad \Delta H = +53\ kJ\ mol^{-1}$$

Which of the following change is **incorrect**?

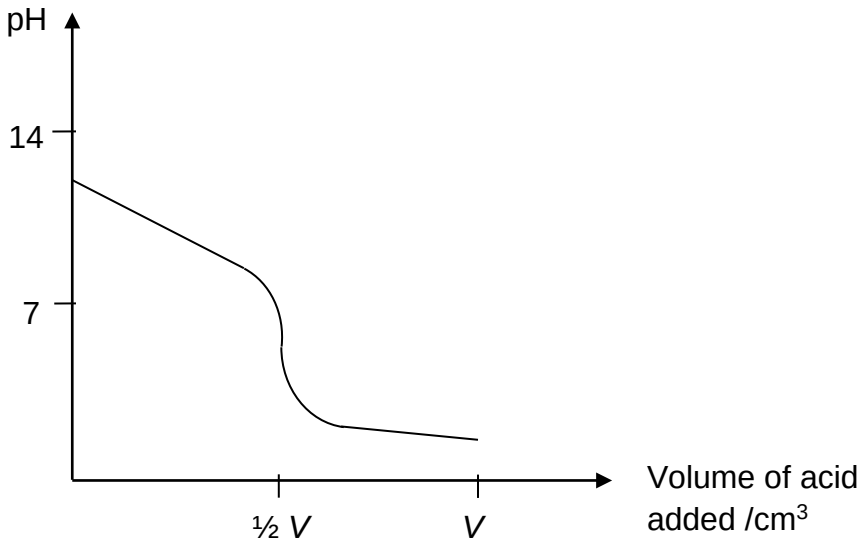
A Numerical value of K_p is not equal to K_c at 25 °C.

B Increasing the mass of H_2 will not cause the equilibrium constant to increase.

C Increasing temperature increases the rate constant and equilibrium constant.

D Rate of forward reaction is equal to rate of backward reaction when equilibrium is reached.

9 The graph shows the change in pH when 0.25 mol dm^{-3} acid is gradually added to V cm^3 of 0.25 mol dm^{-3} base.



Which pair of solutions will give the result as shown in the graph?

A HNO_3 and NH_3

B H_2SO_4 and CH_3NH_2

C CH_3COOH and $Ca(OH)_2$

D $CH_2(COOH)_2$ and NaOH

10 The solubility product of iron(II) carbonate is 2.1×10^{-11} while that of silver carbonate is 8.1×10^{-12} at 25°C.

Which of the following statements is true?

A Addition of silver nitrate increases the solubility of silver carbonate.

B Addition of sulfuric acid to a solution containing iron(II) carbonate increases the solubility product of iron(II) carbonate.

C Iron(II) carbonate precipitates first when sodium carbonate is added to a solution containing equal concentrations of iron(II) and silver ions.

D The solubility of iron(II) carbonate is higher than the solubility of silver carbonate.

11 Liquid **E** has an ΔH^{θ} of vapourisation of +10.0 kJ mol^{-1} and a boiling point of 266 K.

What is the ΔS^{θ} of condensation of vapour **E**?

A –26.6 J mol^{-1} K^{-1}

B –37.6 J mol^{-1} K^{-1}

C +26.6 J mol^{-1} K^{-1}

D +37.6 J mol^{-1} K^{-1}

12 Which of the following has an exothermic enthalpy change?

A $Ca\,(g) \rightarrow Ca^{2+}\,(g) + 2e$

B $CaO\,(s) \rightarrow Ca^{2+}\,(g) + O^{2-}\,(g)$

C $\frac{1}{2}O_2\,(g) \rightarrow O\,(g)$

D $O\,(g) + e \rightarrow O^{-}\,(g)$

13 When a solution of concentrated sodium carboxylate is electrolysed, the equation for the reaction is

$$2RCO_2Na\ (aq) + 2H_2O\ (l) \longrightarrow R\text{–}R\ (l) + 2CO_2\ (g) + 2NaOH\ (aq) + H_2\ (g)$$

Which statement regarding the electrolysis is correct?

A Carbon dioxide is liberated at the cathode.

B Hydrogen is liberated at the cathode.

C R–R is liberated at the cathode.

D The solution around the anode turns red litmus blue.

14 When a large current was passed through acidified aqueous copper(II) sulfate, there was simultaneous liberation, at the cathode, of x mol of copper and y dm^3 of hydrogen (measured at s.t.p.).

How many moles of electrons passed through the solution?

A $x + \frac{y}{11.2}$ **C** $2x + \frac{y}{11.2}$

B $x + \frac{y}{22.4}$ **D** $2x + \frac{y}{22.4}$

15 Two cells, one containing a molten chloride of manganese and the other containing molten chromium(II) chloride were connected in series. 11.0 g of manganese and 15.6 g of chromium were deposited.

What is the oxidation state of manganese ion in the chloride?

A +2 **B** +3 **C** +4 **D** +5

16 Element **G** is in the third period of the Periodic Table. The chloride of **G** has a simple molecular structure while the oxide of **G** has a giant ionic structure.

Which of the following statements is true about **G**?

A The atomic radius of **G** is smaller than that of C*l*.

B The first ionisation energy of **G** is higher than that of Mg.

C The chloride of **G** dissolves in water to give a neutral solution.

D The oxide of **G** reacts with excess aqueous sodium hydroxide to form a colourless complex.

17 **J**, **K** and **L** are elements in Period 3. **K** has a larger ionic radius than **J**, and **L** has a less endothermic first ionisation energy than **K**.

What are elements **J**, **K** and **L**?

	J	**K**	**L**
A	P	S	C*l*
B	P	A*l*	Mg
C	A*l*	Mg	Si
D	A*l*	P	S

18 Beryllium is a Group II metal and has the smallest ionic radius among the Group II metals.

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

A Beryllium chloride has the highest melting point among the Group II chlorides.

B Beryllium ions have the highest charge density amongst the Group II metals ions.

C Beryllium has the highest melting point among the Group II metals.

D Beryllium has the highest electronegativity among the Group II metals.

19 Which of the following statements is most likely to be true for astatine, the element below iodine in Group VII of the Periodic Table?

A Astatine reacts with aqueous iron(II) ions to give iron(III) ions.

B Astatine reacts with aqueous sodium bromide to given aqueous sodium astatide and bromine.

C Hydrogen iodide is more acidic than hydrogen astatide.

D Silver astatide has a lower K_{sp} value than silver iodide.

20 Which process is **not** involved in the catalytic hydrogenation of ethene?

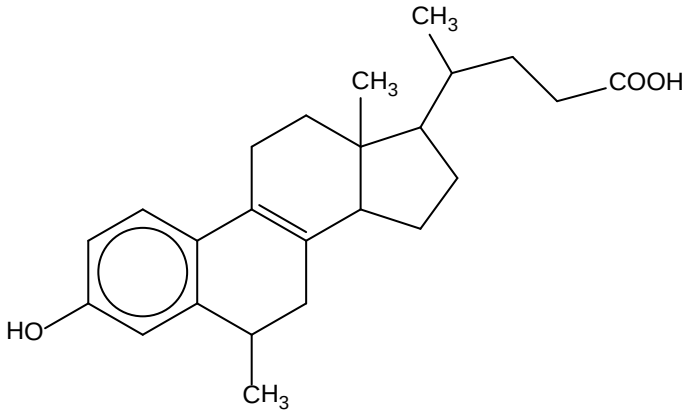
A Absorption

B Activation

C Desorption

D Diffusion

21 How many stereoisomers does this organic molecule have?



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

22 2-methylpropane can react with bromine in the presence of sunlight to give two monosubstituted halogenoalkanes, 1-bromo-2-methylpropane and 2-bromo-2-methylpropane.

Given the relative rates of abstracting H atoms are:

Type of H atom	primary	secondary	tertiary
Relative rate of abstraction	1	4	6

What is the expected ratio of 1-bromo-2-methylpropane to 2-bromo-2-methylpropane formed?

A 9 : 1

B 3 : 2

C 6 : 1

D 1 : 1

23 Why does hydrogen cyanide undergo addition reaction with propanone but not with propene?

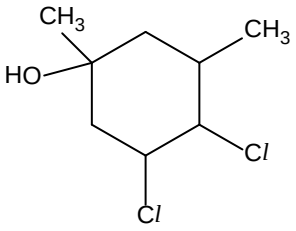
A Propanone is more susceptible to CN^- attack than propene.

B Propene is less susceptible to H^+ attack than propanone.

C The addition product formed with propene would not be stable.

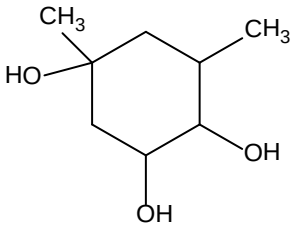
D The two methyl groups in propanone exert a stronger electron-donating effect than the single methyl group in propene.

24 The following compound was heated with ethanolic sodium hydroxide.



Which of the following represents the structure of the organic product?

A



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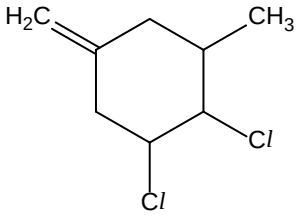
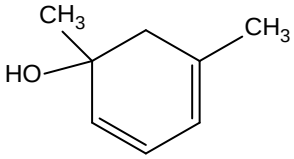
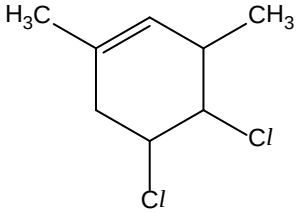


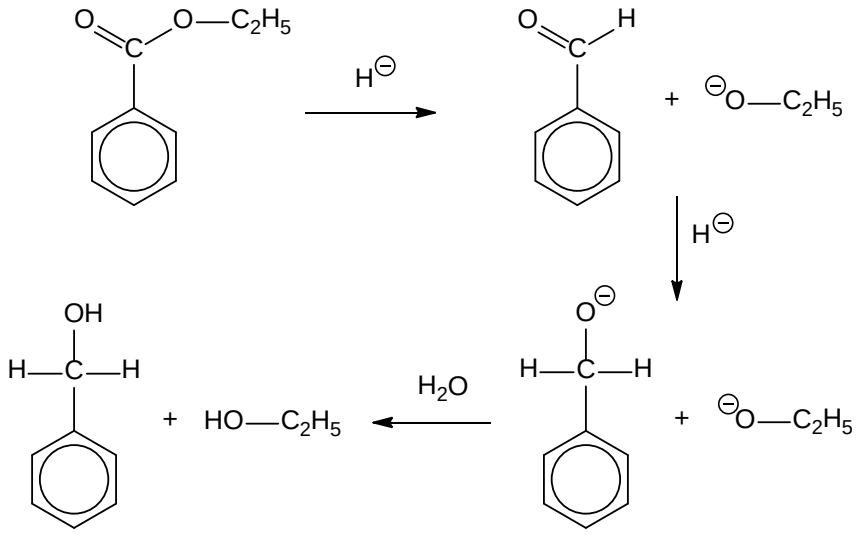
B



D



25 Esters can be converted to alcohols using lithium aluminium hydride followed by the addition of water.



Which of the following reaction does **not** occur in this process?

A Hydrolysis

B Hydrogenation

C Nucleophilic addition

D Nucleophilic substitution

26 When organic compounds **P**, **Q**, **R** and **S** are added separately to water, solutions of increasing pH values are obtained. The possible identities of the compounds **P** to **S** (not necessarily in that order) are given.

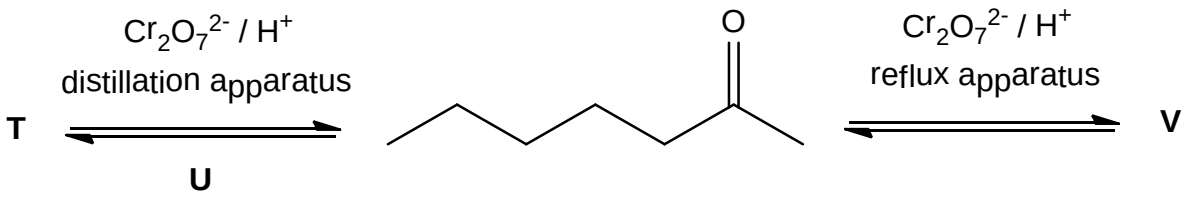
CH_3CH_2COOH CH_3CH_2COCl $(CH_3)_2CHNH_2$ $H_2NCH_2CH_2COOH$

Which is the correct set of identities of compounds **P** to **S**?

	P	**Q**	**R**	**S**
A	CH_3CH_2COCl	CH_3CH_2COOH	$H_2NCH_2CH_2COOH$	$(CH_3)_2CHNH_2$
B	CH_3CH_2COCl	CH_3CH_2COOH	$(CH_3)_2CHNH_2$	$H_2NCH_2CH_2COOH$
C	CH_3CH_2COOH	CH_3CH_2COCl	$H_2NCH_2CH_2COOH$	$(CH_3)_2CHNH_2$
D	CH_3CH_2COOH	CH_3CH_2COCl	$(CH_3)_2CHNH_2$	$H_2NCH_2CH_2COOH$

27 One of the chemicals giving blue cheese its unique aroma is heptan-2-one.

The diagram shows reactions involving heptan-2-one.



Which is the correct identification of compound **T**, reagent **U** and compound **V**?

	compound **T**	reagent **U**	compound **V**
A	heptane	$NaBH_4$	heptanoic acid
B	heptan-2-ol	$NaBH_4$	heptanoic acid
C	heptanal	hydrogen gas	heptan-2-one
D	heptan-2-ol	$LiAlH_4$ in dry ether	heptan-2-one

28 The compound $C_4H_6O_2$ gives butter its distinctive flavour.

It reacts with hydrogen cyanide to form $C_6H_8N_2O_2$ but does not form a silver mirror with ammoniacal silver nitrate.

What is the structural formula of this compound in butter?

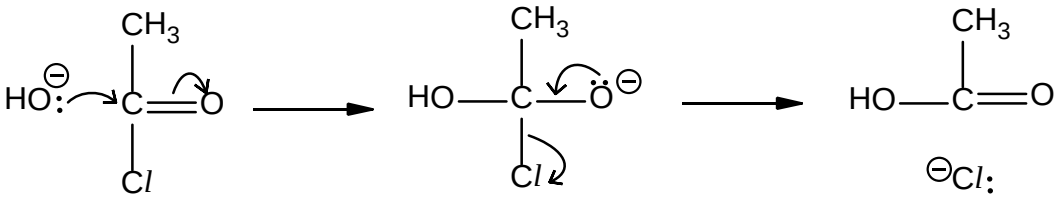
A CH_3COCH_2CHO

B $CH_3COCOCH_3$

C $CH_3COCH{=}CHOH$

D $CH_2{=}CHCOCH_2OH$

29 The two-stage reaction sequence given shows a possible mechanism for the reaction between hydroxide and ethanoyl chloride.



In what way should the *overall* reaction be classified?

A Electrophilic addition

B Nucleophilic addition

C Electrophilic substitution

D Nucleophilic substitution

30 After the reduction of nitrobenzene to phenylamine, using tin and concentrated hydrochloric acid, an excess of sodium hydroxide is added.

What is the purpose of the sodium hydroxide?

A to dry the product

B to liberate phenylamine

C to lower the boiling point for subsequent distillation

D to precipitate tin(II) hydroxide

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.

31 In which sequences are the molecules quoted in order of decreasing boiling points?

1 $CH_3(CH_2)_3CH_3$, $(CH_3)_2CHCH_2CH_3$, $CH_3C(CH_3)_2CH_3$

2 A*l*Br_3, A*l*C*l*$_3$, A*l*F_3

3 SO_2, SiO_2, CO_2

32 Beryllium difluoride reacts readily with trimethylamine, $(CH_3)_3N$ to form a stable addition product. Nitrogen trifluoride has no reaction with trimethylamine.

Which of the following statements are true?

1 Nitrogen trifluoride does not react as the nitrogen atom lacks energetically accessible orbitals for reaction.

2 The bond angle in the addition product is 109.5^o.

3 The molar ratio for the reaction between beryllium difluoride and $(CH_3)_3N$ is 1:1.

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

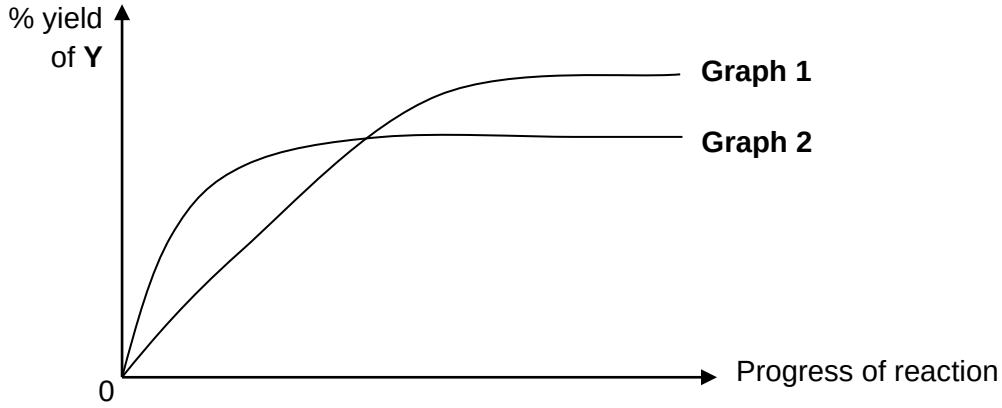
A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

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

33 The graph for the equilibrium,

$$\mathbf{W}\,(g) + \mathbf{X}\,(g) \rightleftharpoons 3\mathbf{Y}\,(g) \qquad \Delta H < 0$$

is given below:



Which of the following changes could account for the change from **Graph 1** to **Graph 2**?

1 Addition of catalyst

2 Increase in temperature

3 Increase in pressure

34 A cell consisting of a V^{2+} (aq), V^{3+} (aq) | Pt (s) half-cell and a Au^{3+} (aq) | Au (s) half-cell is shown below using conventional notation.

$$Pt\,(s) \mid V^{2+}\,(aq), V^{3+}\,(aq) \,||\, Au^{3+}\,(aq) \mid Au\,(s) \qquad E^{q}_{cell} = +1.76\ V$$

Which of the following statements is true?

1 The mass of the Au electrode increase.

2 The negative electrode is the Pt electrode.

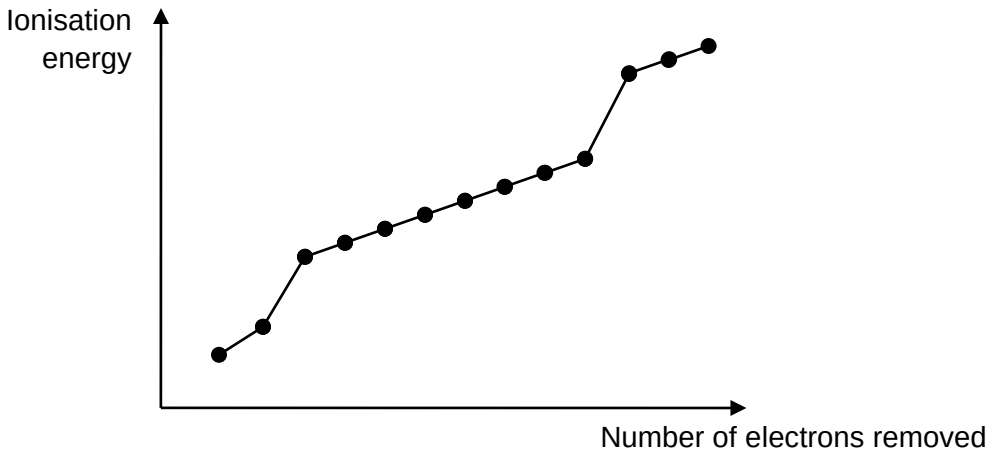
3 The standard electrode potential for Au^{3+} (aq) | Au (s) is +2.02 V.

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.

35 The graph shows the first thirteen ionisation energies for element **Z**.



What can be deduced about element **Z** from the graph?

1 An oxide of **Z** dissolves in water to form an alkaline solution.

2 A chloride of **Z** undergoes hydrolysis to form a solution of pH 3.

3 The element **Z** reacts with steam to form an oxide.

36 Which of the following statements are correct with respect to the trend of the thermal stability of hydrogen halides, HX?

1 The enthalpy change of atomisation of the halogens becomes more endothermic from chlorine to iodine.

2 The enthalpy change of formation of the hydrogen halides becomes less exothermic from hydrogen chloride to hydrogen iodide.

3 The bond energy of the H–X bond becomes less endothermic from hydrogen chloride to hydrogen iodide.

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.

37 Alkanes can be prepared from chloroalkanes by heating under reflux with sodium (in ether) according to the equation:

$$2RCl + 2Na \rightarrow R\text{–}R + 2NaCl$$

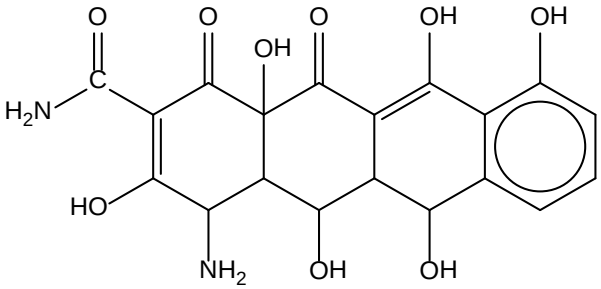
Which alkanes will be produced if a mixture containing equal amounts of CH_3CH_2Cl and $CH_3CHClCH_3$ are used?

1 $CH_3CH_2CH_2CH_3$

2 $CH_3CH_2CH(CH_3)_2$

3 $CH_3CH(CH_3)CH(CH_3)_2$

38 *Oxytetracycline* is a class of broad-spectrum antibiotics used to treat a variety of infections.



Which of the following statements about *oxytetracycline* is correct?

1 One mole of *oxytetracycline* reacts with three moles of thionyl chloride.

2 One mole of *oxytetracycline* reacts with two moles of hot sodium hydroxide to liberate one mole of ammonia gas.

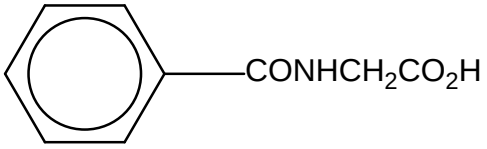
3 One mole of *oxytetracycline* reacts with six moles of ethanoyl chloride.

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.

39 Benzoylglycine (hippuric acid) was first isolated from stallions' urine.



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Which of the following reactions about hippuric acid are correct?

1 It can be made by reacting benzoyl chloride with aminoethanoic acid.

2 It can be made by reacting hot benzoic acid with aminoethanoic acid.

3 It can be hydrolysed with cold aqueous sodium hydroxide to produce an amino acid.

40 Amylase is an enzyme that converts complex carbohydrates into simple sugars.

Which conditions will inhibit the action of amylase?

1 High pH

2 Low temperatures

3 Presence of electrolytes

End of paper