



Catholic Junior College

JC 2 Preliminary Examinations

Higher 2

CANDIDATE
NAME

CLASS

CHEMISTRY

9729/01

Paper 1 Multiple Choice

Wednesday 29 August 2018

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and NRIC/FIN number on the Answer Sheet in the spaces provided.

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 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.

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

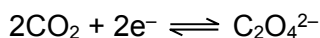
- 1 A sample of tungsten contains four naturally occurring isotopes, ^{182}W , ^{183}W , ^{184}W and ^{186}W .

The relative atomic mass of tungsten in this sample is 183.9. What is the percentage of the isotope ^{182}W in this sample?

Isotope	Relative Abundance (%)
^{182}W	?
^{183}W	?
^{184}W	30.6
^{186}W	28.6

- | | | | |
|----------|------|----------|------|
| A | 10.5 | C | 26.4 |
| B | 14.4 | D | 40.8 |
- 2** 20 cm³ of 0.100 mol dm⁻³ of potassium ferrate(VI), K₂FeO₄, reacts with sodium ethanedioate, Na₂C₂O₄, in an acidic medium to produce 144 cm³ of carbon dioxide gas at room temperature and pressure.

The half equation of $\text{C}_2\text{O}_4^{2-}$ is shown as follows:



What is the final oxidation state of the iron-containing species after the reaction?

- | | A +1 | B +2 | C +3 | D +4 |
|----------|--|---------|---------|---------|
| 3 | <p>When attracted by a strong magnet, some species are able to exhibit paramagnetism. Such species contain unpaired electrons which are able to spin in a way which aligns parallel to the magnetic field.</p> | | | |

Which of the following species in the ground state is able to exhibit paramagnetism?

- | | | | | | | | | |
|----------|-----------------|---|---|--------|---|-----------|---|--------|
| | 1 | O | 2 | Al^+ | 3 | Ti^{2+} | 4 | Cu^+ |
| A | 1 and 3 only | | | | | | | |
| B | 2 and 4 only | | | | | | | |
| C | 1, 3 and 4 only | | | | | | | |
| D | 2, 3 and 4 only | | | | | | | |

- 4 Phosphorus(V) chloride, PCl_5 dissolves in a suitable polar solvent to produce two ions, $[\text{PCl}_4]^+$ and $[\text{PCl}_6]^-$.

Which of the following shows the correct shape for PCl_5 , $[\text{PCl}_4]^+$ and $[\text{PCl}_6]^-$?

	PCl_5	$[\text{PCl}_4]^+$	$[\text{PCl}_6]^-$
A	trigonal planar	square planar	square pyramidal
B	trigonal bipyramidal	square planar	octahedral
C	trigonal planar	distorted tetrahedral	square pyramidal
D	trigonal bipyramidal	tetrahedral	octahedral

- 5 The table shows the boiling point of some halogenoalkanes.

compound	boiling point/ °C
$\text{CH}_3\text{CH}_2\text{Cl}$	12.3
$\text{CH}_3\text{CH}_2\text{Br}$	34.8
$\text{CH}_3\text{CH}_2\text{I}$	70.0

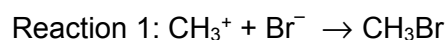
Which of the following correctly explains the difference in the boiling point?

- 1 the electronegativity difference between the halogen and carbon increases from C-Cl to C-I
 - 2 the strength of permanent dipole-permanent dipole attraction increases from C-Cl to C-I
 - 3 the strength of instantaneous dipole-induced dipole attraction increases from $\text{CH}_3\text{CH}_2\text{Cl}$ to $\text{CH}_3\text{CH}_2\text{I}$
 - 4 the bond energy of C-X bond decreases from C-Cl to C-I
- A** 1 and 2 only
B 2 and 4 only
C 3 only
D 3 and 4 only

- 6 Which of the following changes will result in the greatest decrease in the density of a fixed mass of ideal gas?

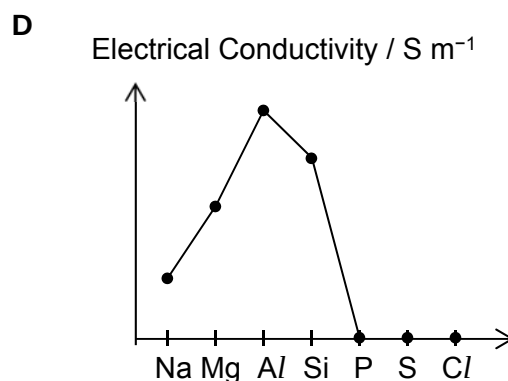
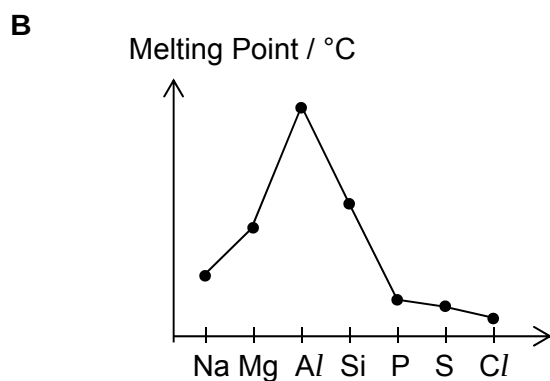
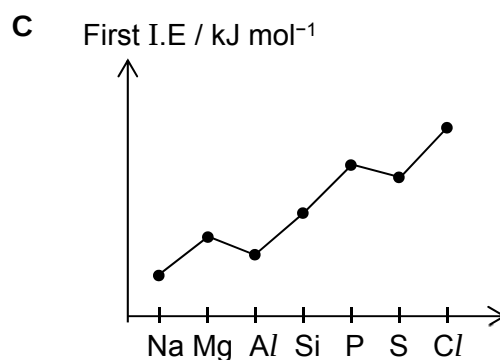
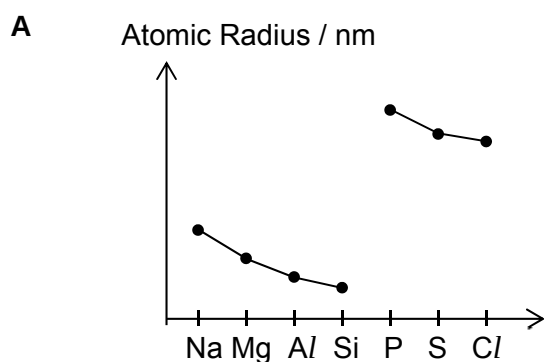
	Pressure	Temperature/ K
A	halves	halves
B	halves	doubles
C	doubles	halves
D	doubles	doubles

- 7 Consider the following reactions.



Which of the following statement is **not** true about the reactions above?

- A Both reactions are acid-base reactions.
 B In reaction 2, HPO_4^{2-} acts as the Brønsted-Lowry base.
 C In reaction 2, HBO_3^{2-} is the conjugate acid of H_2BO_3^- .
 D In reaction 1, a dative covalent bond is formed between CH_3^+ and Br^- .
- 8 Which of the following sketches shows the correct trend in the stated property for the elements in the third period of the Periodic Table?

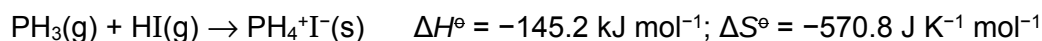


- 9** Compounds of Period 3 elements dissolve in water to form aqueous solutions that are acidic, basic or neutral.

Which of the following sequence shows the order of **increasing** resultant pH when the compounds are added to water?

- A** NaCl , MgCl_2 , SiCl_4 **C** Al_2O_3 , MgO , SO_2
B AlCl_3 , SiCl_4 , PCl_5 **D** P_4O_{10} , SiO_2 , MgO

- 10** Phosphine reacts with hydrogen iodide to form phosphonium iodide in the reaction shown below:

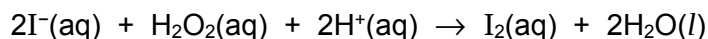


Which of the following statement is true for the above reaction?

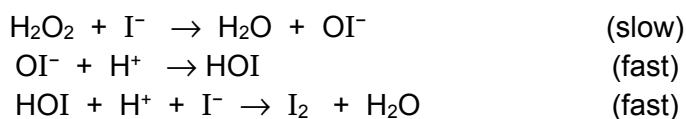
- 1 The products are less disordered than the reactants.
- 2 The reaction is non-spontaneous under standard conditions.
- 3 As temperature increases, the reaction becomes more spontaneous.

- A** 1 only
B 2 only
C 1 and 2 only
D 1, 2 and 3 only

- 11** The reaction of acidified aqueous potassium iodide with aqueous hydrogen peroxide:



is thought to involve the following steps:



Which of the following conclusion can be drawn from this information?

- 1 The acid is acting as a catalyst only.
- 2 The reaction is pseudo-first order with respect to H_2O_2 .
- 3 The reaction rate is independent of the pH of the solution.

- A** 1 only
B 3 only
C 1 and 2 only
D 1,2 and 3 only

- 12 A first-order decomposition reaction is shown below.



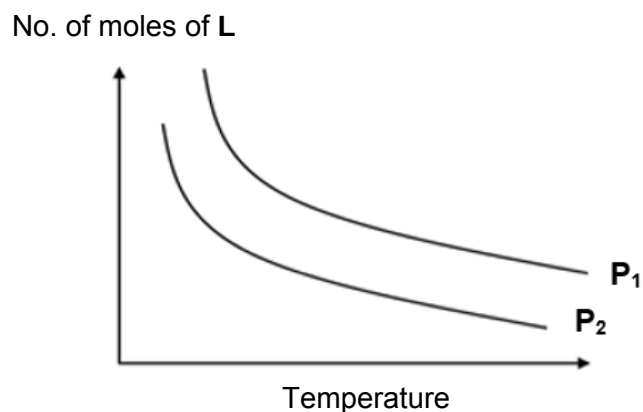
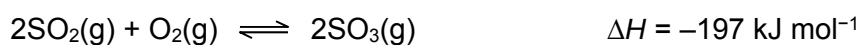
The half-life of the reaction was found to be 3.47 s.

What is the time taken for AB(g) to reach one-third of its initial concentration?

- A 3.0 s B 3.5 s C 5.5 s D 7.0 s

- 13 The graph below shows how the number of moles of compound L varies with temperature at two different pressures of P_1 and P_2 respectively.

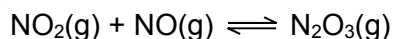
L could be any of the following compounds shown in the equation at equilibrium.



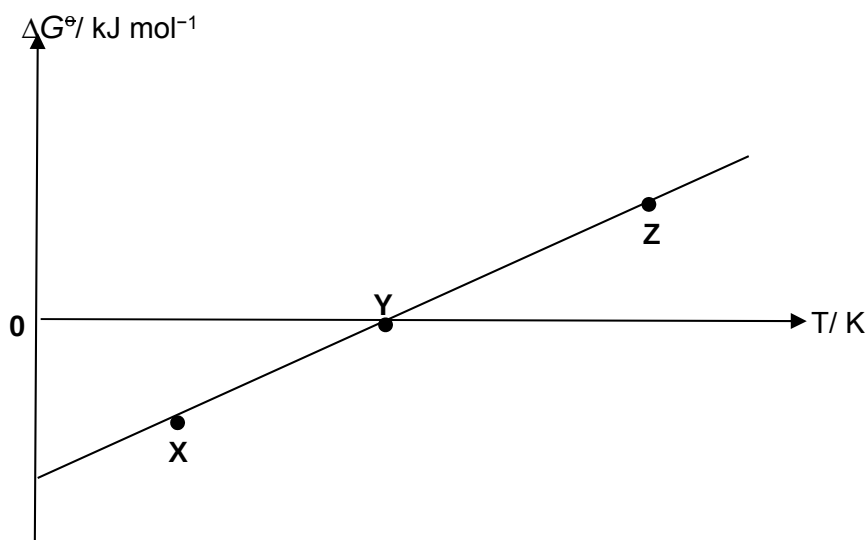
What is the correct identity of L and the correct magnitude of pressures P_1 and P_2 ?

Identity of L		magnitude of pressures P_1 and P_2
A	SO_2	$P_1 > P_2$
B	SO_2	$P_1 < P_2$
C	SO_3	$P_1 > P_2$
D	SO_3	$P_1 < P_2$

- 14 When nitrogen dioxide, NO_2 , and nitrogen monoxide, NO , is mixed, the gases react to form dinitrogen trioxide, N_2O_3 . The reaction is shown in the following equilibrium.



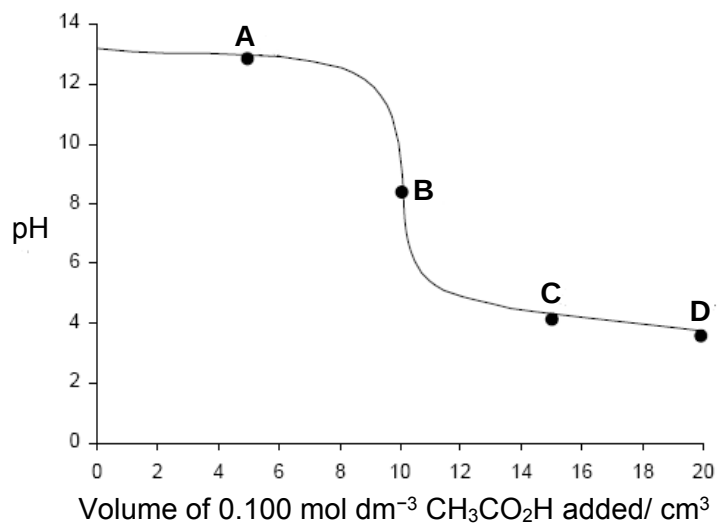
The graph below shows how the $\Delta G^\ominus$ varies with temperature for the above reaction.



Using the graph above, deduce which of the following statement is true about the reaction at equilibrium?

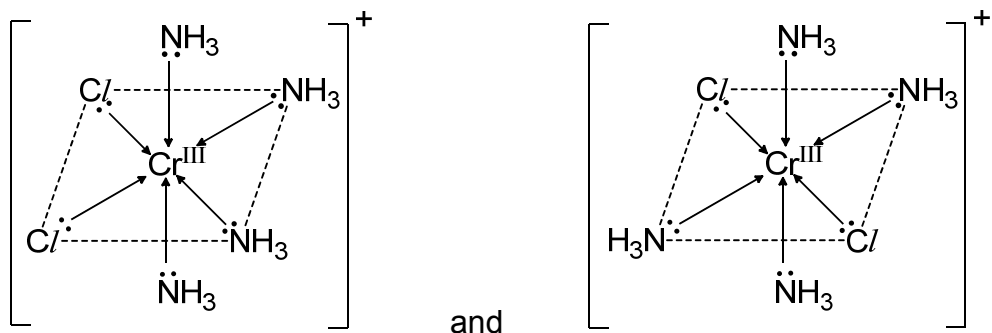
- A At point X, more NO_2 is present as compared to that at point Y.
 - B At point X, the K_c value is likely to be greater than 1.
 - C At point Y, the rate of forward reaction is greater than that of backward reaction.
 - D At point Z, more N_2O_3 is present compared to that at point Y.
- 15 The pH changes when $0.100 \text{ mol dm}^{-3} \text{ CH}_3\text{CO}_2\text{H}$ is added dropwise to 10.0 cm^3 of $0.100 \text{ mol dm}^{-3} \text{ NaOH}(\text{aq})$ as shown below.

At which point on the graph does $\text{pH} = \text{p}K_a$, where K_a is the acid dissociation constant of the weak acid?



- 16** Coordination complexes with more than one type of ligand can exist in a number of stereoisomeric forms.

For example, the chromium(III) complex $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]^+$ can refer to the two stereoisomers as shown:

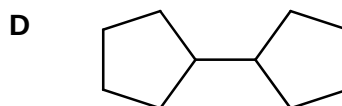
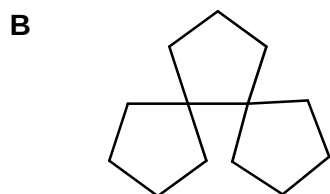
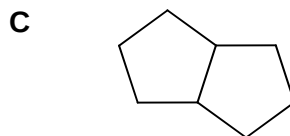
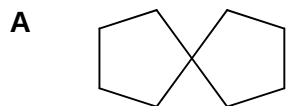


How many stereoisomers can the cobalt(III) complex $[\text{Co}(\text{trien})\text{Cl}_2]^+$ have?
(trien = $(\text{NH}_2\text{CH}_2\text{CH}_2\text{NHCH}_2)_2$, a tetradentate ligand)

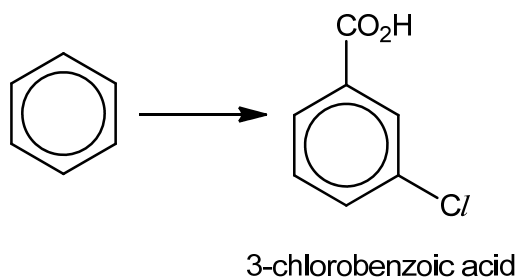
- A** 1 **B** 2 **C** 3 **D** 4

- 17** Cyclopentane undergoes substitution with bromine.

What is a possible by-product of this reaction?



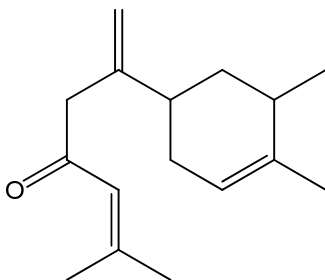
- 18 3-chlorobenzoic acid can be synthesized from benzene in three steps.



Which of the following is the best method for this synthesis?

	Step 1	Step 2	Step 3
A	$\text{Cl}_2, \text{AlCl}_3$	$\text{CH}_3\text{Cl}, \text{AlCl}_3$	$\text{KMnO}_4, \text{H}_2\text{SO}_4$
B	$\text{Cl}_2, \text{AlCl}_3$	$\text{KMnO}_4, \text{H}_2\text{SO}_4$	$\text{CH}_3\text{Cl}, \text{AlCl}_3$
C	$\text{CH}_3\text{Cl}, \text{AlCl}_3$	$\text{KMnO}_4, \text{H}_2\text{SO}_4$	$\text{Cl}_2, \text{AlCl}_3$
D	$\text{CH}_3\text{Cl}, \text{AlCl}_3$	$\text{Cl}_2, \text{AlCl}_3$	$\text{KMnO}_4, \text{H}_2\text{SO}_4$

- 19 The structure of a β -atlantone derivative is shown below.

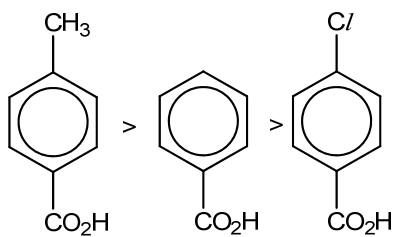


When it is completely reacted with hydrogen in the presence of platinum when heated, how many chiral centres does the product molecule possess?

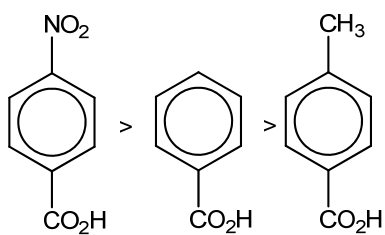
- A** 2 **B** 3 **C** 4 **D** 5

- 20 Which of the following correctly lists the compounds in order of decreasing acidity in aqueous solution?

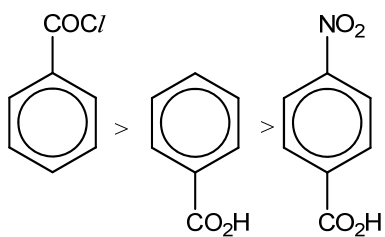
A



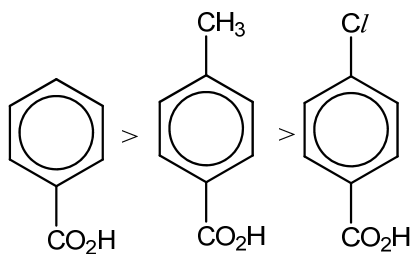
B



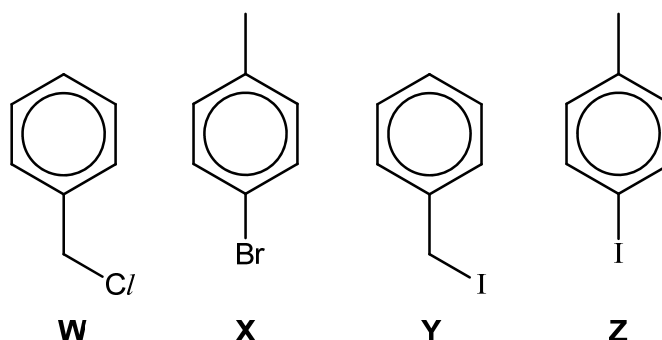
C



D



- 21 Equal amounts of compounds **W**, **X**, **Y** and **Z** are added separately to four test-tubes containing equal concentrations of ethanolic silver nitrate solution in a heated water bath. No precipitate forms in two of the tubes. In the other two tubes, precipitates form at different rates.

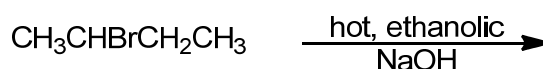


Which statements are correct?

- 1 The compounds which do not form a precipitate are **X** and **Z**.
- 2 The colour of the precipitate which forms the fastest is white.
- 3 The precipitate which forms the fastest weighs more than the other precipitate.

A 1, 2 and 3 **B** 1 and 3 only **C** 2 and 3 only **D** 1 only

- 22 The following reaction gives a mixture of organic products.



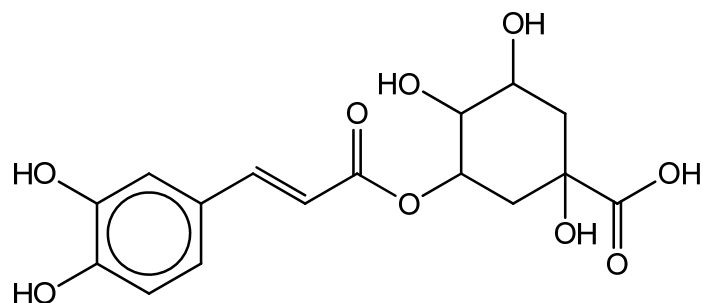
Which of the following statements are true?

- 1 The organic products formed are mainly alcohols.
- 2 The predominant type of reaction occurring is nucleophilic substitution.
- 3 There is a pair of cis-trans isomers among the organic products.

A 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 3 only

- 23** Chlorogenic acids account for up to 8% of the composition of unroasted coffee beans. More than 40 different varieties have been identified in green coffee beans, with 5-caffeoylquinic acid being the most prevalent.

The structure of 5-caffeoylquinic acid is shown below.

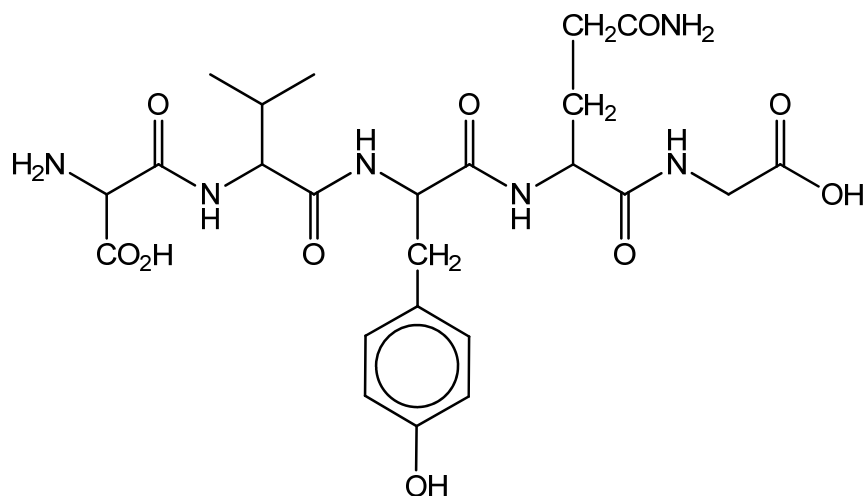


5-caffeoylquinic acid

How many moles of aqueous sodium hydroxide, sodium hydrogencarbonate and phosphorus(V) chloride will react with one mole of 5-caffeoylquinic acid at room temperature?

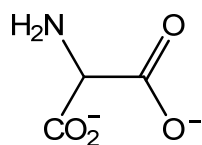
	NaOH(aq)	NaHCO ₃ (aq)	PCl ₅ (s)
A	6	3	6
B	5	1	3
C	4	3	4
D	3	1	4

24 The structure of a polypeptide chain is shown below.

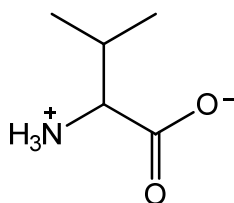


Which of the following will be formed when this polypeptide chain is heated under reflux with 6 mol dm^{-3} of NaOH(aq) ?

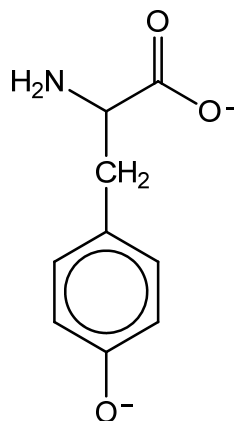
1



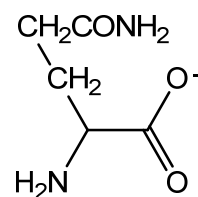
2



3

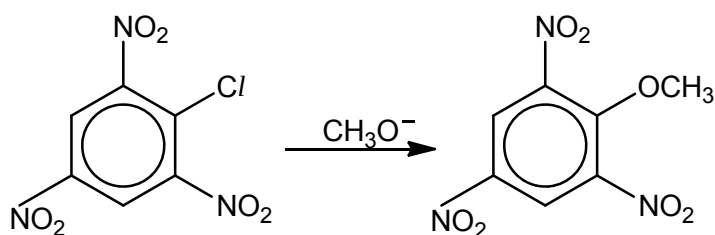


4



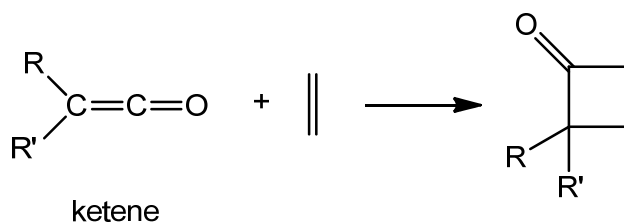
- A 1 and 3 only
 B 2 and 4 only
 C 1, 3 and 4 only
 D 1, 2, 3 and 4

- 25 Methoxide anion, CH_3O^- , can be generated when methanol reacts with sodium metal. The following reaction shows how methoxide anion reacts with an organic compound under suitable conditions.

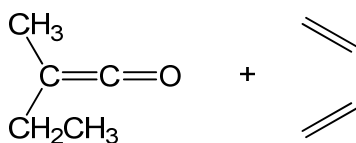


Which of the following is the correct mechanism for the above reaction?

- A electrophilic addition
 - B electrophilic substitution
 - C nucleophilic addition
 - D nucleophilic substitution
- 26 Ketenes contain a carbon involved in both alkene and ketone functional groups. It is a reactive compound which undergoes cycloaddition reaction readily with unsaturated compounds to form cyclic rings. One example of such a reaction is shown below.



Which of the following is the correct product formed for the following cycloaddition reaction?



- A**

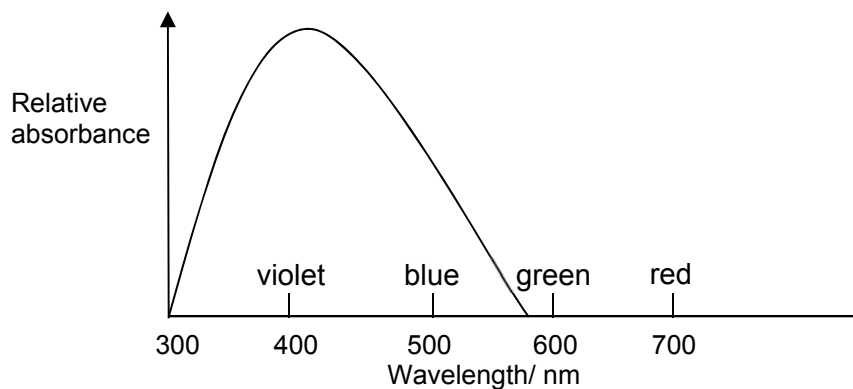
B

C

D

- 30** The chromium picolinate complex is soluble in water and the visible absorption spectrum of the complex is shown below:

[A visible absorption spectrum is a graph depicting the absorption of radiation by a material over a range of visible light wavelengths.]



What is the most likely colour of the chromium picolinate complex?

- | | |
|-----------------|-----------------|
| A violet | C yellow |
| B blue | D green |