

Name:		Index Number:		Class:	
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DUNMAN HIGH SCHOOL

Preliminary Examination 2018

Year 6

H2 CHEMISTRY

9729/01

Paper 1 Multiple Choice

24 September 2018

1 hour

Additional Materials: Data Booklet
 Optical Mark Sheet

INSTRUCTIONS TO CANDIDATES

- 1 Write your **name**, **index number** and **class** on this question paper and the OTAS Mark Sheet.
- 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 wrong answer.
- 4 Any rough working should be done in this booklet.
- 5 The use of an approved scientific calculator is expected, where appropriate.
- 6 On the OTAS Mark Sheet, please shade the code as "Class/Index number".

For illustration only:

A student from class 6C38, with index number 02, should shade "3802".

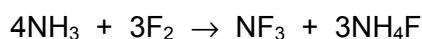
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		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
		A	B	C	D	E	F	G	H	I	

This question paper consists of **15** printed pages and **1** blank page.

- 1 Which option contains one mole of the stated particles?
[D = ${}^2_1\text{H}$]

- A carbonate ions in 60 g of sodium carbonate
- B neutrons in 1.8 g of heavy water, D_2O
- C electrons in 0.1 mol of OH^- ions
- D oxygen atoms in 11.35 dm^3 of O_3 , under s.t.p.

- 2 NF_3 can be obtained from the reaction between ammonia and fluorine gas.



Which statement about the reaction is correct?

- A NH_3 undergoes disproportionation.
- B The oxidation number of nitrogen in NF_3 is +3.
- C NH_3 is a stronger oxidising agent than F_2 .
- D One mole of F_2 loses two moles of electrons.

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

Which statement regarding ${}^{26}\text{Mg}^{2+}$ and ${}^{27}\text{Al}^{3+}$ ions is true?

- 1 ${}^{26}\text{Mg}^{2+}$ has more protons than ${}^{27}\text{Al}^{3+}$.
- 2 Both ions have more neutrons than protons in their nuclei.
- 3 Both ions have outer electronic configuration $2\text{s}^22\text{p}^6$.
- 4 Both ions have the same number of neutrons.

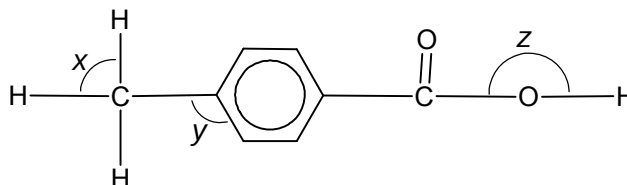
- | | |
|----------------|-------------------|
| A 1 and 2 only | B 1 and 3 only |
| C 3 and 4 only | D 2, 3 and 4 only |

- 4 Two ideal gases X and Y were placed separately into two bulbs of the same volume and pressure. The density of gas X is three times that of gas Y and the molecular mass of gas X is twice that of gas Y.

What is the ratio of the temperature (in Kelvin) of gas X to that of gas Y in the two separate bulbs?

- A** 1 : 3 **B** 1 : 6
C 2 : 3 **D** 3 : 2

- 5** A compound has the structure shown.

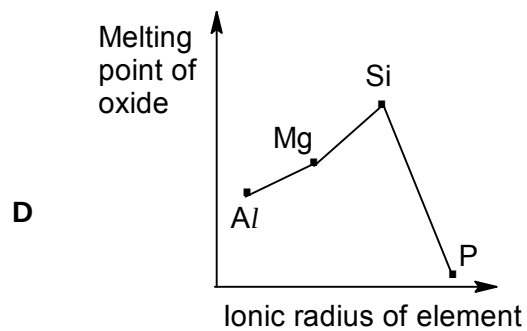
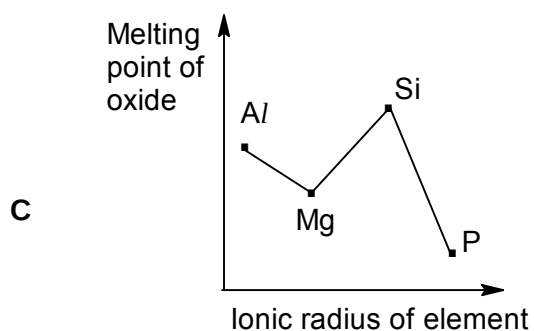
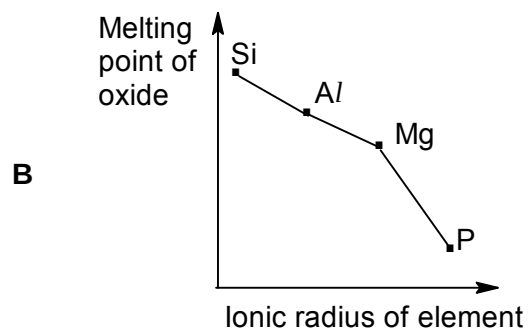
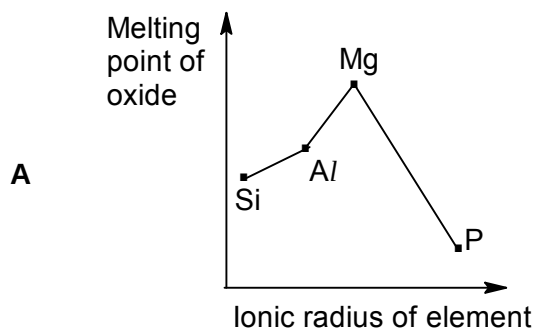


What are the values of the bond angles x , y and z ?

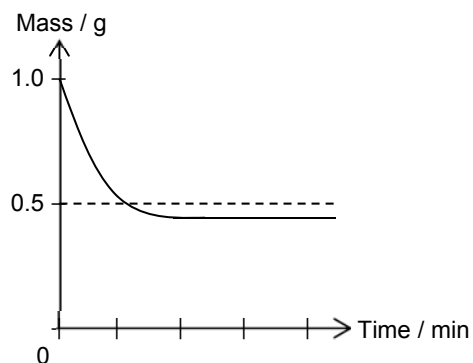
	x	y	z
A	90°	109.5°	104.5°
B	90°	120°	180°
C	109.5°	109.5°	180°
D	109.5°	120°	104.5°

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

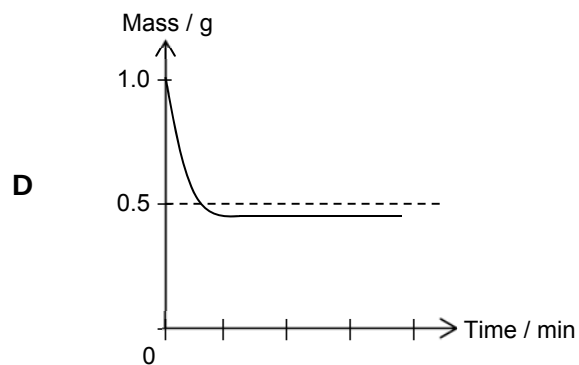
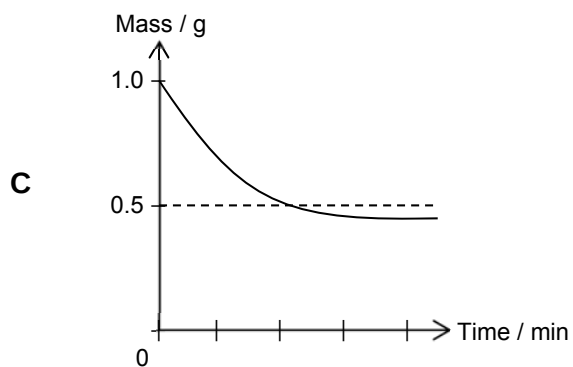
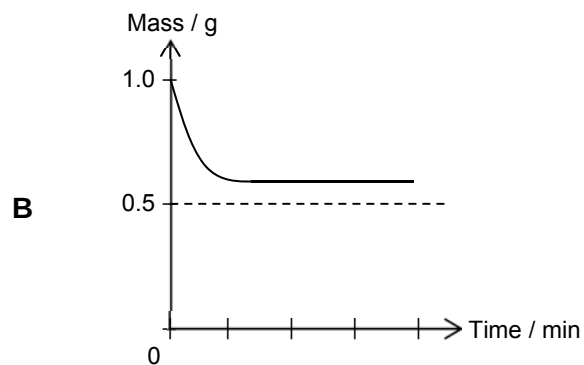
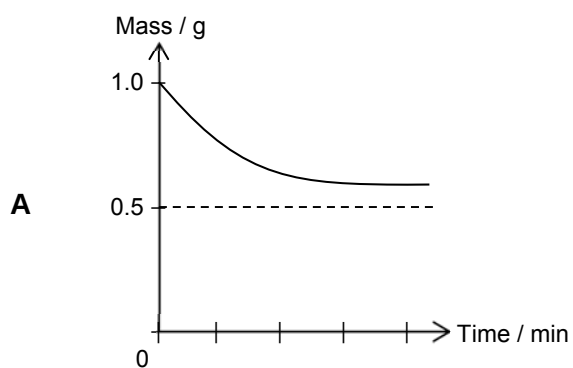
Which graph shows the correct trend when the melting point of the oxide of each of the elements Mg, Al, Si and P is plotted against its ionic radius?



- 7 The graph represents the change in mass that occurs when 1.0 g of powdered magnesium carbonate, MgCO_3 , is heated at a temperature, T .



Which graph would be obtained by heating 1.0 g of powdered calcium carbonate, CaCO_3 , at the same temperature, T ?



- 8 X_2 , Y_2 and Z_2 are Cl_2 , Br_2 and I_2 but are not necessarily in the given order.

The table below recorded observations when these halogens are separately added to aqueous solutions containing the halide ions followed by the addition of an organic solvent, CCl_4 .

Experiment	Reactants	Observation after shaking with CCl_4
1	$X_2(aq) + Y^-(aq)$	Violet organic layer seen.
2	$Y_2(aq) + X^-(aq)$	(Observations not recorded)
3	$Z_2(aq) + X^-(aq)$	Orange-red organic layer seen.
4	$Z_2(aq) + Y^-(aq)$	Violet organic layer seen.

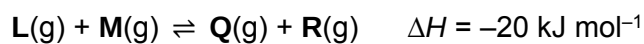
Which statement could be deduced from the above experiments, given $X_2(aq)$ is an orange solution?

- A The colour of the organic layer in Experiments 2 and 4 is the same.
- B Identity of Z_2 is Br_2 .
- C There is no redox reaction occurring in Experiment 3.
- D X_2 is a stronger oxidising agent than Z_2 .
- 9 For which process is the enthalpy change always negative?
- A Dissolving an ionic solid in water.
- B Reaction between an acid and a base.
- C Forming gaseous atoms from a diatomic molecule.
- D Synthesising a compound from its elements.
- 10 A rock sample was found to contain isotopes **T** and **U** which are radioactive. Initially, the ratio of the number of atoms of **T** to **U** in the rock sample is 1 : 16. The decay of isotopes **T** and **U** was found to follow first order kinetics. The half-life of **T** is 12 days while that of **U** is 3 days.

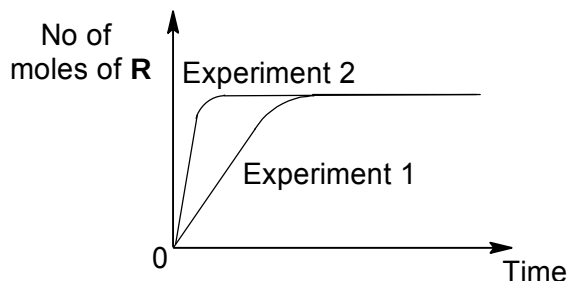
How long, in days, will it take for a rock sample to contain a molar ratio of **T** to **U** of 4 : 1?

- | | |
|------|------|
| A 6 | B 12 |
| C 18 | D 24 |

- 11 The stoichiometry of a reaction is shown by the equation below.



Two experiments were carried out in enclosed vessels which the rate of production of **R** was measured. The results are shown in the diagram below.



Which changes in the conditions might explain the results shown?

- | | |
|----------|--|
| 1 | Temperature of the vessel is higher in Experiment 2. |
| 2 | A smaller vessel is used in Experiment 2. |
| 3 | A catalyst is used in Experiment 2. |
| A | 1, 2 and 3 |
| B | 1 and 2 only |
| C | 2 and 3 only |
| D | 1 only |

- 12 In which reaction is the first reactant **not** acting as a Bronsted-Lowry base?

- A** $\text{NH}_3 + \text{CH}_3\text{Cl} \rightarrow \text{CH}_3\text{NH}_3^+ + \text{Cl}^-$
- B** $\text{OH}^- + \text{HSO}_4^- \rightarrow \text{H}_2\text{O} + \text{SO}_4^{2-}$
- C** $\text{CH}_3\text{OH} + \text{HClO}_4 \rightarrow \text{CH}_3\text{OH}_2^+ + \text{ClO}_4^-$
- D** $\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{NO}_3^+ + \text{HSO}_4^-$

- 13** The solubility products of calcium fluoride and calcium carbonate are $4.0 \times 10^{-11} \text{ mol}^3 \text{ dm}^{-9}$ and $8.7 \times 10^{-9} \text{ mol}^2 \text{ dm}^{-6}$ at 25°C respectively.

Which statement is correct?

- 1 When calcium nitrate is added into a 1 dm^3 solution containing 0.01 mol of fluoride and 0.01 mol of carbonate ions in order to separate fluoride and carbonate ions, calcium fluoride is collected as the filtrate upon filtration.
- 2 Calcium fluoride has a lower molar solubility than calcium carbonate.
- 3 Addition of sodium fluoride to a saturated solution containing calcium fluoride does not change the solubility product of calcium fluoride.

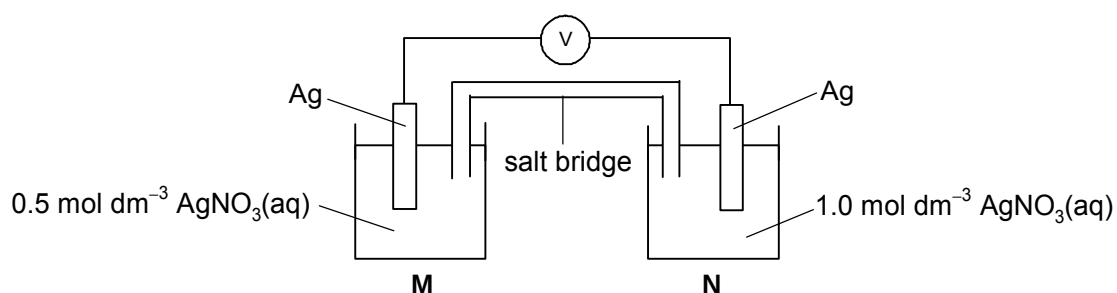
A 1, 2 and 3 only

B 2 and 3 only

C 1 and 3 only

D 3 only

- 14** A concentration cell set up is shown below. The net effect of a concentration cell is the same as mixing the two solutions of different concentrations until concentration equilibrium is established.



Which statement is true?

- A** The E_{cell} value decreases when small amount of $\text{NH}_3(\text{aq})$ is added to the half-cell **M**.
- B** The E_{cell} value increases when small amount of $\text{KCl}(\text{s})$ is added to the half-cell **N**.
- C** The electrons flow from half-cell **N** to **M**.
- D** **M** is the oxidation half-cell.

- 15** A current of 5 amperes was passed for 5 seconds through a molten salt containing X^{3+} ions. The mass of X deposited was 5 g. If M is the relative molecular mass of X and e is the electronic charge, then an expression of Avogadro Constant is given by

A $\frac{5M}{3e}$

B $\frac{125}{3Me}$

C $\frac{3e}{5M}$

D $\frac{3Me}{125}$

- 16 The table shows the electronic configuration of three d-block elements in the Periodic Table.

Element	Electronic configuration
X	$[\text{Ar}]3d^74s^2$
Y	$[\text{Ar}]3d^84s^2$
Z	$[\text{Ar}]3d^{10}4s^1$

Which statement is correct?

- The electronic configuration of central metal ion for $[\text{Y}(\text{CN})_6]^{4-}$ is $[\text{Ar}]3d^7$.
- Upon reduction from $\text{ZCl}_2(\text{aq})$ to $[\text{ZCl}_2]^{-}(\text{aq})$, a colourless solution will be formed.
- The $E^\ominus$ value of $\text{X}^{3+}/\text{X}^{2+}$ is likely to be less positive than that of $\text{Z}^{3+}/\text{Z}^{2+}$.
- X is likely to form an oxoanion of formula XO_4^{2-} .

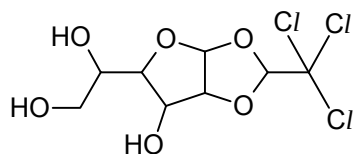
A 1, 2 and 4 only

B 2 and 3 only

C 1 and 4 only

D 3 and 4 only

- 17 Chloralose is a drug that is commonly used in neuroscience and veterinary medicine as an anesthetic.



chloralose

How many stereoisomers does chloralose have?

A 16

B 32

C 64

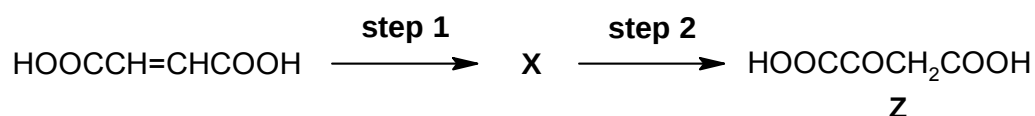
D 128

- 18 2,2-dimethylpropane reacts with chlorine gas in the presence of ultraviolet light to give a mixture of products.

Which statement regarding this reaction is correct?

- A Only one mono-substituted product is formed.
- B Only the propagation step involves C–Cl bond formation.
- C Both propagation and termination steps produce hydrogen chloride.
- D Only the initiation step of the mechanism involves homolytic fission.

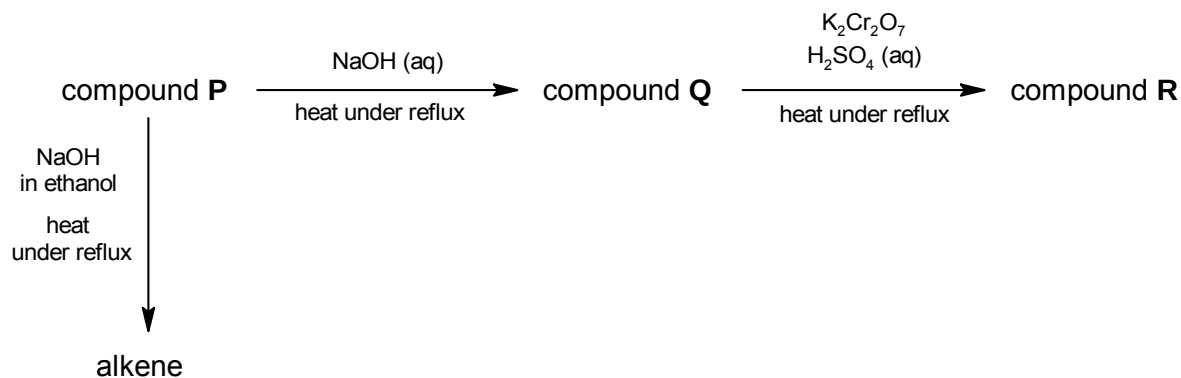
- 19 Compound Z can be obtained by a two-step process involving intermediate X.



What is the identity of intermediate X?

- | | |
|---|------------------------------------|
| A $\text{HOOCCH}_2\text{CH}_2\text{COOH}$ | B $\text{HOOCCHBrCH}_2\text{COOH}$ |
| C $\text{HOOCCH(OH)CH}_2\text{COOH}$ | D $\text{HOOCCH(OH)CH}_2\text{OH}$ |

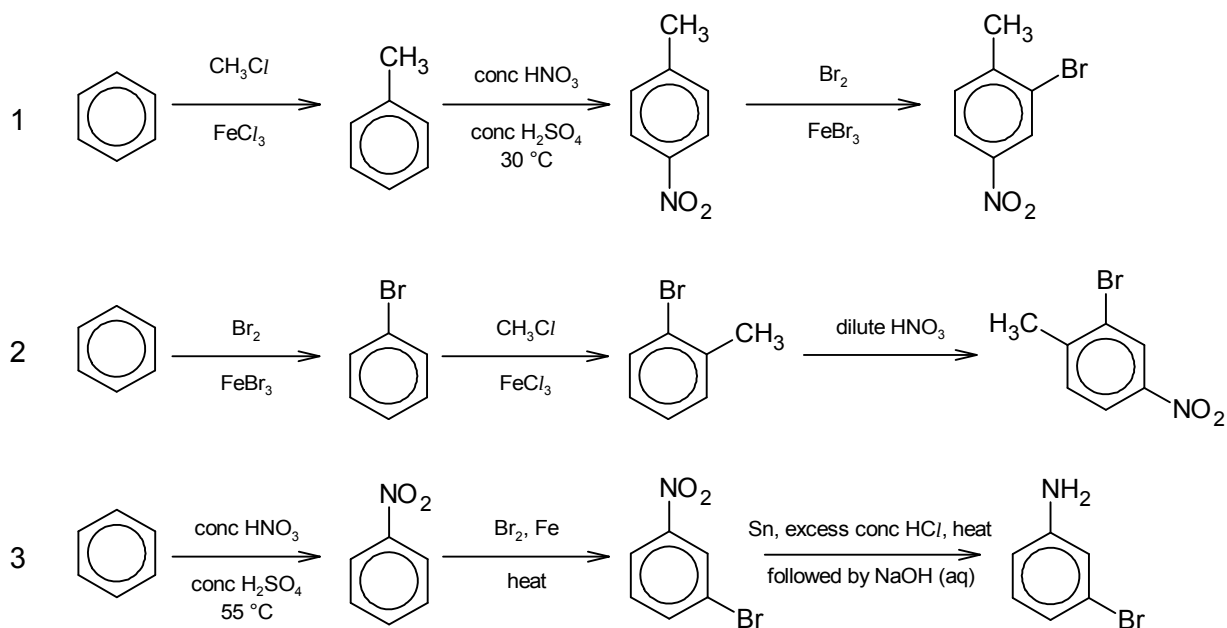
- 20 The flow chart below shows a series of reactions.



Which class of compound are P, Q and R?

	P	Q	R
A	halogenoalkane	primary alcohol	carboxylic acid
B	halogenoalkane	primary alcohol	aldehyde
C	primary alcohol	aldehyde	carboxylic acid
D	primary alcohol	halogenoalkane	aldehyde

21 Which of the following synthetic routes is correct?



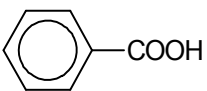
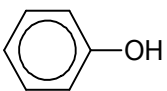
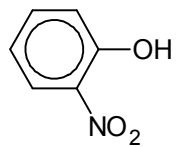
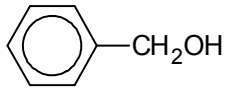
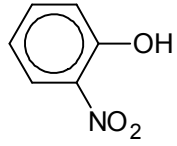
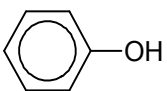
A 1 only

B 1 and 2 only

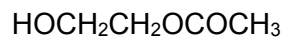
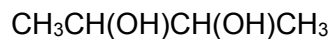
C 2 and 3 only

D 1 and 3 only

22 Which row shows the given molecules arranged in order of increasing pK_a values?

	smallest pK_a value	→	largest pK_a value
A			
B			
C	CF ₃ CH ₂ OH		CH ₃ OH
D			

23 Which reagent is able to distinguish between the two compounds below?

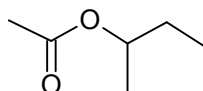


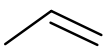
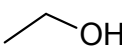
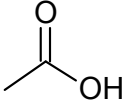
- A Hot alkaline $\text{I}_2(\text{aq})$ B Hot acidified $\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$
 C 2,4-DNPH D Neutral aqueous FeCl_3

24 Which products are formed when butanal reacts with Fehling's solution?

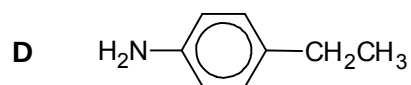
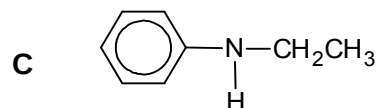
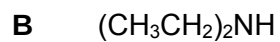
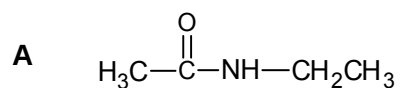
- A Cu_2O and $\text{CH}_3\text{CH}_2\text{COO}^-$
 B Cu_2O and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 C Cu_2O and $\text{CH}_3\text{CH}_2\text{CH}_2\text{COO}^-$
 D CuO and $\text{CH}_3\text{CH}_2\text{CH}_2\text{COO}^-$

25 Which synthetic route will give the following ester as the product?

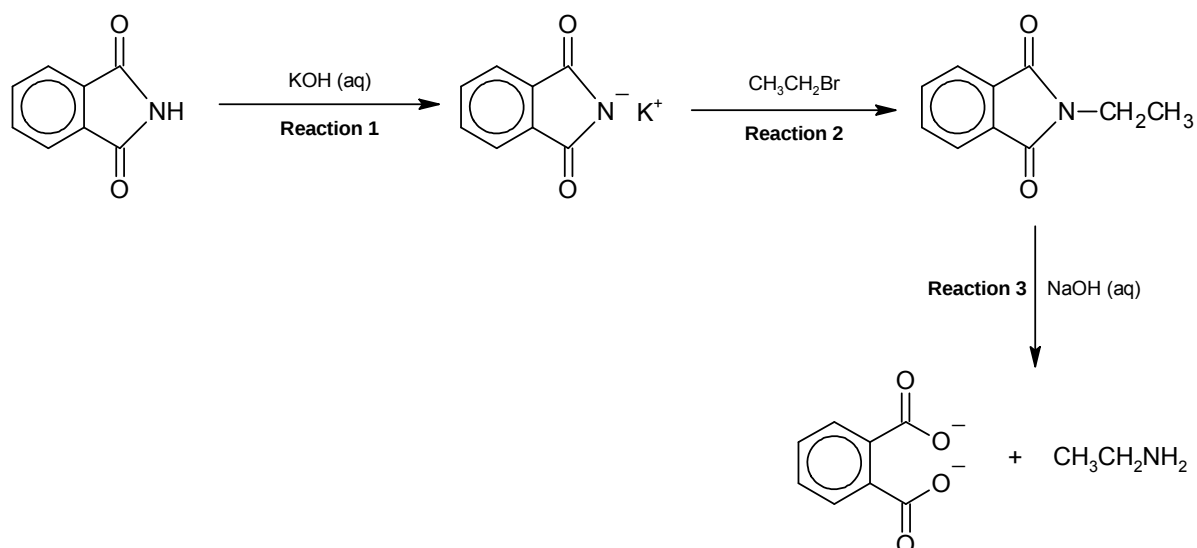


- A  $\xrightarrow{\text{hot acidified KMnO}_4}$ $\xrightarrow{\text{PCl}_5}$ $\xrightarrow{\text{propan-2-ol}}$
- B  $\xrightarrow[\text{heat under reflux}]{\text{KMnO}_4, \text{H}_2\text{SO}_4(\text{aq})}$ $\xrightarrow{\text{SOCl}_2}$ $\xrightarrow{\text{butan-1-ol}}$
- C  $\xrightarrow[\text{in dry ether}]{\text{LiAlH}_4}$ $\xrightarrow{\text{PCl}_5}$ $\xrightarrow{\text{butan-2-ol}}$
- D $\text{CH}_3\text{Br} \xrightarrow[\text{heat under reflux}]{\text{KCN in ethanol}} \xrightarrow[\text{heat under reflux}]{\text{H}_2\text{SO}_4(\text{aq})} \xrightarrow[\text{heat under reflux}]{\text{butan-2-ol, conc H}_2\text{SO}_4}$

26 Which compound has the lowest pK_b value?



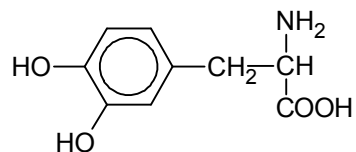
27 The diagram below shows a sequence of reactions.



How can the three reactions be classified?

	Reaction 1	Reaction 2	Reaction 3
A	hydrolysis	substitution	acid-base
B	hydrolysis	addition	acid-base
C	acid-base	substitution	hydrolysis
D	acid-base	addition	hydrolysis

- 28 The molecule shown is used in the treatment of Parkinson's disease.

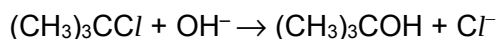


Which statement about the molecule is correct?

- 1 It is likely to be soluble in water due to zwitterion formation.
- 2 Two Br atoms will be incorporated when aqueous bromine is added.
- 3 One mole of molecule reacts with three moles of sodium carbonate to form a salt.

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

- 29 Nucleophilic substitution of 2-chloro-2-methylpropane follows an S_N1 mechanism.



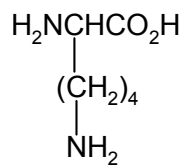
S_N1 reactions take place more rapidly in polar solvents.

Which solvent should be used?

- 1 water
- 2 hexane
- 3 ethanol
- 4 tetrachloromethane

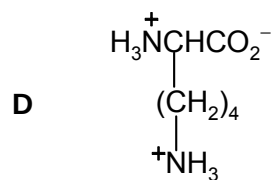
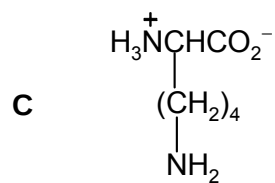
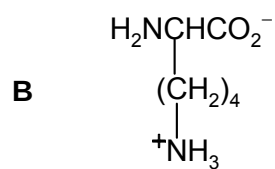
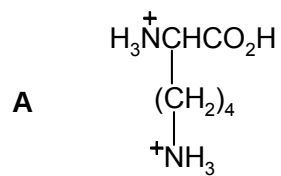
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|----------|-----------------|----------|-----------------|
| A | 1 and 2 only | B | 1 and 3 only |
| C | 1, 2 and 4 only | D | 1, 3 and 4 only |

30 Lysine is an amino acid.



lysine

Which structure is predominant when lysine is in aqueous solution at pH 5?



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2018 DHS YEAR 6 H2 CHEMISTRY (9729) Preliminary Examination
Paper 1 MCQ – Answers

1	2	3	4	5	6	7	8	9	10
C	B	D	C	D	A	A	A	B	D

11	12	13	14	15	16	17	18	19	20
C	A	D	D	A	B	C	A	C	A

21	22	23	24	25	26	27	28	29	30
D	B	A	C	D	B	C	A	B	D