DUNMAN HIGH SCHOOL
Preliminary Examination 2015
Year 6

H1 CHEMISTRY   8872/01

Paper 1 Multiple Choice   **29 September 2015**
                                                                      50 minutes

Additional Materials: Optical Mark Sheet
                             Data Booklet

INSTRUCTIONS TO CANDIDATES

1   Write your **name** and **class** on this question paper.

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   You may use a calculator.

This question paper consists of **12** printed pages and **0** blank page.

© DHS 2015   **[Turn over**

Section A

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

1 10 cm^3 of gaseous hydrocarbon was completely burnt in 80 cm^3 of oxygen (present in excess) at 425 K. After cooling to room temperature, the volume of the gaseous mixture decreased to 55 cm^3. A further reduction of 40 cm^3 was observed when the residual gas was passed through calcium hydroxide. All gas volumes were measured at room temperature and pressure.

What is the formula of the hydrocarbon?

A C_3H_8 B C_4H_8

C C_4H_{10} D C_5H_{12}

2 Chlorine gas is a severe irritant to the eyes and respiratory system. The maximum safe toleration level of chlorine gas in air is 0.005 mg dm^{-3}.

How many atoms of chlorine gas are present in 2 dm^3 of air at this toleration level?

A $\dfrac{0.005}{1000} \times \dfrac{2}{71} \times 6 \times 10^{23}$

B $\dfrac{0.005}{1000} \times \dfrac{4}{71} \times 6 \times 10^{23}$

C $\dfrac{0.005}{71} \times 2 \times 1000 \times 6 \times 10^{23}$

D $\dfrac{0.005}{71} \times 4 \times 6 \times 10^{23}$

3 0.5 g of zinc powder was found to reduce an acidified solution of 25.50 cm^3 of $0.200 \text{ mol dm}^{-3}$ VO_2^+. Which one of the following is the reduced product of VO_2^+?

A VO_3^- B VO^{2+}

C V^{3+} D V^{2+}

4 In 1999 Russian chemists claimed to be the first to identify atoms of a new element of proton number 114. This was produced by bombarding atoms of plutonium, Pu, with atoms of an isotope of a Group II element, **X**. This reaction taking place is as shown:

$$^{244}_{94}Pu + X \rightarrow \,^{289}_{114}[new\,element] + 3\,neutrons\left(^{1}_{0}n\right)$$

What is element **X**?

A Mg   B Ca   C Sr   D Ba

5   Which of the following chemical species contains the most number of unpaired electrons?

   A P^-

   B N^{2-}

   C Ti^+

   D Cu^+

6   The elements **P** and **Q** are in groups VI and VII respectively in the same period.

   Which of the following statements regarding **P** and **Q** is most likely to be true?

   A PQ_2 is linear in shape.

   B PQ_4 is a non–polar molecule.

   C   **P** is more electronegative than **Q**.

   D   The first ionisation energy of **P** will likely be less endothermic than that of **Q**.

7   The interhalogen compound BrF_3 is a volatile liquid which autoionises as follows.

$$2BrF_3 \rightleftharpoons BrF_2^+ + BrF_4^-$$

   The electrical conductivity of BrF_3 decreases with increasing temperature.
   Which one of the following statement is correct?

   A   The autoionisation process is endothermic and the shape of the anion is square planar.

   B   The autoionisation process is exothermic and the shape of the cation is linear.

   C   The autoionisation process is endothermic and the shape of the anion is tetrahedral.

   D   The autoionisation process is exothermic and the shape of the cation is bent.

8   Phosgene, $COCl_2$, is a poisonous gas used as a chemical weapon in World War I. It can dissociate into two other poisonous gases, carbon monoxide and chlorine, at high temperatures according to the equilibrium below:

$$COCl_2\ (g) \rightleftharpoons CO\ (g) + Cl_2\ (g)$$

   When 1 mol of phosgene is heated in a 2 dm^3 closed vessel at 600 K, 0.2 mol of phosgene remains at equilibrium, what is the numerical value of K_c at 600 K?

   A   0.025   **B**   0.25

   C   1.6   **D**   3.2

9

$$H_2PO_4^- + HBO_3^{2-} \rightleftharpoons HPO_4^{2-} + H_2BO_3^-$$
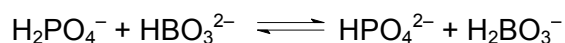
The equilibrium constant for the reaction represented by the equation above is greater than 1.0. Which of the following gives the correct relative strengths of the acid and base in the reaction?

	Acids		**Bases**
A	$H_2PO_4^- > H_2BO_3^-$	and	$HBO_3^{2-} > HPO_4^{2-}$
B	$H_2BO_3^- > H_2PO_4^-$	and	$HBO_3^{2-} > HPO_4^{2-}$
C	$H_2PO_4^- > H_2BO_3^-$	and	$HPO_4^{2-} > HBO_3^{2-}$
D	$H_2BO_3^- > H_2PO_4^-$	and	$HPO_4^{2-} > HBO_3^{2-}$

10 Which of the following is a suitable indicator for the titration between 0.10 mol dm^{-3} ethanoic acid and 0.2 mol dm^{-3} sodium hydroxide?

A methyl red (pH range 4.2 – 6.3)

B bromothymol blue (pH range 6.0 – 7.6)

C phenolphthalein (pH range 8.2 – 10)

D There is no suitable indicator.

11 The table shows the enthalpy change of neutralisation per mole of water formed, ΔH, for various acids and bases.

acid	base	ΔH / kJ mol^{-1}
hydrochloric acid	sodium hydroxide	−57.0
P	sodium hydroxide	−51.0
hydrochloric acid	**Q**	−52.0
sulfuric acid	**R**	−57.0

What are **P**, **Q** and **R**?

	P	**Q**	**R**
A	ethanoic acid	ammonia	barium hydroxide
B	ethanoic acid	sodium hydroxide	ammonia
C	sulfuric acid	ammonia	potassium hydroxide
D	sulfuric acid	sodium hydroxide	ammonia

12 Given the general energy cycle for NaH,
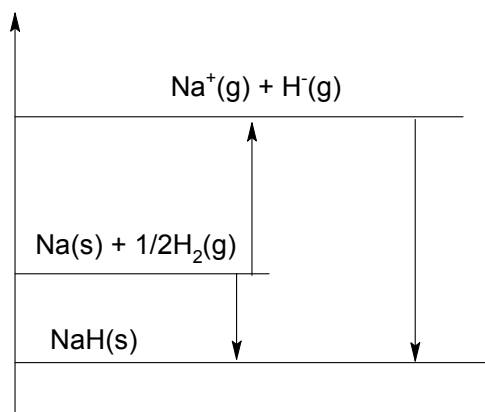
Which value is essential to calculate the lattice energy of the compound NaH?

A Enthalpy change of combustion.

B Enthalpy change of neutralisation.

C Bond energy of sodium.

D Enthalpy change of formation.

13 The reaction between gaseous hydrogen and iodine monochloride is highly exothermic. The overall equation of the reaction is shown below:

$$H_2(g) + 2ICl(g) \rightarrow I_2(g) + 2HCl(g)$$
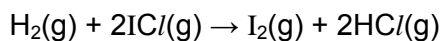
3 experiments were carried out to study the rate of the above reaction.

Experiment Number	Initial concentration of H_2 / mol dm^{-3}	Initial concentration of ICl / mol dm^{-3}	Initial reaction rate / mol dm^{-3} s^{-1}
1	2.0	2.0	0.0034
2	4.0	1.0	0.0034
3	2.0	1.0	0.0017

Which of the following statement about this reaction is true?

A The rate equation is rate = $k[H_2][ICl]^2$.

B The overall order of the reaction is 1.

C The units of rate constant is mol^{-1} dm^3 s^{-1}.

D The order of reaction with respect to H_2 is 2.

14 Given that the radioactive decay follows a first order kinetics.
What is the half–life of a radioactive isotope if its rate of decay decreases from 300 counts per minute to 37.5 counts per minute after 1 day?

    A   4 hours

    B   6 hours

    C   8 hours

    D   12 hours

15 A mixture of 3–chloromethylbenzene and liquid bromine is placed in a sunny spot in the laboratory for a period of time. The reaction that occurs takes place in a number of steps to give several products.
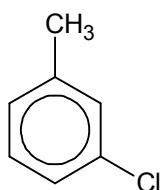
3–chloromethylbenzene

Which of the following is **not** a possible product?


    D   HBr
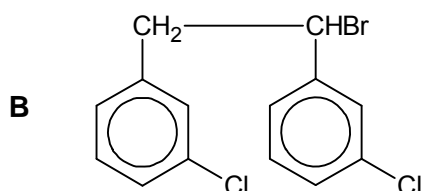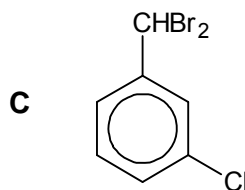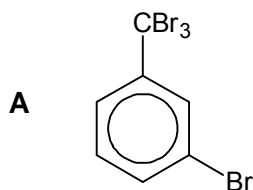
16 An organic compound has the following properties:

    (i)   It forms a brick–red precipitate with Fehling's solution.
    (ii)   1 mol of the compound gives 2 mol of CO_2 upon oxidation with $KMnO_4$.
    (iii)   1 mol of the compound burns in air by reacting with 6.5 mol of O_2 gas.

Which compound could give these results?

    A $CH_3COCH_2C(OH)(CH_3)CH_2CHO$ **B** $HCOCH=CHCH(CH_3)CO_2H$

    C $CH_2=CHCH_2COCH_2CH=CH_2$ **D** $CH_3(CH_2)_2C_6H_4CHO$

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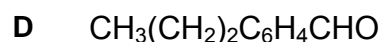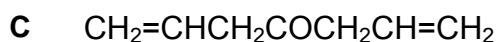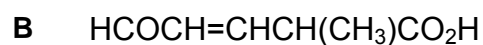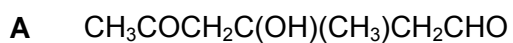
17 What would be obtained when 2–methylbut–2–ene is heated under reflux with concentrated sulfuric acid, followed by water?

A

Major product   Minor product

B

Sole product

C

Both products in same proportion
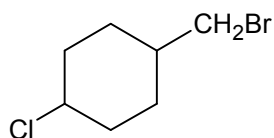
D

Sole product
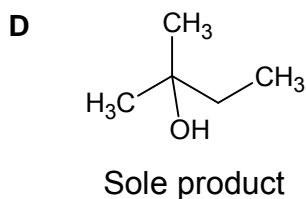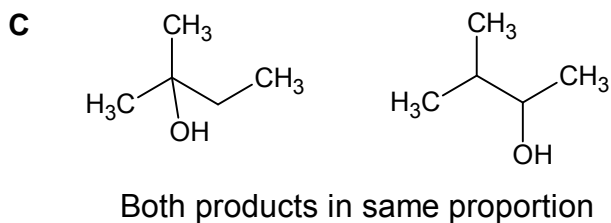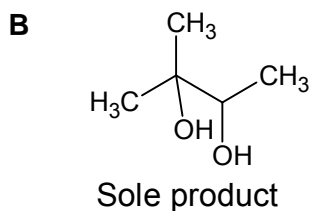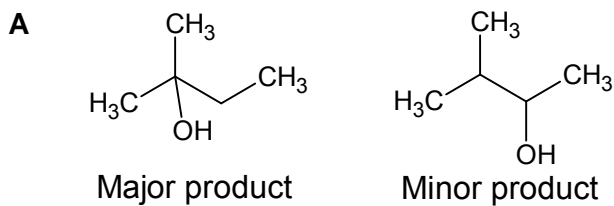
18 A substance, **X**, is oxidised by acidified potassium dichromate(VI) solution under suitable conditions to give a product which produces a silver mirror with Tollens' reagent and reacts with sodium carbonate.

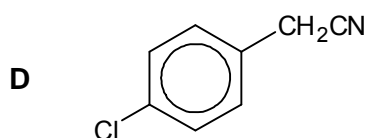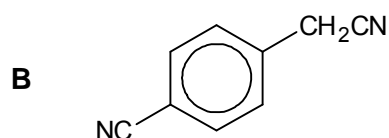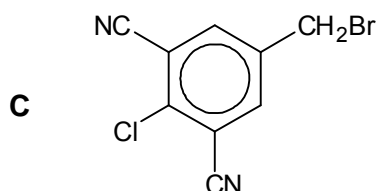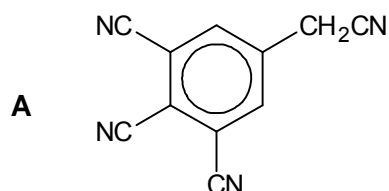Which of the following could represent the structure of **X**?

A

C

B

D

     8872/01
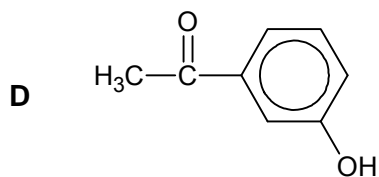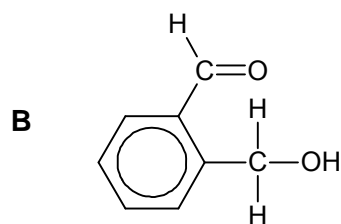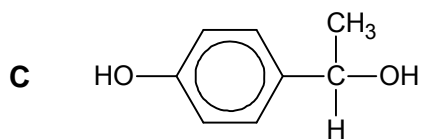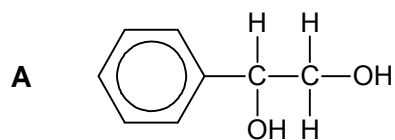
19 Compound **P** has the following structure.

P

Which compound is obtained by substitution when a cyanide ion reacts with **P**?

A

C

B

D

20 Cyanohydrins are useful intermediates in organic syntheses. They can be made by reacting carbonyl compounds with hydrogen cyanide.

Which statement is true about the reaction between propanal and hydrogen cyanide?

A This reaction is a substitution reaction.

B The hybridisation of carbonyl carbon atom changes from sp^2 to sp^3.

C This reaction can be achieved by refluxing the reactants at 60 °C.

**D** The product has one carbon lesser than propanal.

21 Lactic acid occurs naturally, for example in sour milk. Its displayed formula is shown.
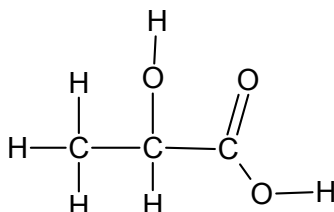
Which reaction occurs with lactic acid?

A It decolourises aqueous bromine rapidly.

B It is insoluble in water.

C It reduces Fehling's reagent.

D Two molecules react with each other in the presence of a strong acid.

22 Which of the following statements about the following cysteine molecule is false?

$$H_2N-\overset{\displaystyle H}{\underset{\displaystyle \underset{\displaystyle SH}{CH_2}}{C}}-CO_2H$$
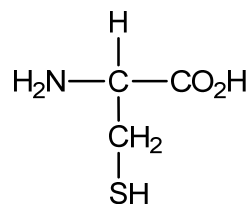
cysteine (cys)

A In a basic medium, cysteine will move towards the positively charged terminal when a current is passed through the medium.

B Cysteine reacts with excess sodium and sodium carbonate separately to give a gaseous product in a mole ratio of 1: 1.

C Cysteine may be formed from $H_2NCH(CN)CH_2SH$.

D Cysteine does not react with ethanol to yield a sweet–smelling product.

23 How many carboxylic acids and alcohols can be produced from the acidic hydrolysis of an ester with molecular formula $C_4H_8O_2$?

	Number of	
	carboxylic acids	alcohols
A	2	3
B	3	3
C	3	4
D	2	4

24 A compound **R** was boiled with aqueous NaOH and the resulting mixture was cooled and acidified. The final products included a product $C_2H_4O_2$ and an alcohol which produces a yellow precipitate with alkaline aqueous iodine.

Compound **R** is

A $CH_3COOCH_2CH_2CH_3$ **B** $CH_3CH_2COOCH_2CH_3$

C $CH_3CH_2COOCH_3$ **D** $(CH_3)_2CHOCOCH_3$

25   Citric acid, which causes the sharp taste of lemon juice, has the following formula.

$$CH_2CO_2H$$
$$HO-C-CO_2H$$
$$CH_2CO_2H$$
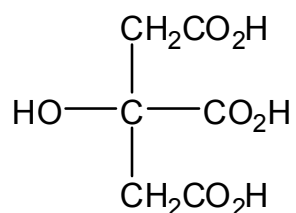
Which of the following reacts completely with 1 mol of citric acid?

A   4 mol of NaOH

B   2 mol of Na

C   4 mol of PCl_5

D   3 mol of ethanoic acid

Section B

For each question, one or more of the three numbered statements **1** to **3** may 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.

26   Chlorine reacts with hot concentrated aqueous sodium hydroxide according to the equation below.

$3Cl_2(g) + 6NaOH(aq) \rightarrow NaClO_3(aq) + 5NaCl(aq) + 3H_2O(l)$

Which conclusions can be drawn from this information?

1   The oxidation state of the chlorine in one of the products is +5.

2   The chlorine undergoes disproportionation.

3   The sodium hydroxide acts as a reducing agent.

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

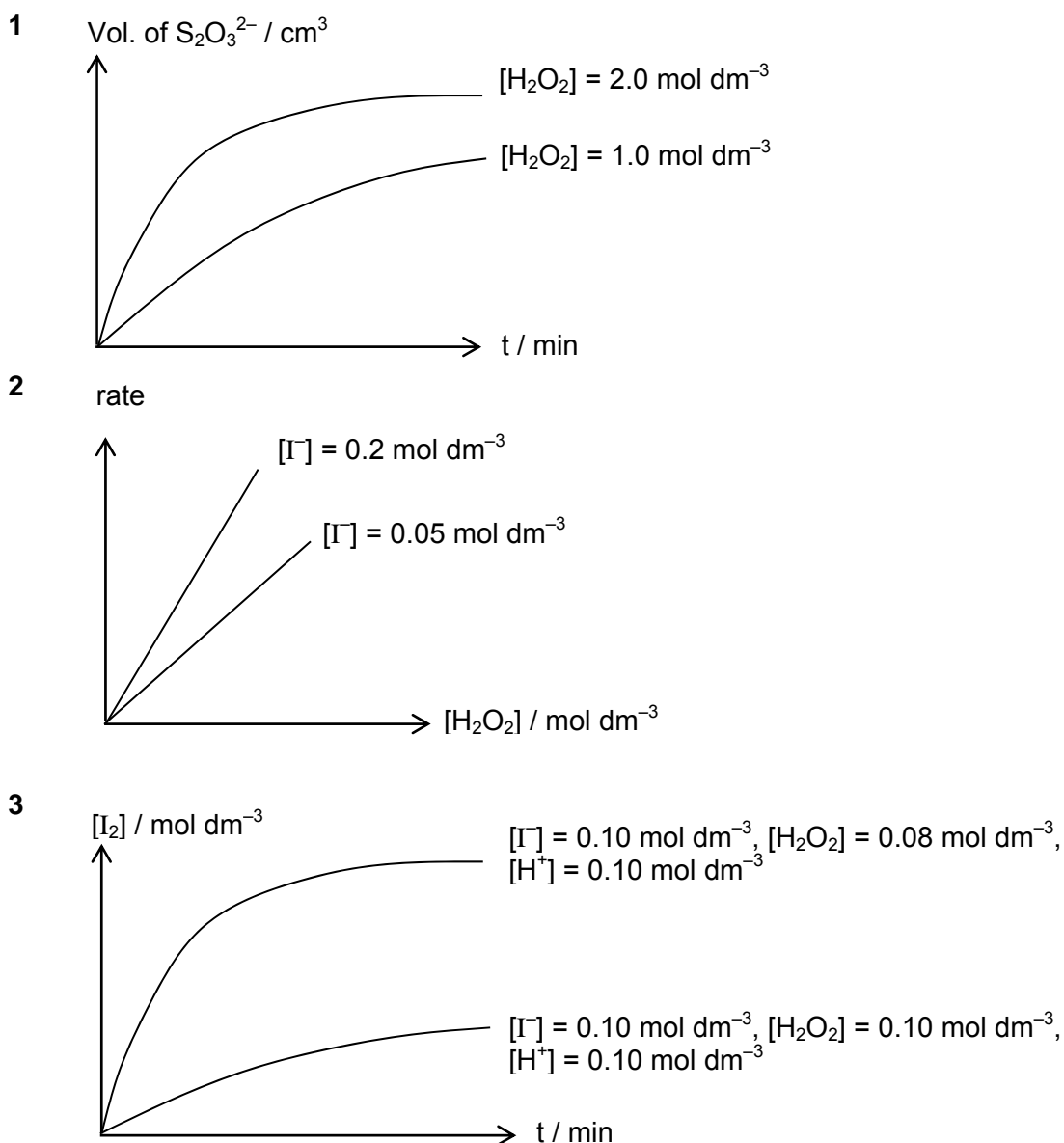| A	B	C	D
1, **2** and **3** are correct	**1** and **2** only are correct	**2** and **3** only are correct	**1** only is correct

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

27 When an acidified solution of hydrogen peroxide is mixed with a solution of potassium iodide, the following reaction occurs:

$$H_2O_2 + 2\,I^- + 2H^+ \rightarrow 2H_2O + I_2$$
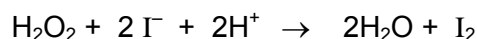
The order of reaction with respect to concentration of hydrogen peroxide may be determined by performing experiment(s) and then graphically analysing the results.

Which of the following plot will allow you to determine the order with respect to concentration of hydrogen peroxide?

1 Vol. of $S_2O_3^{2-}$ / cm^3

$[H_2O_2]$ = 2.0 mol dm^{-3}

$[H_2O_2]$ = 1.0 mol dm^{-3}

t / min

2 rate

$[I^-]$ = 0.2 mol dm^{-3}

$[I^-]$ = 0.05 mol dm^{-3}

$[H_2O_2]$ / mol dm^{-3}

3 $[I_2]$ / mol dm^{-3}

$[I^-]$ = 0.10 mol dm^{-3}, $[H_2O_2]$ = 0.08 mol dm^{-3}, $[H^+]$ = 0.10 mol dm^{-3}

$[I^-]$ = 0.10 mol dm^{-3}, $[H_2O_2]$ = 0.10 mol dm^{-3}, $[H^+]$ = 0.10 mol dm^{-3}

t / min

28 Pentaerythritol is an intermediate in the manufacture of paint.

$$HOCH_2-\underset{\underset{CH_2OH}{|}}{\overset{\overset{CH_2OH}{|}}{C}}-CH_2OH$$
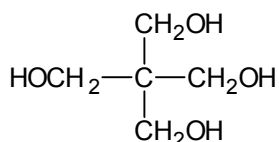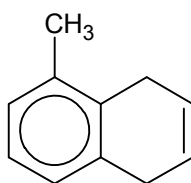
pentaerythritol

Which of the following statements about pentaerythritol are **correct**?

1 It decolourises acidified potassium manganate(VII) on heating.

2 It reacts with potassium metal.

3 It can be synthesised by reducing the following compound with LiA/H$_4$(aq).

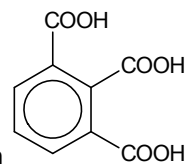$$HOCH_2-\underset{\underset{CHO}{|}}{\overset{\overset{CHO}{|}}{C}}-CH_2OH$$
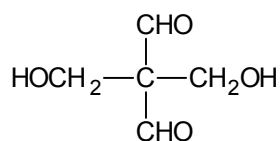
29 Compound **A** has the structure as shown below:

Compound **A**

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

1 **A** undergoes reduction.

2

A reacts with acidified potassium manganate (VII) to form .

3 **A** will decolorise bromine solution in the absence of light.

30 Cyclopentadiene is an important precursor in both organic and inorganic synthesis.

Which of the following is true regarding the cyclopentadiene?

1 Cyclopentadiene turns reddish–brown aqueous bromine colourless.

2 2 moles of CO_2 gas are liberated upon treating 1 mole of cyclopentadiene with hot acidified $KMnO_4$.

3 Cyclopentadiene can be produced by treating 3–bromo–cyclopentene with KOH in ethanol under reflux.

2015 DHS YEAR 6 H1 CHEMISTRY PRELIMINARY EXAMINATION
Paper 1 MCQ – Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C	B	D	B	C	D	D	C	A	C	A	D	C	C	A	B	A	B	D	B

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