1. Nov/2022/Paper_11/No.5

How many σ bonds are present in one $H–C{\equiv}C–C(CH_3)=CH(CH_3)$ molecule?

A 5 **B** 11 **C** 13 **D** 16

2. Nov/2022/Paper_11/No.35

Structural isomerism and stereoisomerism should be considered when answering this question.

How many isomeric compounds with molecular formula $C_5H_6O_4$ contain two $–CO_2H$ groups and one C=C double bond?

A 5 **B** 6 **C** 7 **D** 8

3. Nov/2022/Paper_12/No.28

Which pair includes a hydrocarbon without a chiral centre?

A $CH_3CH_2CH_2CH(CH_3)CH_2CH_3$ $CH_3CH(CH_3)CH(CH_3)CH_2CH_3$

B $CH_3CH_2CH_2CH(CH_2CH_3)CH_3$ $CH_3CH_2CH_2CH(CH_3)CH_2CH_3$

C $CH_3CH_2CH_2CH(CH_3)CH_2CH_3$ $CH_3CH_2CH(CH_3)CH(CH_3)_2$

D $CH_3CH(CH_2CH_3)CH(CH_3)CH_3$ $CH_3CH(CH_3)CH_2CH(CH_3)_2$

4. Nov/2022/Paper_12/No.30

cis-but-2-ene reacts with cold dilute acidified potassium manganate(VII) solution to give product X.

cis-but-2-ene reacts with hot concentrated acidified potassium manganate(VII) solution to give product Y.

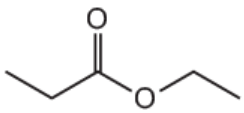
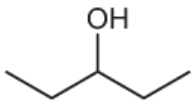
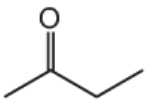
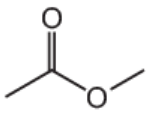
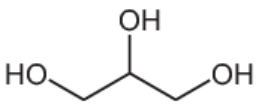
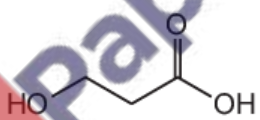
Which row describing the reactions of X and Y is correct?

	when sodium metal is added to separate samples of X and Y	when sodium hydroxide solution is added to separate samples of X and Y
A	both X and Y will react	neither X nor Y will react
B	both X and Y will react	only one of X and Y will react
C	only one of X and Y will react	neither X nor Y will react
D	only one of X and Y will react	only one of X and Y will react

5. Nov/2022/Paper_21/No.4

Organic compounds can be distinguished using chemical tests.
Table 4.1 shows four pairs of compounds.

Table 4.1

organic compounds		reagent	positive result of chemical test on identified compound
A1 	**A2** 		
B1 	**B2** 		
C1 	**C2** 		
D1 	**D2** 		

(a) Complete Table 4.1 to:

- identify a reagent that could distinguish between the compounds in each pair
- give the **positive** result of the chemical test **and** identify which compound shows this result.

Use a different reagent for each test. [8]

(b) **C1** has melting point −94 °C and boiling point +49 °C.

Explain these properties by referring to the type of van der Waals' forces between molecules.

.....

.....

..... [2]

(c) Draw the structure of the cis isomer of **C2**.

[1]

(d) **C2** forms a polymer when heated gently.

(i) Identify the type of polymer that forms from **C2**.

..... [1]

(ii) Draw one repeat unit of the polymer formed from **C2**.

[2]

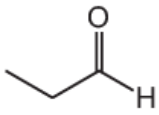
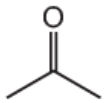
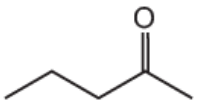
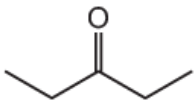
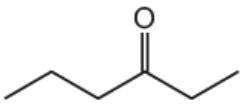
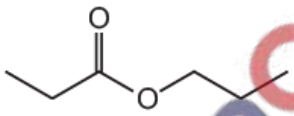
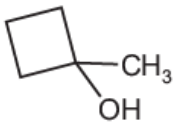
[Total: 14]

6. Nov/2022/Paper_22/No.3(a, b)

Organic compounds can be distinguished using chemical tests and analytical techniques.

(a) Table 3.1 shows four pairs of organic compounds.

Table 3.1

organic compounds		reagent	positive result of chemical test on identified compound
A1 	**A2** 		
B1 	**B2** 		
C1 	**C2** 		
D1 	**D2** 		

(i) Complete Table 3.1 to:

- identify a reagent which can distinguish between the compounds in each pair
- give the **positive** result of the chemical test **and** identify which compound shows this result.

Use a different reagent for each test. [8]

(ii) **A1** and **A2** are structural isomers.

Define structural isomers.

.....

..... [1]

(iii) Give the systematic name of **B2**.

..... [1]

(iv) Deduce the molecular formula of **D1**.

..... [1]

(b) **D2** forms polymer **Z** when heated gently.

(i) Identify the type of polymer that forms from **D2**.

..... [1]

(ii) Draw one repeat unit of polymer **Z**.

[2]

Table 3.2

bond	functional group containing the bond	characteristic infrared absorption range (in wavenumbers) / cm^{-1}
C–O	hydroxy, ester	1040–1300
C=C	aromatic compound, alkene	1500–1680
C=O	amide carbonyl, carboxyl ester	1640–1690 1670–1740 1710–1750
C≡N	nitrile	2200–2250
C–H	alkane	2850–3100
N–H	amine, amide	3300–3500
O–H	carboxyl hydroxy	2500–3000 3200–3650

Both spectra show absorptions between 2850 and 2950 cm^{-1} owing to C–H bonds in each molecule.

(i) Use the two infrared spectra and Table 3.2 to identify the functional group present only in **E**.
Explain your answer, referring only to absorptions at frequencies greater than 1500 cm^{-1}.

functional group .....

explanation .....

.....

[1]

(ii) Use the infrared spectrum of **F** to identify the functional group formed when **E** reacts with cold dilute acidified $KMnO_4(aq)$.
Explain your answer, referring only to absorptions at frequencies greater than 1500 cm^{-1}.

functional group .....

explanation .....

.....

[1]

(iii) The mass spectrum of **E** shows a molecular ion peak and an M+2 peak of approximately equal abundance at *m*/*e* = 120 and 122.

Deduce the relative molecular mass, M_r, of **E**.

M_r = ... [1]