



CANDIDATE
NAME

SUGGESTED ANSWERS

CG

H1 GROUP

1 / 2 / 3

CHEMISTRY

8873 /01

Paper 1

XX September 2025

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name and class in the spaces at the top of this page and on the Answer Sheet in the spaces provided unless this has been done for you.

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 The table below contains incomplete information about three ions, E, F and G, which are isoelectronic (same number of electrons).

The atoms of F and G are isotopes.

ion	mass number	atomic number	number of neutrons	number of electrons	charge
E	55	25	31		y
F	56	26			
G	x				3+

What are the possible values of **x** and **y**?

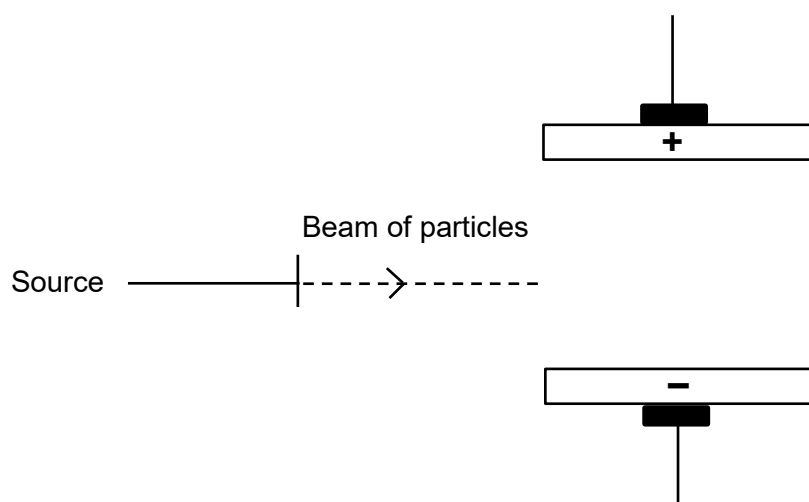
	x	y
A	56	2+
B	56	3+
C	57	2+
D	57	3+

Answer: C

ion	Mass number	Atomic number	Number of neutrons	Number of electrons	charge
X	55	25	30	23	2+
Y	56	26	30	23	3+
Z	57	26	31	23	3+

3

- 2 In two separate experiments, a beam of protons and a beam of electrons, travelling at the same velocity, is passed through an electric field as shown.



Which set of observations is correct?

- A The two beams are deflected in opposite directions. The electron beam is deflected the most.
- B The two beams are deflected in opposite directions. The proton beam is deflected the most.
- C The two beams are deflected in the same direction. The electron beam is deflected the most.
- D The two beams are deflected in the same direction. The proton beam is deflected the most.

Answer: A

Protons are positively charged and hence are deflected towards the negative plate. Electrons are negatively charged and hence are deflected towards the positive plate.

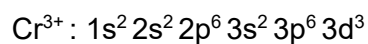
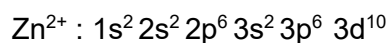
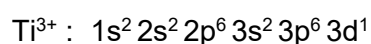
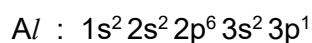
As electrons are lighter than protons, electrons are deflected more than protons.

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

Which species has three unpaired electrons?

- A Al
- B Ti^{3+}
- C Zn^{2+}
- D Cr^{3+}

Answer: D



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

How many atoms are there in 100 cm³ of oxygen gas measured at s.t.p.?

- A 2.51×10^{21} B 2.65×10^{21} C 5.02×10^{21} D 5.30×10^{21}

Answer: D

$$\begin{aligned}\text{Amount of O}_2 &= (100 \div 1000) \div 22.7 \\ &= 0.0044053 \text{ mol}\end{aligned}$$

$$\begin{aligned}\text{No. of O}_2 \text{ molecules} &= 0.0044053 \times 6.02 \times 10^{23} \\ &= 2.652 \times 10^{21}\end{aligned}$$

$$\begin{aligned}\text{No. of O atoms} &= 2.652 \times 10^{21} \times 2 \\ &= 5.30 \times 10^{21}\end{aligned}$$

- 5 The relative atomic mass of antimony, which consists of the isotopes ¹²¹Sb and ¹²³Sb, is 121.8.

Calculate the percentage of ¹²³Sb in the isotopic mixture.

- A 40% B 45% C 50% D 60%

Ans: A

Let the percentage of ¹²³Sb in the isotopic mixture be x%

$$\begin{aligned}\frac{x}{100} (123) + \frac{100-x}{100} (121) &= 121.8 \\ 123x - 121x &= 80 \\ x &= 40\end{aligned}$$

- 6 The boiling point of ethylamine, CH₃CH₂NH₂, is 16.6 °C.

Which bonds are broken when ethylamine is boiled?

- 1 instantaneous dipole-induced dipole interactions
- 2 hydrogen bonds
- 3 covalent bonds

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

Answer: B

Boiling point of molecules results in overcoming intermolecular forces of attractions. The main dominant intermolecular force present in ethylamine is hydrogen bonds. The weaker id-id attractions are also present.

- 7 Three substances, H, J and K, have physical properties as shown.

substance	H	J	K
melting point / °C	801	-7	3550
boiling point / °C	1413	59	4827
electrical conductivity when in solid state	poor	poor	good

What could be the identities of H, J and K?

	H	J	K
A	bromine	sodium chloride	graphite
B	bromine	sodium chloride	silicon dioxide
C	sodium chloride	bromine	graphite
D	sodium chloride	bromine	silicon dioxide

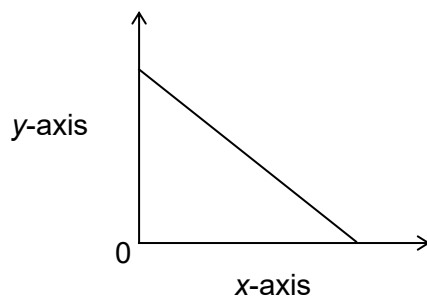
Answer: C

Ionic compound NaCl is a non-electrical conductor in solids as ions are fixed in position. Bromine is a covalent compound with no mobile ions and no mobile electrons. Graphite is an electrical conductor due to free delocalised electrons along the layers.

Melting and boiling points of bromine is lower than NaCl as the instantaneous dipole-induced dipole interactions between bromine molecules is weaker than the electrostatic forces of attraction between oppositely charged ions in NaCl.

8 The kinetics of a zero order reaction $L \rightarrow M$ was investigated.

A pair of quantities was plotted and the following graph was obtained.



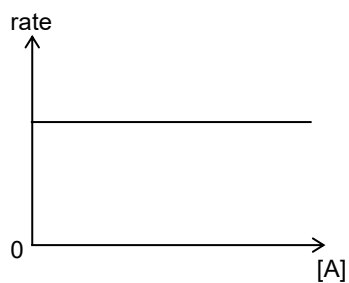
Which pair of quantities gives the graph above?

	y-axis	x-axis
A	rate	[L]
B	rate	[M]
C	[L]	time
D	[M]	time

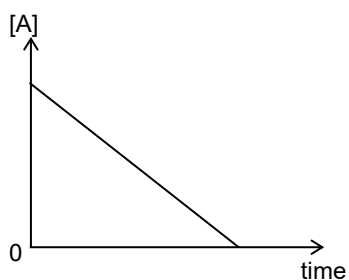
Answer: C

For a zero order reaction, rate is independent of concentration of reactant. So,

the rate vs [reactant] graph is as such:



While the [reactant] vs time graph is as such:



- 9 There are 39 known isotopes of radon (Rn) from ^{193}Rn to ^{241}Rn . The most stable isotope is ^{222}Rn with a half-life of 3.8 days.

Given that the decay of ^{222}Rn is a first order reaction, how long will it take for ^{222}Rn to decrease to one-eighth of its original amount?

- A 7.6 days B 11.4 days C 15.2 days D 30.4 days

Answer: B

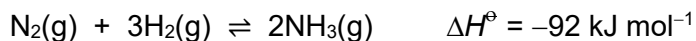
$$\frac{c(\text{final})}{c(\text{initial})} = \left(\frac{1}{2}\right)^n$$

$$\frac{1}{8} = \left(\frac{1}{2}\right)^n$$

$$n = 3$$

$$\text{time taken} = 3 \times 3.8 = 11.4 \text{ days}$$

- 10 Which changes in conditions would result in a change in the value of the equilibrium constant, K_c , for the following reaction?



- 1 increasing temperature
- 2 increasing the concentration of N_2
- 3 adding a catalyst

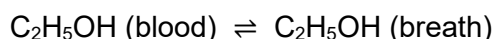
- A 1, 2 and 3 B 1 and 2 only C 2 and 3 only D 1 only

Answer: D

K_c is only affected by temperature. It is not affected by the concentration of reactants or products or by the presence of catalyst.

- 11 Ethanol in blood can be assumed to be in dynamic equilibrium with ethanol in breath.

This equilibrium forms the basis of the roadside breathalyser test.



The equilibrium constant, K_c , for this equilibrium is 4.3×10^{-4} .

The concentration of ethanol in a motorist's blood is found to be 75 mg in 100 cm³ of blood.

What is the concentration of ethanol in the motorist's breath in mg per 100 cm³?

- A 3.23×10^{-4} B 3.23×10^{-2} C 1.74×10^5 D 3.23×10^6

Answer: B

$$K_c = \frac{[\text{C}_2\text{H}_5\text{OH}(\text{breath})]}{[\text{C}_2\text{H}_5\text{OH}(\text{blood})]}$$

$$K_c = 4.3 \times 10^{-4} = \frac{[\text{C}_2\text{H}_5\text{OH}(\text{breath})]}{75}$$

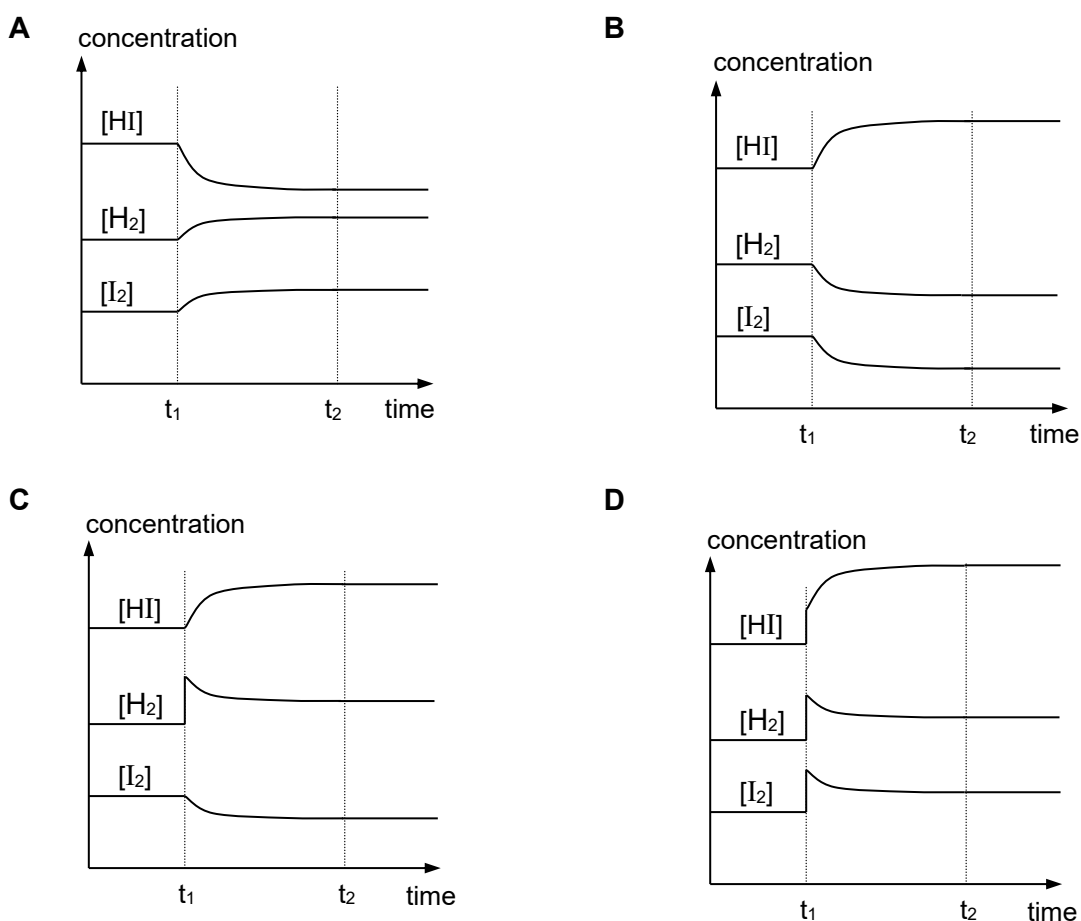
$$[\text{C}_2\text{H}_5\text{OH}(\text{breath})] = 0.3225 = 3.23 \times 10^{-2} \text{ mg per } 100 \text{ cm}^3$$

- 12 Hydrogen reacts with iodine to form hydrogen iodide. This reaction is reversible and is allowed to reach an equilibrium.



At time = t_1 , the temperature was increased.

Which graph correctly shows the changes in the concentrations of hydrogen, iodine and hydrogen iodide?



Answer: **B**

When the temperature of the system was increased at t_1 , by Le Chatelier's Principle, the equilibrium position shifts to the right to absorb the heat added. [HI] increased while [H₂] and [I₂] decreased. So Option A is wrong.

A new equilibrium is achieved at t_2 .

The effect of temperature does not result in sharp spikes or drops in the concentration.

Option C is wrong because the sharp increase in $[H_2]$ at t_1 indicates that there was an addition of H_2 and not due to a change in temperature.

Option D is wrong because the sharp increase in $[HI]$, $[H_2]$ and $[I_2]$ at t_1 indicates that there was an increase in pressure or decrease in volume of the system.

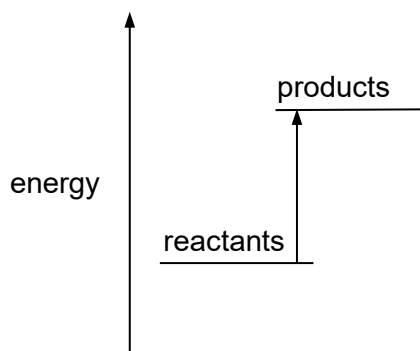
13 Which statement best defines the term *bond energy* for HBr?

- A Energy released when one mole of HBr is formed from its gaseous atoms.
- B Energy released when one mole of HBr is formed from its gaseous ions.
- C Energy required when one molecule of HBr is broken down into its gaseous atoms.
- D Energy required when one mole of HBr is broken down into its gaseous atoms.

Ans: D

Bond energy (of dissociation) is the **energy required** to break **one mole of covalent bonds** between two atoms in the gaseous state.

14 Which change could have the energy level diagram shown?



- A $H_2O(g) \rightarrow H_2O(l)$
- B $C(s) + O_2(g) \rightarrow CO_2(g)$
- C $Li^+(g) + H^-(g) \rightarrow LiH(s)$
- D $LiOH(s) \rightarrow Li^+(g) + OH^-(g)$

Answer: D

The diagram shows an endothermic reaction

Option A : Condensation is exothermic

Option B : combustion reaction is exothermic

Option C : lattice energy is exothermic

Option D : breaking ionic structure (opposite of LE) is endothermic

15 Use of the Data Booklet is relevant to this question.

The lattice energies of rubidium fluoride, RbF, and caesium chloride, CsCl, are shown in the table.

compound	lattice energy / kJ mol ⁻¹
RbF	-760
CsCl	-650

Which value is likely to be the lattice energy of caesium fluoride, CsF, in kJ mol⁻¹?

A -460

B -550

C -680

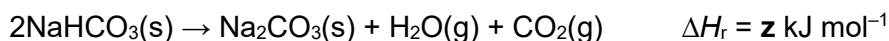
D -800

Ans: C

$$|Lattice\ Energy| \propto \left| \frac{q_+ \times q_-}{(r_+ + r_-)} \right|$$

Both cations are singly charged. Cs⁺ has a larger ionic radius than Rb⁺. F⁻ has a smaller ionic radius than Cl⁻. Magnitude of lattice energy of CsF likely to be in between RbF and CsCl.

16 Sodium bicarbonate, NaHCO₃, decomposes into sodium carbonate, water and carbon dioxide when heated.



The following enthalpy changes of formation are given.

compound	$\Delta H_f / \text{kJ mol}^{-1}$
NaHCO ₃ (s)	-948
Na ₂ CO ₃ (s)	-1131
H ₂ O(g)	-286
CO ₂ (g)	-394

What is the value of z?

A -85

B +85

C -863

D +863

Ans: B

$$\Delta H_r = \Sigma \Delta H_f(\text{products}) - \Sigma \Delta H_f(\text{reactants})$$

$$\Delta H_r = -1131 - 394 - 286 - (2)(-948) = +85 \text{ kJ mol}^{-1}$$

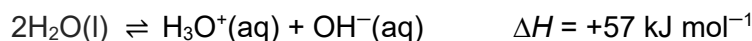
17 What is the definition of an Arrhenius base?

- A A substance that accepts hydrogen ions.
- B A substance that donates a lone pair of electrons.
- C A substance that produces hydroxide ions in aqueous solution.
- D A substance that readily reacts with an acid to form a salt and water only.

Answer: C

Arrhenius acid and base theory of water states Arrhenius base dissolves in water to form hydroxide ions.

18 The equation for the dissociation of water is as follows:



Which statement about the dissociation of water is correct?

- A As the volume of water increases, the pH of water also increases.
- B As temperature increases, the pH of water also increases.
- C The sum of pH and pOH is 14 at all temperatures.
- D $[\text{H}^+]$ will always equal to $[\text{OH}^-]$ at all temperatures.

Answer D

A is wrong because both volume and no of moles of water increase proportionally, $[\text{H}^+]$ remains constant, hence pH should be constant.

B is wrong because as temperature increases, the forward endothermic reaction is favoured. $[\text{H}^+]$ increases, pH decreases.

C is wrong because $\text{pH} + \text{pOH} = 14$ is only true at 25°C .

D is correct because at all temperatures, $[\text{H}^+] = [\text{OH}^-]$.

19 What is the pH of a solution containing 0.3 mol dm^{-3} sulfuric acid?

A 0.22

B 0.52

C 1.00

D 13.8

Answer: A

Sulfuric acid, H_2SO_4 , is a dibasic acid.

$$[\text{H}^+] = 2 \times 0.3 = 0.6 \text{ mol dm}^{-3}$$

$$\text{pH} = -\lg 0.6 = 0.22$$

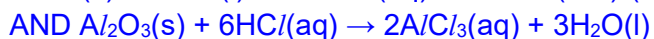
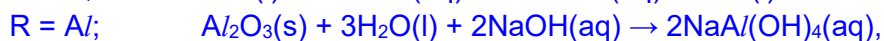
20 The table below describes the reaction of oxides of three elements in Period 3 of the Periodic Table when the oxides are reacted with acid or base.

element	reaction of oxide of element
P	dissolves in HCl(aq) to give a colourless solution
Q	dissolves in NaOH(aq) to give a colourless solution
R	dissolves in both NaOH(aq) and HCl(aq) , each giving a colourless solution

What could be the identities of P, Q and R?

	P	Q	R
A	Mg	S	Al
B	Na	Si	Al
C	Al	S	Si
D	S	Al	Mg

Answer: A



(Note: Q cannot be Si because SiO_2 only dissolves in **concentrated** NaOH.)

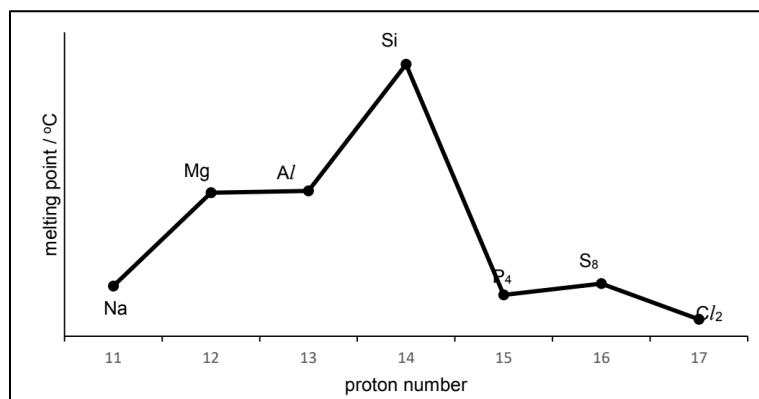
21 Which physical properties of the elements Na to Cl in Period 3 of the Periodic Table show a strictly decreasing trend across the period?

- 1 melting point
- 2 atomic radius
- 3 ionic radius

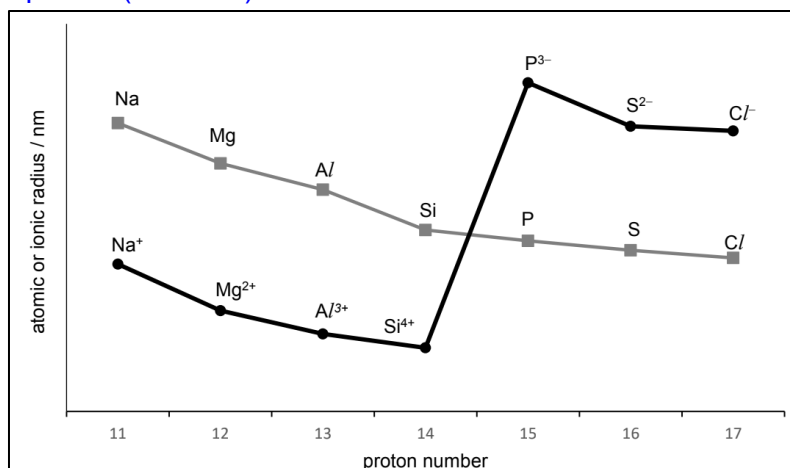
A 1, 2 and 3 **B** 1 only **C** 2 only **D** 2 and 3 only

Answer: C

Option 1 (incorrect):



Option 2 (correct); Option 3 (incorrect):



22 For the hydrides of the elements in Group 17, which trends down the group are correct?

	ease of decomposition	bond length
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

Answer: D

Down Group 17, the **size of the halogen atom increases**, i.e. size of Cl < Br < I, hence the **valence orbitals that are used in bonding become larger and more diffused**.

Thus the **effectiveness of overlap between valence atomic orbitals decreases** (i.e. becomes less effective) from chlorine to iodine resulting in a **decrease in bond strength and therefore an increase in bond length**. In addition, since **lesser energy is required to overcome the H–X bond**, it is **easier to break the H–X bond** (i.e., **easier to decompose**).

23 Which row regarding the shapes of ethane, ethene and benzene is correct?

	ethane	ethene	benzene
A	non-planar	non-planar	planar
B	non-planar	planar	planar
C	planar	non-planar	non-planar
D	planar	planar	non-planar

Answer: B

Ethane is non-planar because it is tetrahedral in shape.

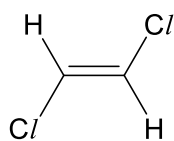
Ethene is planar because both carbon atoms are trigonal planar.

Benzene is planar because all carbon atoms are trigonal planar.

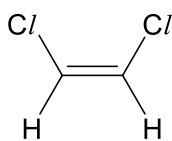
24 Which molecule can exhibit *cis-trans* isomerism?

- A** 1,1-dichloroethene
- B** 1,2-dichloroethene
- C** 1,1,2-trichloroethene
- D** tetrachloroethene

Answer: B

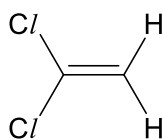


trans-1,2-dichloroethene

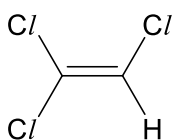


cis-1,2-dichloroethene

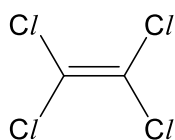
All other options have 2 same atoms bonded to at least one carbon atom, thus they cannot exhibit *cis-trans* isomerism.



1,1-dichloroethene



1,1,2-trichloroethene



tetrachloroethene

25 Which row **incorrectly** describes the change in bond angle about the carbon atom after a reaction?

	reaction	bond angle
A	CH ₄ with Cl ₂ (g) under UV light	no change
B	CH ₃ CH ₂ OH with conc. H ₂ SO ₄ and heat	increased
C	CH ₃ CH ₂ Br with aqueous NaOH and heat	no change
D	CH ₃ CH ₂ Br with ethanolic NaOH and heat	decreased

Answer: D

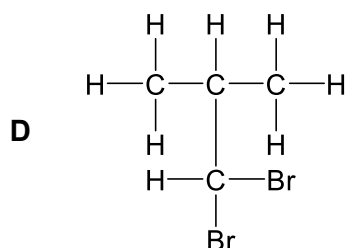
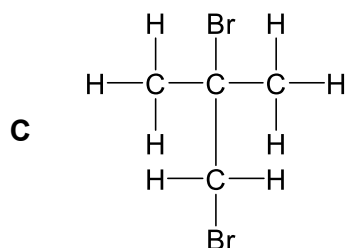
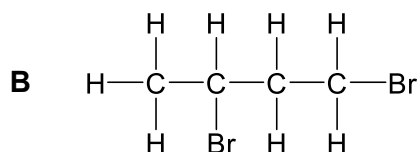
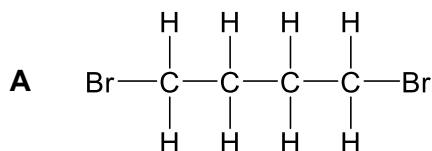
A: Substitution reaction. CH₄ becomes CH₃Cl. Carbon atom still forms four σ bonds so the shape is still tetrahedral, and bond angle is still 109.5°.

B: Elimination reaction. CH₃CH₂OH becomes CH₂=CH₂. In CH₃CH₂OH, each carbon atom forms four σ bonds so the shape is tetrahedral, and bond angle is 109.5° about each carbon atom. After elimination, CH₂=CH₂ is obtained, where each carbon atom forms three σ bonds and one π bond so the shape is trigonal planar, and bond angle is 120° about each carbon atom.

C: Substitution reaction. CH₃CH₂Br becomes CH₃CH₂OH. Each carbon atom still forms four σ bonds so the shape is still tetrahedral, and bond angle is still 109.5° about each carbon atom.

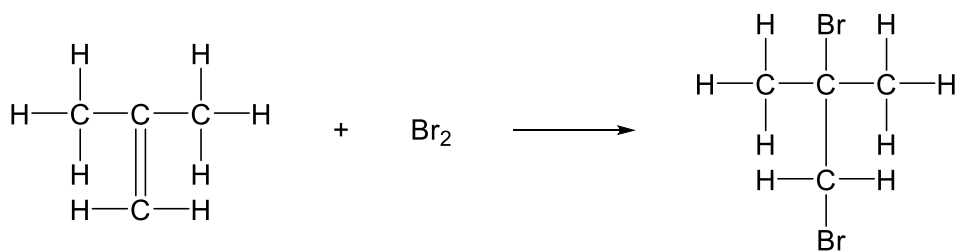
D: Elimination reaction. CH₃CH₂Br becomes CH₂=CH₂. In CH₃CH₂Br, each carbon atom forms four σ bonds so the shape is tetrahedral, and bond angle is 109.5° about each carbon atom. After elimination, CH₂=CH₂ is obtained, where each carbon atom forms three σ bonds and one π bond so the shape is trigonal planar, and bond angle is 120° about each carbon atom. Bond angle has increased, not decreased.

26 Which compound could be formed by the action of bromine on an alkene of formula C₄H₈?

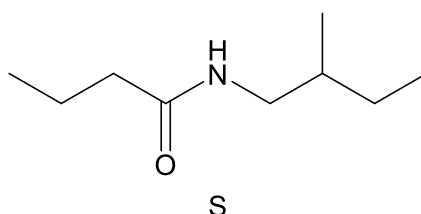


Answer: C

Alkenes undergo addition reaction with Br₂. The Br atoms will be added across the C=C bond, so the Br atoms should be on **adjacent carbon atoms** in the product.



27 The skeletal formula of S is shown.

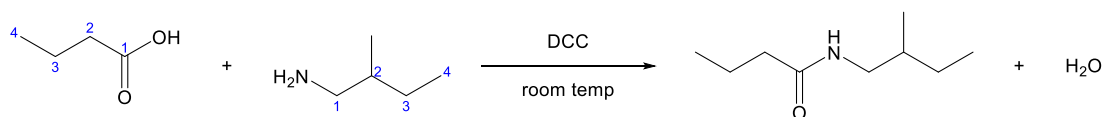


S can be made by reacting compounds T and U in the presence of dichlorohexylcarbodiimide, DCC.

What are the identities of T and U?

	T	U
A	propanoic acid	2-methylbutylamine
B	propanoic acid	3-methylbutylamine
C	butanoic acid	2-methylbutylamine
D	butanoic acid	3-methylbutylamine

Answer: C



28 Platinum nanoparticles are used in a catalytic converter.

Which statements regarding platinum nanoparticles are correct?

- For the same mass of platinum, there is an increase in frequency of effective collisions between reactants and platinum nanoparticles when the diameter of nanoparticles is decreased.
- Platinum nanoparticles are used since they have a large surface area to volume ratio.
- Platinum nanoparticles form stronger bonds with reactants than bulk platinum.

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

Answer: A

Option 1 (correct): When diameter is decreased, there is a larger surface area to volume ratio. Hence, even with the same mass of platinum, there are more catalytic sites available.

Option 2 (correct): A large surface area to volume ratio allows the use of a lower mass of platinum to achieve similar catalytic activity, thus saving on cost.

Option 3 (incorrect): There is no direct link between bond strength and size of platinum particle used.

29 Some properties of polymers W, X, Y and Z are shown.

polymer	properties of the polymer
W	decomposes when heated and cannot be reshaped easily
X	low tensile strength and can be recycled
Y	softens when heated and can be reshaped easily
Z	high tensile strength and rigid

Which polymers are thermosets?

- A** W and X **B** W and Z **C** X and Y **D** Y and Z

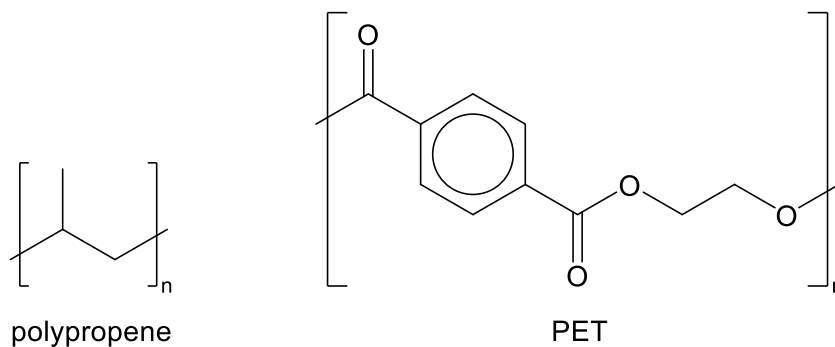
Answer: B

Thermosets have extensive cross-linking between polymer chains. These strong covalent bonds between polymer chains cannot be easily broken by warming.

The polymers cannot be softened by heat so thermosets cannot be reshaped easily. They will decompose when reheated.

The cross-linking also causes thermosets to be rigid (harder and stiffer) with higher tensile strength.

- 30 Many bottles used to contain liquids are made with polypropene or poly(ethylene terephthalate), also known as PET.



Which statement is correct?

- A PET can be used for storing alkaline detergent because it is a condensation polymer.
- B Polypropene can be used for storing alkaline detergent because it has no double bonds.
- C PET cannot be used for storing alkaline detergent because the ester functional group in PET can react with alkali.
- D Polypropene cannot be used for storing alkaline detergent because the C–C bonds in polypropene can react with alkali.

Answer: C

The ester functional group linking the monomers together in PET can be hydrolysed by alkalis, so PET cannot be used for storing alkaline cleaning materials because PET will degrade (react or dissolve).

1	2	3	4	5	6	7	8	9	10
C	A	D	D	A	B	C	C	B	D
11	12	13	14	15	16	17	18	19	20
B	B	D	D	C	B	C	D	A	A
21	22	23	24	25	26	27	28	29	30
C	D	B	B	D	C	C	A	B	C