

Past-paper walk-through

Shapes of organic molecules; and bonds ■ 13.3

eXercise

Questions in this set

- 9701/12 N25 Q5 ■ 1 mark
- 9701/12 N25 Q25 ■ 1 mark
- 9701/14 N25 Q6 ■ 1 mark

Question 5

9701/12 N25 ■ Q5 ■ 1 mark

- 5 The bonding between two atoms of nitrogen in an N_2 molecule involves the hybridisation of atomic orbitals to form sp orbitals.

Which row is correct?

	formation of the σ bond between the nitrogen atoms in N_2	type of orbital which contains the lone pair of electrons on each nitrogen atom in N_2
A	an sp orbital from one atom overlaps with an sp orbital of the other atom	p
B	an sp orbital from one atom overlaps with an sp orbital of the other atom	sp
C	an s orbital from one atom overlaps with a p orbital of the other atom	p

Question 5

D

an s orbital from one atom overlaps
with a p orbital of the other atom

sp

Solution 5

Answer: **B**

Why

- Each nitrogen in N_2 is sp hybridised, giving two sp orbitals and two unhybridised p orbitals.
- The σ bond comes from head-on overlap of one sp orbital from each atom.
- The remaining sp orbital on each nitrogen holds its lone pair; the p orbitals make the two π bonds.

Question 25

9701/12 N25 ■ Q25 ■ 1 mark

25 Two statements about a molecule of methanal are given.

- 1 It is planar.
- 2 It contains three σ bonds.

Which statements are correct?

A both 1 and 2

B 1 only

C 2 only

D neither 1 nor 2

Solution 25

Answer: **A**

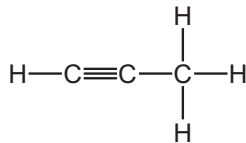
Why

- Methanal's carbon is sp^2 hybridised, so the whole molecule is planar.
- It has two C–H bonds and one C=O.
- A double bond is one σ plus one π , so there are three σ bonds in total – both statements hold.

Question 6

9701/14 N25 ■ Q6 ■ 1 mark

- 6** The diagram shows the bonding in a molecule of propyne.



Which types of hybridisation are shown by the carbon atoms in propyne?

- A** sp , sp^2 and sp^3
- B** sp and sp^3 only

Question 6

C sp^2 and sp^3 only

D sp^2 only

Solution 6

Answer: **B**

Why

- The two carbons of the $\text{C}\equiv\text{C}$ triple bond are sp hybridised.
- The methyl carbon has four single bonds, so it is sp^3 .
- There is no trigonal-planar carbon anywhere in propyne, so no sp^2 appears.