14.2 Further Aspects of Bonding

Mark Schemes

Course	DP IB Chemistry
Section	14. Chemical Bonding & Structure (HL only)
Topic	14.2 Further Aspects of Bonding
Difficulty	Medium

To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

1

The correct answer is **B** because:

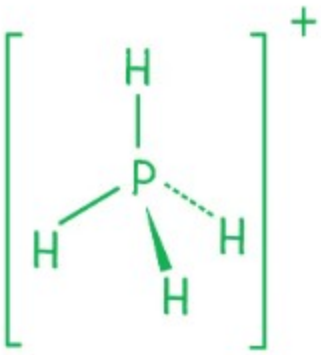
- Structures I and III have resonance structures
- This is because they both contain more than one bonded oxygen and the electrons in the double bond are able to spread themselves evenly across both oxygens

A, **C** & **D** are incorrect as	structure II is incorrect as it does not contain other carbon oxygen single bonds to allow the double bond electrons to spread across to

2

The correct answer is **A** because:

- Phosphorus is in group 15 so has 5 electrons in its outer shell
- Four of these electrons are involved in bonds to the four hydrogen atoms
- The remaining electron is removed as the ion has a positive charge
- This gives the molecule four electron domains
- We can determine hybridisation of the central atom from the number of electron domains
- Four bond pairs and no lone pairs give the molecular a tetrahedral shape



B, **C** & **D** are incorrect as	these options give the incorrect molecular shape and hybridisation of the central atom

3

The correct answer is **A** because:

- The breakdown of O_2 involves shorter wavelength light (λ <242 nm) than the breakdown of O_3 (λ < 330 nm)
- The difference is due to the relative strengths of the O–O bonds in the two molecules
- O_3 has a bond order of 1.5 whereas O_2 has a bond order of 2
- The stronger bonds in O_2 require the higher energy radiation of the shorter wavelength to break

B is incorrect as	O_2 bond dissociation occurs at a higher energy than O_3 as O_2 bonds are stronger
C is incorrect as	O_3 bonds are longer than O_2 bonds
D is incorrect as	O_3 bond dissociation occurs at a lower frequency of light than O_2 (remember wavelength and frequency are inversely proportional)

4

The correct answer is **A** because:

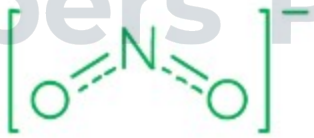
- Carbon has 3 bond pairs
- This gives it 3 electron domains so will be sp^2 hybridised
- Oxygen has 1 bond pair and two lone pairs
- This gives it 3 electron domains so will be sp^2 hybridised
- Electron domains refer to the number of bond pairs and lone pairs around an atom

B, **C** & **D** are incorrect as	they give the wrong hybridisation types for carbon and oxygen

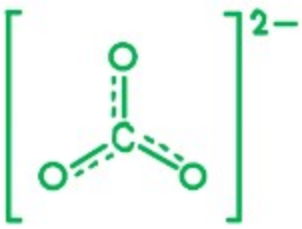
5

The correct answer is **C** because:

- Structures II has two nitrogen oxygen bonds
  - The pi electrons in the nitrogen oxygen double bond spread across both these bonds
  -



- Structures III has three carbon oxygen bonds
  - The pi electrons in the carbon oxygen double bond spread across all three of these bonds
  -



A, **B** & **D** are incorrect as	Structure I only has no other bonds in which the pi electrons in the carbon oxygen double bond can spread across