



(ii) Explain why both bonds in the ozone molecule are the same length. You may wish to draw a diagram.

[1]

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(iii) Using section 10 of the data book, predict the bond lengths in the ozone molecule.

[1]

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(iv) Describe the difference in bond strengths in ozone and oxygen, and how this affects the energy of radiation reaching the Earth's surface.

[2]

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(v) When oxygen absorbs radiation, homolytic fission may occur. Determine the wavelength of light absorbed by a single molecule of oxygen. Use sections 1, 2 and 11 of the data book. Show your working.

[2]

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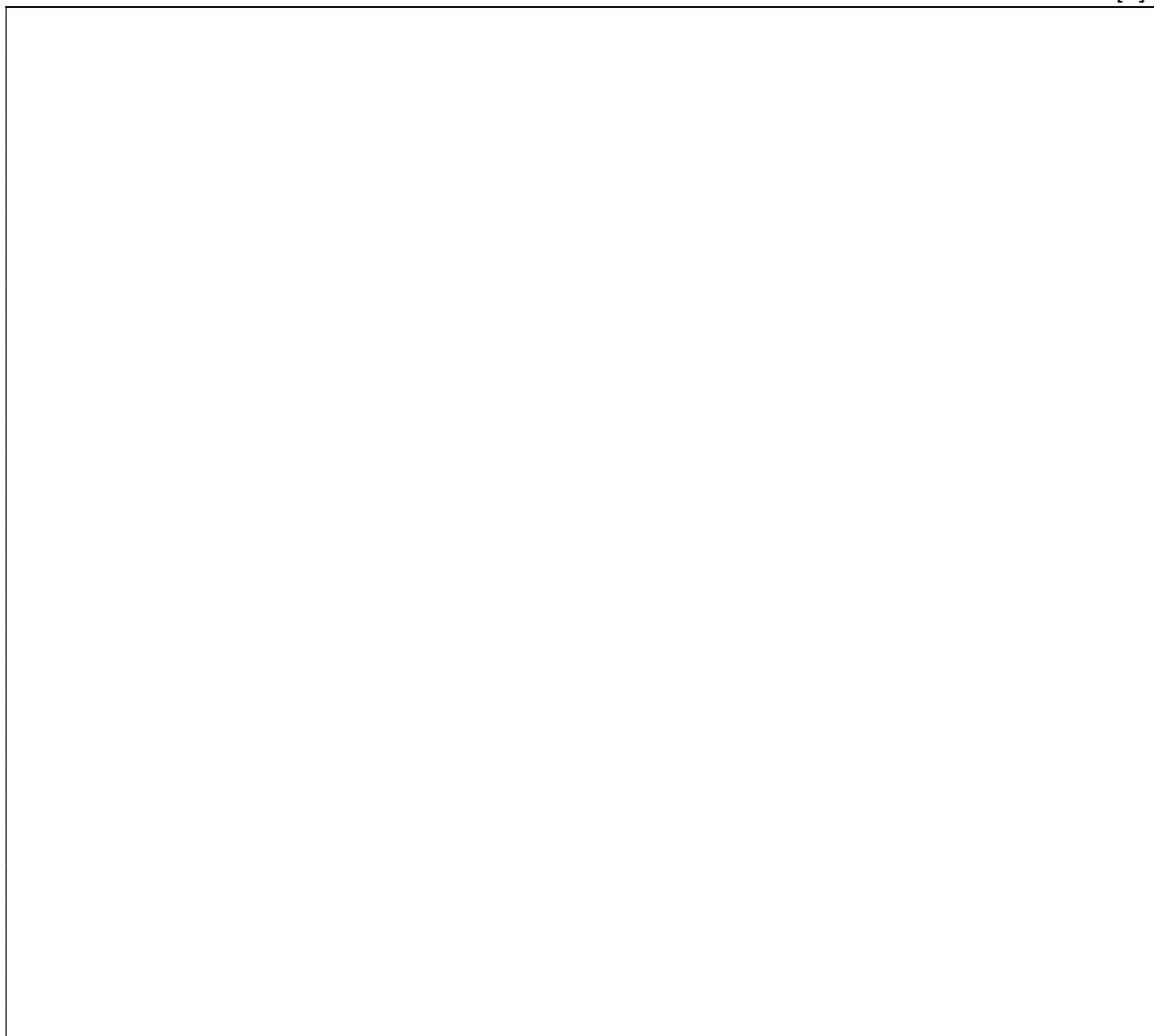
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3. (a) VSEPR theory can be used to predict the shapes of molecules, like xenon tetrafluoride ( $\text{XeF}_4$ ), iodine trifluoride ( $\text{IF}_3$ ) and the phosphorus hexachloride ion ( $\text{PCl}_6^-$ ).

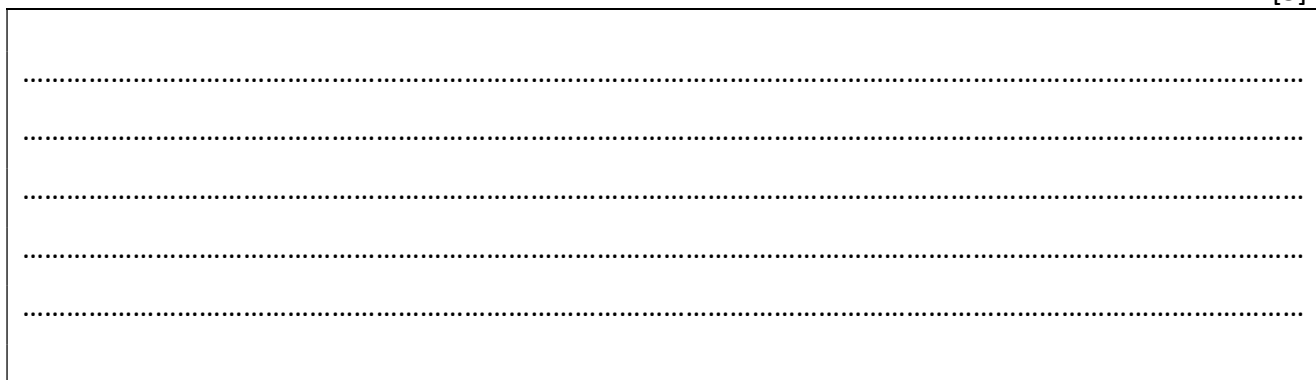
(i) Draw Lewis (electron dot) structures to represent  $\text{XeF}_4$ ,  $\text{IF}_3$  and  $\text{PCl}_6^-$ . State the **shapes** of the molecules/molecular ion.

[6]



(ii) Determine which of  $\text{XeF}_4$ ,  $\text{IF}_3$  and  $\text{PCl}_6^-$  would be *polar*. Outline your reasoning.

[3]



4. Ethane (C<sub>2</sub>H<sub>6</sub>) has only single bonds, ethene (C<sub>2</sub>H<sub>4</sub>) has one double bond and ethyne (C<sub>2</sub>H<sub>2</sub>) has one triple bond.

(a) The bonding in these molecules may also be described in terms of *sigma* and *pi* bonds.

(i) Explain what is meant by the terms *sigma bond* and *pi bond*.

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(ii) Describe the double bond in ethene and the triple bond in ethyne in terms of sigma and pi bonds.

[2]

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(b) Explain the term *hybridization*, and state the hybridization of the carbon atoms in ethane, ethene and ethyne.

[4]

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Total Marks 30 (45 minutes)