

Oxygen and Sulfur

Question Paper

Level	Pre U
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	Oxygen and sulfur- Main group chemistry
Booklet	Question Paper

Time Allowed: 14 minutes

Score: /12

Percentage: /100

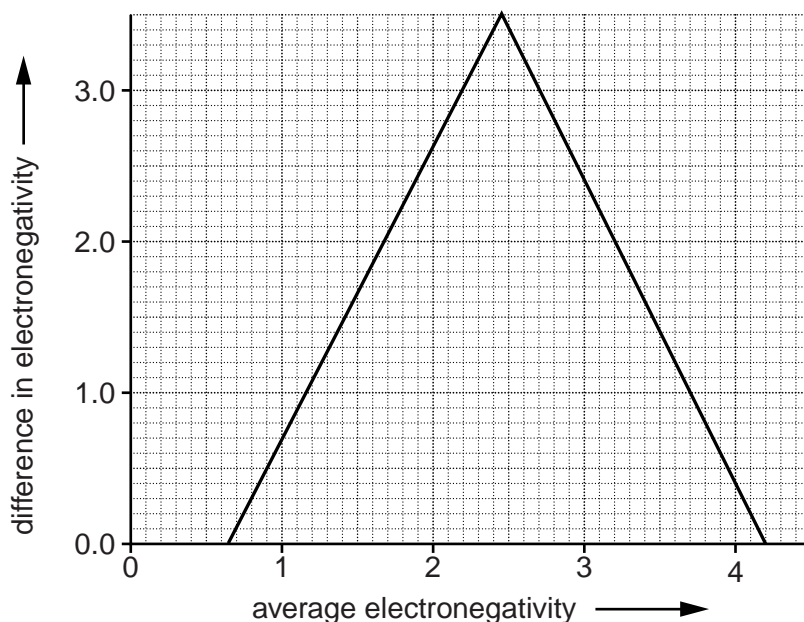
Grade Boundaries:

1. This question is about compounds of Group 16 elements.

- (a) There has been much recent interest in the structural and electronic properties of molybdenum disulfide, MoS_2 , and bismuth telluride, Bi_2Te_3 . Electronegativity values for their constituent elements are shown.

element	Mo	Bi	Te	S
electronegativity		2.01	2.16	2.59

- (i) Plot and label the points for MoS_2 and Bi_2Te_3 on the van Arkel diagram.



[1]

- (ii) Circle the option that **best** describes the bonding in Bi_2Te_3 .

intermediate covalent-metallic

intermediate ionic-metallic

intermediate covalent-ionic

intermediate covalent-ionic-metallic

[1]

- (iii) Circle the option that **best** describes the bonding in MoS_2 .

more covalent than Bi_2Te_3

more ionic than Bi_2Te_3

less covalent than Bi_2Te_3

less ionic than Bi_2Te_3

[1]

- (b) (i) 'Fool's gold' is iron disulfide, FeS_2 . The S atoms exist as an ion containing an S–S covalent bond. The iron ion exhibits an oxidation number of +2.

Draw a dot-cross diagram of the sulfur-containing ion in FeS_2 , indicating the charge(s).

[3]

- (ii) There are no S–S bonds in MoS_2 .

What is the oxidation number of molybdenum in MoS_2 ?

oxidation number [1]

- (c) Sulfur can react with hot aqueous sodium sulfide, Na_2S , to form a yellow solution of compound X, which has the composition by mass, Na, 26.4%; S, 73.6%.

- (i) What is meant by the term *empirical formula*?

.....

..... [1]

- (ii) Use this information to prove that X has an empirical formula of NaS_2 . Show your working.

[2]

- (iii) The sulfur-containing ion in compound **X** consists of a chain of sulfur atoms with an overall 2– charge.

Deduce how many sulfur atoms are in the chain of the ion.

..... atoms [1]

- (iv) When solid **X** is added to an excess of acid, an oily liquid results that is immiscible with water. Assume that there is only one sulfur-containing product.

Suggest the structure of this product.

[1]

[Total: 12]