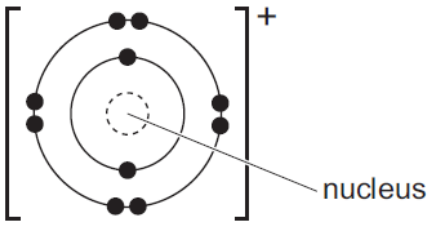
Atoms, elements and compounds – 2020 O Level

1. Nov/2021/Paper_11/No.8

The diagram of an ion is shown.



What can be deduced about the number of protons in this ion?

A It has 9 protons.

B It has 10 protons.

C It has 11 protons

D You cannot deduce the number of protons from this diagram.

2. Nov/2021/Paper_11/No.21

Which statement describes the conversion of magnesium atoms to magnesium ions?

A The change is reduction because there has been a gain of electrons.

B The change is oxidation because there has been a loss of electrons.

C The change is reduction because there has been a loss of electrons.

D The change is oxidation because there has been a gain of electrons.

3. Nov/2021/Paper_12/No.8

An ion contains 20 electrons and has a charge of +3.

From which element was the ion formed?

A aluminium

B calcium

C iron

D vanadium

4. Nov/2021/Paper_12/No.9

Which statement is correct?

A Diamond conducts electricity while graphite does not.

B Graphite has delocalised ions between its layers.

C In diamond, each carbon atom is joined to three other carbon atoms only.

D The layered structure of graphite makes it slippery.

5. Nov/2021/Paper_12/No.10

Which material has the highest melting point?

A ammonia

B methane

C sodium chloride

D water

6. Nov/2021/Paper_12/No.11

Which statement describes ionic bonds?

A a lattice of ions in a 'sea of electrons'

B electrostatic attraction between oppositely charged ions

C the sharing of electrons between atoms to gain a noble gas configuration

D the transfer of electrons from atoms of a non-metal to the atoms of a metal

7. Nov/2021/Paper_12/No.12

Which substances contain at least one double bond?

1 C_2H_4

2 O_2

3 C_2H_6

4 CO_2

A 1, 2 and 3 **B** 2, 3 and 4 **C** 1, 2 and 4 **D** 1, 3 and 4

8. Nov/2021/Paper_12/No.27

An atom of which element has the same electronic configuration as an atom of an ion of strontium?

A calcium

B krypton

C rubidium

D selenium

9. Nov/2021/Paper_21/No.1

Choose from the following compounds to answer the questions.

aluminium iodide
ethanol
glucose
lead(IV) chloride
lithium bromide
magnesium carbonate
methane
potassium phosphate
silver nitrate
sodium sulfate
sulfur dioxide

Each compound may be used once, more than once or not at all.

Which compound:

(a) produces ammonia when its aqueous solution is warmed with aqueous sodium hydroxide and aluminium

..... [1]

(b) contains ions with a 1– charge which are present in many fertilisers

..... [1]

(c) contains ions with a 2+ charge

..... [1]

(d) forms an orange colour when it reacts with chlorine in aqueous solution

..... [1]

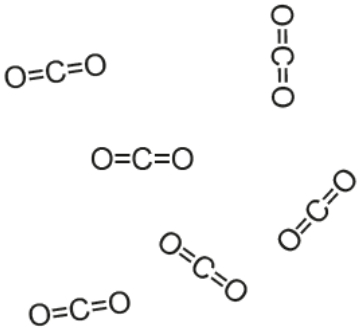
(e) is a hydrocarbon that is formed from the bacterial decay of vegetable matter?

..... [1]

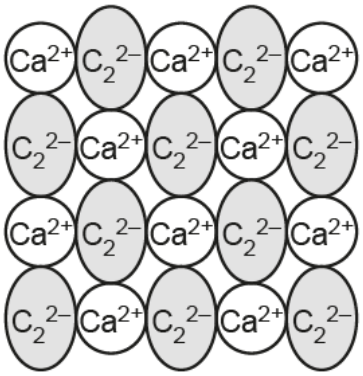
[Total: 5]

10. Nov/2021/Paper_21/No.2

Part of the structures of carbon dioxide and calcium carbide are shown.



carbon dioxide



calcium carbide

(a) Explain in terms of structure and bonding why carbon dioxide has a low boiling point and calcium carbide has a high boiling point.

.....

.....

.....

.....

.....

..... [3]

(b) Calcium carbide, CaC_2, reacts with water to form ethyne, C_2H_2, and calcium hydroxide.

Construct the equation for this reaction.

..... [1]

(c) Ethyne is an unsaturated hydrocarbon.

State the meaning of the term *hydrocarbon*.

.....

..... [1]

(d) Ethyne is a member of the alkyne homologous series.

The molecular formulae of the first four members of the alkyne homologous series are shown.

C_2H_2
C_3H_4
C_4H_6
C_5H_8

Predict the formula for the fifth member of the alkyne homologous series.

..... [1]

(e) Ethyne reacts with hydrogen in a similar way to ethene reacting with hydrogen.

The reaction between ethyne and hydrogen is exothermic.

(i) What type of chemical reaction occurs when ethyne reacts with hydrogen?

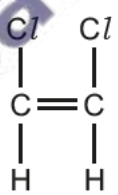
..... [1]

(ii) Predict the molecular formula of a product formed when ethyne reacts with hydrogen.

..... [1]

(f) 1,2-dichloroethene is produced when excess ethyne reacts with chlorine.

The structure of 1,2-dichloroethene is shown.



Deduce the partial structure of the polymer of 1,2-dichloroethene.

Show three repeat units.

[2]

[Total: 10]

11. Nov/2021/Paper_21/No.8d

Hydrazine, $H_2N - NH_2$, is a colourless liquid.

(i) Draw a dot-and-cross diagram for a molecule of hydrazine.

Include only the outer shell electrons.

[1]

(ii) The melting point of hydrazine is 2 °C.
The boiling point of hydrazine is 114 °C.

Use this information to suggest why hydrazine is a solid at 0 °C.

.....

..... [1]

12. Nov/2021/Paper_22/No.1

Choose from the following compounds to answer these questions.

aluminium sulfate
ammonia
calcium carbonate
carbon dioxide
chlorofluorocarbons
copper(II) sulfate
hydrogen chloride
potassium nitrate
sodium chloride

Each compound may be used once, more than once or not at all.

Which compound:

(a) is a gas which dissolves in water to form an alkaline solution

..... [1]

(b) is an anhydrous solid which is used to test for water

..... [1]

(c) contains ions with a 3+ charge

..... [1]

(d) is a solid used in flue gas desulfurisation

..... [1]

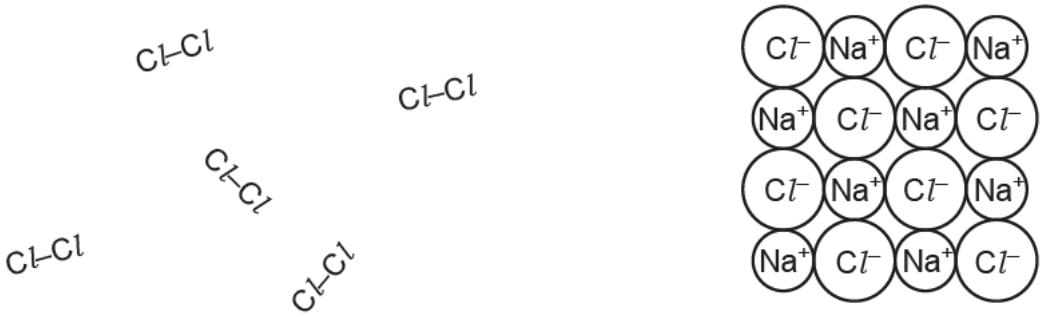
(e) causes eutrophication?

..... [1]

[Total: 5]

13. Nov/2021/Paper_22/No.2

Part of the structures of chlorine and sodium chloride are shown.



chlorine sodium chloride

(a) Explain in terms of structure and bonding why chlorine has a low boiling point and sodium chloride has a high boiling point.

.....

.....

.....

.....

.....

..... [3]

(b) Write the electronic configuration of a chlorine atom.

..... [1]

(c) The electrolysis of molten sodium chloride is carried out using graphite electrodes.

(i) State the meaning of the term *electrolysis*.

.....

..... [1]

(ii) State the direction of movement of both the positive and negative ions when molten sodium chloride is electrolysed.

positive ions .....

negative ions .....

[1]

(iii) State one observation that can be made at the positive electrode when molten sodium chloride is electrolysed.

..... [1]

(iv) Give the formulae of the two negative ions present in aqueous sodium chloride.

..... [1]

(d) When aqueous sodium chloride is electrolysed, hydrogen is produced at the negative electrode.

Explain, in terms of transfer of electrons, why hydrogen and **not** sodium is produced at the negative electrode.

.....

..... [1]

(e) A 36.3 g sample of a compound contains 14.4 g carbon, 0.600 g hydrogen and 21.3 g chlorine.

(i) Calculate the empirical formula of this compound.

[2]

(ii) The relative molecular mass of this compound is 181.5.

Deduce the molecular formula of this compound.

[1]

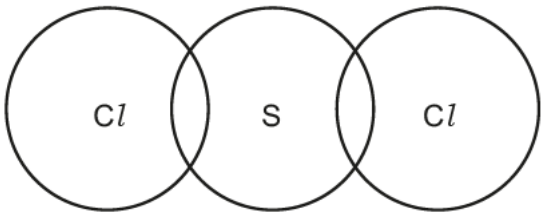
[Total: 12]

14. Nov/2021/Paper_22/No.8c,d

(c) Sulfur dichloride, Cl — S — Cl, has a simple molecular structure.

Complete the dot-and-cross diagram for a molecule of sulfur dichloride.

Include only the outer shell electrons.



[1]

(d) The melting point of sulfur dichloride is –121 °C.
The boiling point of sulfur dichloride is 59 °C.

Deduce the state of sulfur dichloride at room temperature.

Give a reason for your answer.

.....

..... [2]

15. Jun/2020/Paper_11/No.7

Which definition of isotopes is correct?

A atoms of different elements which have the same number of electrons

B atoms of different elements which have the same number of neutrons

C atoms of the same element which have different numbers of electrons

D atoms of the same element which have different numbers of neutrons

16. Jun/2020/Paper_11/No.8

Which ion has the most shells that contain electrons?

A Al^{3+} **B** Be^{2+} **C** N^{3-} **D** S^{2-}

17. Jun/2020/Paper_11/No.9

Which substance conducts electricity both when solid and when molten?

A an alloy

B a hydrocarbon

C a metal oxide

D a salt

18. Jun/2020/Paper_11/No.10

Which substance is an ionic compound?

A ammonia

B calcium chloride

C ethanoic acid

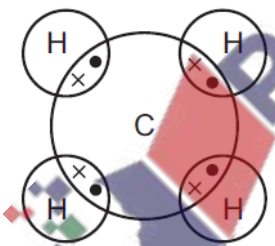
D hydrogen chloride

19. Jun/2020/Paper_11/No.11

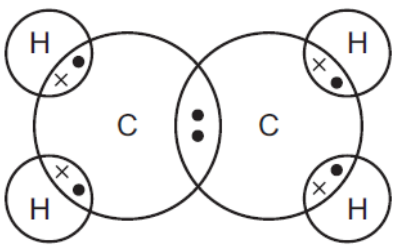
The dot-and-cross diagrams for four compounds are shown.

Which diagram is correct? (Note that only the outer shell electrons are shown.)

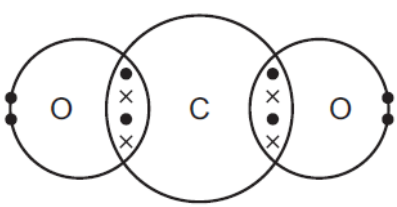
A



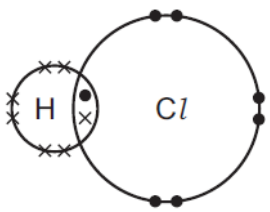
B



C

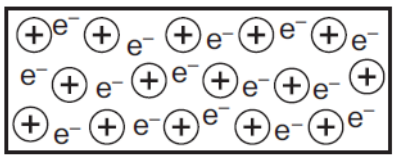


D



20. Jun/2020/Paper_11/No.12

Element X has a lattice of positive ions and a 'sea of electrons'.



Which property will X have?

A It conducts electricity by the movement of ions and electrons.

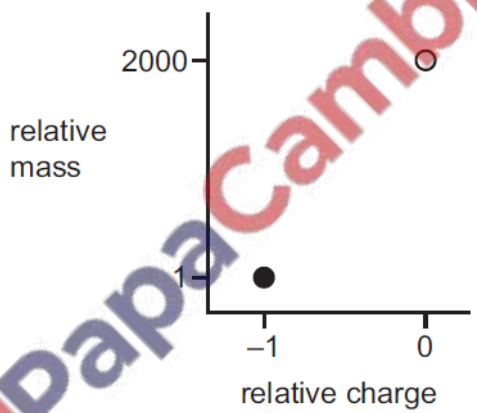
B It has a high melting point.

C It is decomposed by an electric current.

D It is not malleable.

21. Jun/2020/Paper_12/No.7

The diagram shows the relative mass and the relative charge of two particles, ○ and ●, present in atoms and ions.



Which of these particles are present in a hydrogen atom and in a hydrogen ion?

	H	H^+
A	both ○ and ●	both ○ and ●
B	both ○ and ●	○ but not ●
C	● but not ○	neither ○ nor ●
D	○ but not ●	● but not ○

22. Jun/2020/Paper_12/No.8

Which ion has the most shells that contain electrons?

A Al^{3+} **B** Be^{2+} **C** N^{3-} **D** S^{2-}

23. Jun/2020/Paper_12/No.9

Which substance conducts electricity both when solid and when molten?

A an alloy

B a hydrocarbon

C a metal oxide

D a salt

24. Jun/2020/Paper_12/No.10

When they react together, which pair of elements form an ionic compound?

A carbon and hydrogen

B hydrogen and chlorine

C lithium and oxygen

D sulfur and oxygen

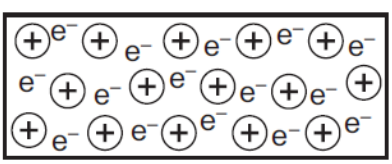
25. Jun/2020/Paper_12/No.11

How many shared electrons are in one carbon dioxide molecule?

A 2 **B** 4 **C** 8 **D** 12

26. Jun/2020/Paper_12/No.12

Element X has a lattice of positive ions and a 'sea of electrons'.



Which property will X have?

A It conducts electricity by the movement of ions and electrons.

B It has a high melting point.

C It is decomposed by an electric current.

D It is not malleable.

27. Jun/2020/Paper_21/No.1

Choose from the following oxides to answer the questions.

calcium oxide

carbon monoxide

copper(II) oxide

nitrogen dioxide

nitrogen monoxide

silicon dioxide

sulfur dioxide

water

zinc oxide

Each oxide may be used once, more than once or not at all.

Which oxide:

(a) is used as a food preservative

..... [1]

(b) is amphoteric

..... [1]

(c) has a molecule that contains only 15 protons

..... [1]

(d) has a high melting point because it has a giant covalent structure

..... [1]

(e) reacts with dilute sulfuric acid to make a blue solution?

..... [1]

[Total: 5]

28. Jun/2020/Paper_22/No.1

Choose from the following chlorides to answer the questions.

aluminium chloride

ammonium chloride

calcium chloride

hydrogen chloride

iron(III) chloride

silver chloride

sodium chloride

Each chloride may be used once, more than once or not at all.

Which chloride:

(a) contains a cation with a 2+ charge

..... [1]

(b) reacts with warm aqueous sodium hydroxide to form a gas which turns damp red litmus paper blue

..... [1]

(c) is insoluble in water

..... [1]

(d) has a molecule which has only 18 protons

..... [1]

(e) is a coloured solid at room temperature and pressure?

..... [1]

[Total: 5]