

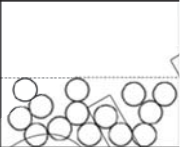
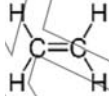
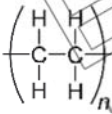
**PAPER 1 (20 marks)**

<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>
A	D	B	C	A	B	B	D	B	C
<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>
C	D	A	D	A	B	B	D	C	C

**SEC 4E5N – SCIENCE (CHEMISTRY) 5076/5078 – PRELIM 2019 – SUGGESTED ANSWERS**

**PAPER 3 – Section A (45 marks)**

Qn	Answers	Mark
1	<p>(a) (i) <u>CO</u> [1]</p> <p>(ii) <u>CO<sub>2</sub></u> [1]</p> <p>(iii) <u>CO</u> [1] and <u>NO</u> [1]</p> <p>(b) (i) <u>nitrogen dioxide</u> [1] and <u>sulfur dioxide</u> [1]</p> <p>(ii) acidic gas that <u>irritates the eyes and attacks the lungs</u>, causing <u>breathing difficulties</u> / can <u>lead to bronchitis</u> or <u>reacts with rainwater and causes acid rain</u>, <u>corrodes metal buildings</u> / <u>destroy stone structures</u> / <u>leaches important nutrients from the soil</u> thereby <u>destroy forest</u> / <u>lowers pH of water thereby killing aquatic lives</u> [1]</p> <p>(c) <u>Argon / Ar</u> as it is an <u>inert</u> / <u>unreactive</u> gas [1]</p>	[8]
2	<p>(a) Isotopes are <u>atoms of the same element</u> / with <u>same number of protons</u> but <u>different number of neutrons / nucleon number</u>. [1]</p> <p>(b) proton: <u>20</u> neutron: <u>24</u> electron: <u>20</u> 3 answers correct – [2] 1 – 2 answers correct – [1] 0 answer correct – [0]</p> <p>(c) the no. of electrons in an atom is <u>expected to be different</u> from that of an ion. [<i>must answer but no mark awarded</i>] <u>Atom is electrically neutral</u> / <u>no. of electrons is the same as no. of protons</u> in an atom [1] whereas the <u>no. of electrons is 2 fewer</u> in a calcium ion as a calcium atom has <u>lost 2 valence electrons</u> [0.5] to <u>achieve the stable noble gas configuration</u> [0.5]</p>	[5]
3	<p>(a) (i) any pH <u>greater than or equals to 5.0</u> but <u>less than 6.0</u> [1]</p> <p>(ii) <u>mango</u> [1]</p> <p>(b) calcium hydroxide: to <u>neutralise</u> / <u>remove excess H<sup>+</sup> ion</u> / <u>soil acidity</u> [1] <i>reject: to increase pH of the soil</i></p> <p>(c) <u>Ammonium sulfate will react with calcium calcium hydroxide to form ammonia</u> [1] which is liberated and <u>leads to a loss of nitrogen</u> that is essential for plant growth [1].</p> <p><u>Ca(OH)<sub>2</sub> + (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> → CaSO<sub>4</sub> + 2NH<sub>3</sub> + 2H<sub>2</sub>O</u> [1]</p>	[6]

4	<p>(a) (i) <u>iron</u> [1]</p> <p>(ii) <u>sulfuric acid</u> [1]</p> <p>(iii) <u>iron(II) sulfate</u> [1]</p> <p>(iv) <u>iron(II) hydroxide</u> [1]</p> <p>(b) <u>haematite</u> [1]</p> <p>(c) <math>\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})</math> [1]</p>	[6]
5	<p>(a) P, S, R, Q [1]</p> <p>(b) <u>effervescence can be observed</u> [1] metal <b>S reacts</b> with hydrochloric acid to <u>form salt and hydrogen gas</u> [1]</p> <p>(c) the particles are <u>close together</u> in a <u>disorderly arrangement</u> [1] the particles are able to <u>move freely throughout the entire volume</u> [1]</p> <div style="text-align: center;">  </div> <p><i>students must draw at least 9 particles – [0.5] particles are close together and of the same size – [0.5] zero mark if student identified wrong physical state</i></p>	[6]
6	<p>(a) structural formula of ethene [1]</p> <div style="text-align: center;">  </div> <p>polymerisation of ethene [1]</p> <div style="text-align: center;">  </div> <p>general formula of alkanes: <math>\text{C}_n\text{H}_{2n+2}</math> [0.5]</p> <p>general formula of alkenes: <math>\text{C}_n\text{H}_{2n}</math> [0.5]</p> <p>(b) (i) <u>hydrogenation</u> [1]</p> <p>(ii) <u>UV light</u> [1]</p> <p>(c) A homologous series is a family of organic compounds which has the <u>same functional group</u>, [0.5] + <i>one of the following</i></p> <ul style="list-style-type: none"> <li>• <u>same general formula</u> [0.5]</li> <li>• each <u>successive member</u> differing in composition by a <u>-CH<sub>2</sub>- group</u> [0.5]</li> <li>• <u>similar chemical properties</u> [0.5]</li> </ul>	[8]

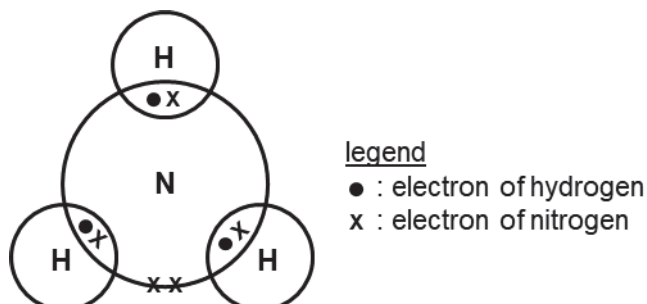
	<p>(d) <b>Bubble the gases</b> separately into <b>aqueous bromine / bromine solution</b>. [1]          Gas is <b>alkene</b> if <b>reddish-brown solution decolourises</b>. Gas is <b>alkane</b> if the <b>reddish-brown solution remains</b>.</p>	
7	<p>(a) O.S. of copper <b>increased</b> from <b>+1 in CuCl</b> to <b>+2 in CuCl<sub>2</sub></b> or Cu<sup>+</sup> <b>loses an electron</b> and is <b>oxidised</b> to form Cu<sup>2+</sup> [1]</p> <p>O.S. of silver <b>decreased</b> from <b>+1 in AgCl</b> to <b>0 in Ag</b> or Ag<sup>+</sup> <b>gains an electron</b> and is <b>reduced</b> to form Ag [1]</p> <p>Since reduction and oxidation occurred simultaneously, the reaction is redox. (<i>-0.5 if concluding statement is missing</i>)</p> <p>(b) (i) the silver chloride produced forms an <b>insoluble layer</b> around the insoluble <b>silver oxide</b>, <b>preventing further reaction</b> with the acid. [1]</p> <p>(ii) <b>any 2 aqueous reagents</b> that can be used to make silver chloride [1]</p> <p><b>mix the two aqueous reagents together</b> [0.5]  <b>filter the mixture</b> to obtain <b>silver chloride as residue</b> [0.5]  <b>wash</b> the silver chloride residue with distilled water [0.5]  <b>dry</b> by pressing between sheets of filter paper [0.5]</p>	[6]

PAPER 3 – Section B (20 marks)

Qn	Answers	Marks
8	<p>(a) <b>cracking of petroleum / crude oil</b> [1]</p> <p>(b) <b>Agree with student</b> [no mark awarded]          Ammonia does not conduct electricity in gaseous state as there are <b>no free moving ions and electrons</b> to act as charge carriers. [1]          The <b>presence of free moving ions</b> in aqueous ammonia act as charge carriers to conduct electricity. [1]</p> <p>(c) (i) <b>No, it is better to use lower temperature</b>          the <b>percentage of ammonia produced decreases</b> when a higher temperature is used [1]</p> <p>(ii) <b>as pressure increases, there are more particles per unit volume</b> [0.5] <b>no. of effective collisions increase</b>, [0.5] therefore <b>rate of reaction increases</b> [1]</p> <p>(d) Based on the given equation, no. of moles of H<sub>2</sub>:NH<sub>3</sub> is 3:2. [1]</p> <p>max. volume of NH<sub>3</sub> produced          = (2 ÷ 3) x 60          = <b>40.0 dm<sup>3</sup></b> [1]</p> <p><i>alternative answer</i>          max. volume of NH<sub>3</sub> produced          = (60 ÷ 24) x (2 ÷ 3) x 24</p>	[10]

= 40.0 dm<sup>3</sup>

(e)



correct no. of unbonded electrons – [1]

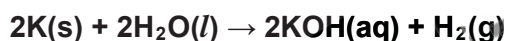
correct no. of bonded electrons – [1]

9

(a) (i) potassium is **very reactive** / storing in kerosene prevents potassium from **reacting with water and oxygen in the air easily** [1] [10]

(ii) Potassium **reacts very violently**. [1]

The metal **catches fire** / **burns with a lilac flame** [1]

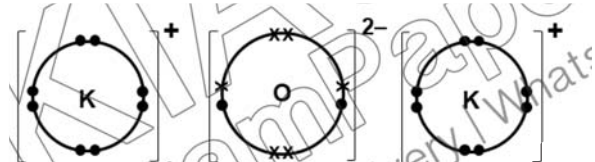


balanced chemical equation – [1]

correct state symbols – [1]

(iii) **fuel for aircraft engines** / **fuel for heating and cooking** [1]

(b)



correct no. of charges – [1]

correct no. of valence electrons in each element – [1]

(c) Potassium oxide has a **giant ionic structure**. [0.5]

A **large amount of energy required** [0.5] to **overcome the strong electrostatic forces of attraction between the oppositely charged ions**, [0.5] hence it **has a relatively high melting point** [0.5] and exists as a solid at r.t.p.

10 (a) (i) two atoms covalently bonded / chemically combined together [1] [10]

(ii) as the atoms have 7 valence electrons, [0.5] they share electrons to achieve the stable noble gas configuration [0.5]

(b) Down the group,

- colour intensity increases
- melting and/or boiling points increase
- physical state at r.t.p. goes from gas to liquid to solid

*any two of the above physical properties* [2]

(c) add bromine solution to aqueous sodium iodide [0.5]  
if reddish-brown bromine solution turns colourless / decolourises, [0.5] a displacement reaction has taken place and bromine is more reactive than iodine [0.5]

add iodine solution to sodium bromide solution. [0.5]

the solution turns yellow / black solids formed in the solution [0.5]

which shows that displacement reaction did not take place and iodine is less reactive than bromine [0.5]

*R: solution turns black*

(d) no. of moles of hydrogen iodide

$$= 256 \div (127 + 1)$$

$$= 256 \div 128$$

$$= 2.00 \text{ mol [1]}$$

no. of moles of iodine

$$= 0.5 \times \text{no. of moles of hydrogen iodide}$$

$$= 0.5 \times 2.00$$

$$= 1.00 \text{ mol}$$

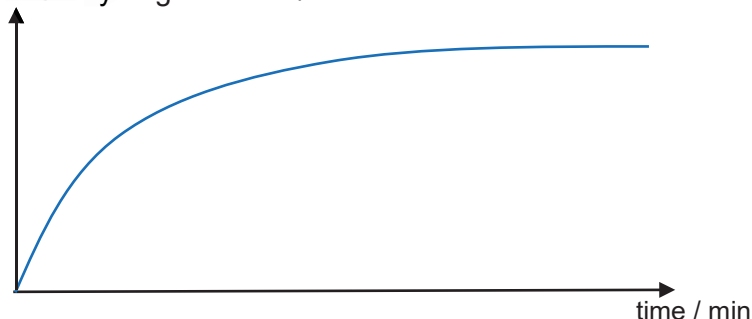
mass of solid (iodine) required

$$= 1.00 \times (127 \times 2)$$

$$= 1.00 \times 254$$

$$= \underline{254 \text{ g [1]}}$$

(e) volume of hydrogen iodide / cm<sup>3</sup>



*correct shape of graph* – [1]

