Errata List for Chemistry Matters for GCE ‘O’ Level Textbook (3rd Edition)
ISBN: 978-981-4988-05-6
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Note: The following errata will be corrected in subsequent reprints of this book.

<table>
<tr><th>Chapter</th><th>Page No.</th><th>Original</th><th>Change</th></tr>
<tr><td>1</td><td>3</td><td>In the laboratory, a digital stopwatch is used to measure time (Figure 1.2). Mechanical or analogue stopwatches can also be used, but they may not be as accurate (Table 1.2).

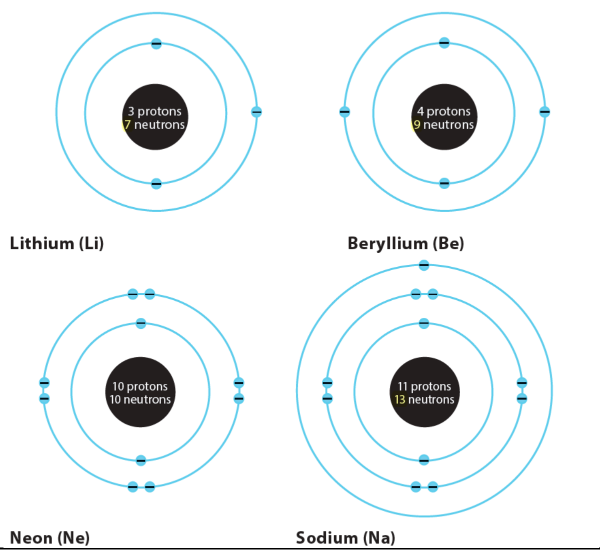
Table 1.2 Accuracy of digital and analogue stopwatches
<table><tr><th>Apparatus</th><th>Accuracy</th></tr><tr><td>digital stopwatch</td><td>±0.01 s
(a hundredth of a second)</td></tr><tr><td>analogue stopwatch</td><td>±0.1 s
(a tenth of a second)</td></tr></table></td><td>Change “but they may not be as accurate” to “Table 1.2 shows the smallest division of these apparatus.”

Change table caption from “Accuracy” of digital and analogue stopwatches to “Smallest Division” of digital and analogue stopwatches.

Change table header from “Accuracy” to “Smallest Division of Apparatus”.</td></tr>
<tr><td>1</td><td>5</td><td>Some experiments require an accurate fixed volume of a chemical, such as when we want to prepare a known concentration of an acid. This calls for the use of apparatus like pipettes and volumetric flasks. Other times, we may need apparatus that provide a range of volumes to be read, such as when we measure how much liquid is added to dissolve a solid. In such cases, a measuring cylinder or burette provides that flexibility. Table 1.3 shows the accuracies of some apparatus in measuring liquids. Figure 1.7 shows how we can draw these apparatus using diagrams.

Table 1.3 Apparatus for measuring volume of liquids
<table><tr><th>Apparatus</th><th>Accuracy</th></tr><tr><td>pipette</td><td>measures accurate fixed volumes, e.g. 10.0 cm³ or 25.0 cm³</td></tr><tr><td>volumetric flask</td><td>measures accurate fixed volumes that are larger, e.g. 100 cm³ or 250 cm³</td></tr><tr><td>measuring cylinder</td><td>measures a range of volumes to the nearest 0.5 cm³, e.g. 31.5 cm³ or 23.0 cm³</td></tr><tr><td>burette</td><td>measures a range of volumes to the nearest 0.05 cm³, e.g. 31.55 cm³ or 23.00 cm³</td></tr></table></td><td>Change “Table 1.3 shows the accuracies of some apparatus in measuring liquids” to “Table 1.3 shows how some apparatus are used in measuring liquids.”

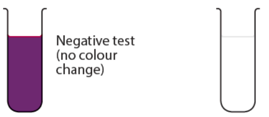
Change table header from “Accuracy” to “What It Measures”.

Delete “measures” from the table rows.</td></tr>
<tr><td>3</td><td>53</td><td>
</td><td>Change “7 neutrons” in lithium to “4 neutrons”.

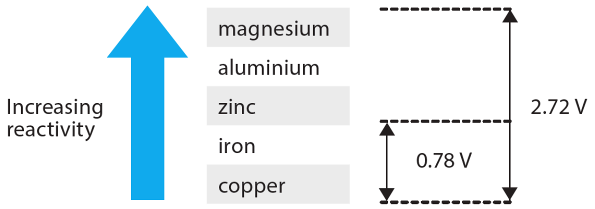
Change “9 neutrons” in beryllium to “5 neutrons”.

Change”13 neutrons” in sodium to “12 neutrons”.</td></tr>
<tr><td>4</td><td>76</td><td>The Metallic Bond
Why Do Metals Not Combine Using Ionic or Covalent Bonding or Covalent Bonding?</td><td>Delete repeated “or Covalent Bonding”.</td></tr>
<tr><td>5</td><td>95</td><td>Poly(ethene) is a polymer with weak intermolecular forces of attraction between the molecules. Hence, the melting and boiling points of poly(ethene) is low.</td><td>Change “is” low to “are” low.</td></tr>
</table>

Chapter	Page No.	Original	Change
6	96	If you mix metal atoms of one element with atoms of another element(s), an alloy is formed (Figure 5.24).	Change atoms of “another element(s)” to atoms of “one or more other elements”.
5	99	**Past to Present** The earliest known alloys originated from meteorites. It had a mixture of iron and nickel known as “meteorite iron” (Figure 5.29). At around 2500 BC, bronze objects were made (Figure 5.30). This suggests that people had learnt how to make alloys, rather than rely on rare meteorites.	Change “It had a mixure” to “These meteorites contained mixtures”.
6	109	Sulfuric acid is written as H_2SO_4 in the modern system but would have been written as H_2O_4S under the original Hill system. As more compounds were found, the writing of chemical formulae evolved to suggest the types of bonds that exist within them. For example, H_2SO_4 suggests that the substance consists of H^+ and SO_4^{2-} ions. Table 6.3 shows how some chemical formulae is written using the Hill system and the modern system.	Change formulae “is” to formulae “are”.
6	111	**Link** Transition metals are elements found between Groups 3 and 12 that have variable valences. They will be covered in more detail in Chapter 14. Note that while zinc and silver are in the transition metal block, they form only one common ion each and so their charges are fixed (Table 6.6). **Table 6.6** Zinc and silver ions have fixed valences. Name of Metal / Formula of Ion / Valency of Ion zinc / Zn^{2+} / 2 silver / Ag^+ / 1	Change “Groups 3 and 12” to “Groups 3 and 11”. Change “Note that while zinc and silver are in the transition metal block, they form only one common ion each and so their charges are fixed (Table 6.6)” to “Note that while silver is in the transition metal block, it forms only one common ion and so its charge is fixed (Table 6.6).” Change table caption from “Zinc and silver ions have fixed valences” to “Silver ions have fixed valences”. Removed row for zinc.
7	135	④ Slowly add the titrant from the burette into the conical flask. Swirl the flask constantly as the titrant is added. Stop adding the titrant when the contents of the flask has changed colour permanently. This indicates the end-point of the reaction. Record the volume of titrant used.	Change “has” to “have”.
8	136	**Limiting Reactants** Imagine that making a cup of fruit smoothie requires 1 orange and 2 bananas. If you have 10 oranges and 100 bananas, you would only be able to make 10 cups of this smoothie. There are not enough oranges to be combined will all of the bananas. 80 bananas will be left over.	Change “will” to “with”.
8	148	The surfaces of copper objects become **tarnished** as they react with the oxygen in the air to form copper(II) oxide. Copper(II) oxide is a base that reacts with acids. In Let’s Investigate 8A, the citric acid in the fruit reacts and removes the copper(II) oxide, returning the object to its shiny form.	Change “reacts and” to “reacts with and”.
8	150	**Strength of Acids and Concentration of Acids** The strength of an acid is its degree of ionisation whereas concentration is related to the number of acid molecules present in a given volume of water. A strong acid can be concentrated (large number of acid molecules in a given volume) or dilute (small number of acid molecules in a given volume). Similarly, a weak acid can be concentrated or dilute.	Change “The strength of an acid is its degree of ionisation whereas concentration” to “The strength of an acid depends on its degree of ionisation whereas its concentration”.

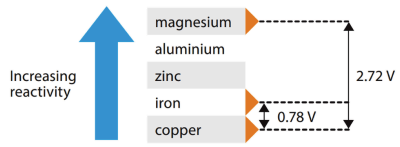
Chapter	Page No.	Original	Change
8	159	**Helpful Note** Compounds containing SO_3^- ions are sulfites. Compounds containing SO_4^{2-} ions are sulfates. H_2SO_3 is called sulfurous acid and H_2SO_4 is known as sulfuric acid.	Change "SO_3^-" to "SO_3^{2-}".
9	164	There are a lot of other compounds, also known as salts, that are present in your tears, blood and perspiration. For example, hydrogen carbonate is present in our blood to help maintain its pH.	Change "hydrogen carbonate is" to "hydrogencarbonate salts are".
9	168	In this method, the metal, base or carbonate • must be in *excess* so that all the acid is used up. Otherwise, the salt produced will be contaminated with the acid; and • is *insoluble* in water. Thus, the excess starting materials can be removed from the salt solution by filtration.	Placed sentence in parenthesis: "must be in *excess* so that all the acid is used up (otherwise, the salt produced will be contaminated with the acid); and".
9	169	**Reaction of Acid With a Metal** A salt, such as zinc sulfate, can be prepared by reacting dilute sulfuric acid and zinc metal.	Change "A salt, such as zinc sulfate," to "Zinc sulfate".
9	171	**Reaction of Acid With an Insoluble Base** A salt, such as copper(II) nitrate, can be prepared by reacting dilute nitric acid with copper(II) oxide (Figure 9.5). **Reaction of Acid With an Insoluble Carbonate** A salt, such as magnesium chloride, can be prepared by reacting dilute hydrochloric acid with magnesium carbonate (Figure 9.6).	Change "A salt, such as copper(II) nitrate," to "Copper(II) nitrate". Change "A salt, such as magnesium chloride," to "Magnesium chloride".
10	195	Pungent ammonia gas is produced when some of the protein in cheese break down. When we tear open the packaging of a wedge of cheese, the ammonia gas contained within the packaging is released, allowing us to detect its pungent odour (Figure 11.5). Gases may be pungent or odourless. Some gases can be identified based on colour, while others are colourless. Let us look at how we can chemically test for some gases based on their characteristics.	Change "break down" to "breaks down".
12	215	In a positive test, manganate(VII) ions are reduced to manganese(II) ions by the reducing agent, shown by the decolourisation of the solution (Figure 12.21).  Figure 12.21 Potassium manganate(VII) test results for the presence of reducing agents	Add a Helpful Note: Solutions with manganese(II) ions may appear pale pink if a more concentrated solution is used.
13	234	Table 13.6 Differences between simple cells and electrolytic cells **Source of Electrical Energy** — Simple Cell: Electrical energy is produced through chemical reactions. / Electrolytic Cell: Electrical energy is supplied by an external source (e.g. battery). **Electron Movement** — Simple Cell: Electrons move from the anode to the cathode. / Electrolytic Cell: Electrons move from the battery to the cathode, through the electrolyte, and into the anode. **Polarity of Electrodes** — Simple Cell: Anode: negative (–) Cathode: positive (+) / Electrolytic Cell: Anode: positive (+) Cathode: negative (–)	Change Electron Movement in Simple Cell to "Electrons move spontaneously from the anode to the cathode." Change Electron Movement in Electrolytic Cell to "Electron flow is driven by the battery, moving from the anode to the cathode."

<table>
<tr><th>Chapter</th><th>Page No.</th><th>Original</th><th>Change</th></tr>
<tr><td>13</td><td>235</td><td>



</td><td>

Change the diagram to:



</td></tr>
<tr><td>13</td><td>238</td><td>

The hydrogen fuel cell utilises hydrogen as the fuel and oxygen from air as the oxidiser. Hydrogen fuel cells do not directly contribute to climate change because their only product is water, besides electricity. Figure 13.25 shows a hydrogen fuel cell set-up. In this set-up, aqueous phosphoric acid (H_3PO_4) is used as the electrolyte.

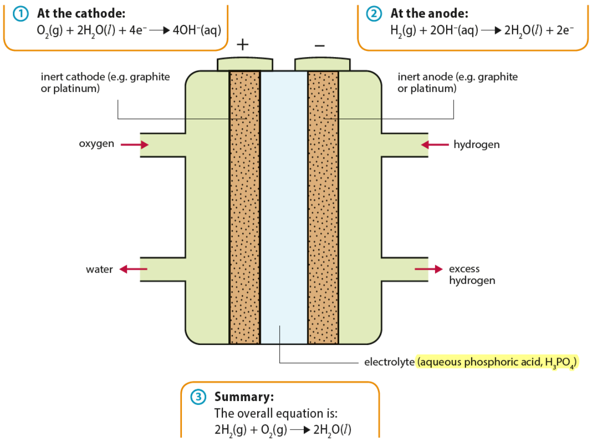


Figure 13.25 A hydrogen fuel cell set-up

</td><td>

Change “a hydrogen fuel cell set-up” to “a possible hydrogen fuel cell set-up”.

Change aqueous “phosphoric acid (H_3PO_4)” to aqueous “potassium hydroxide (KOH)”.

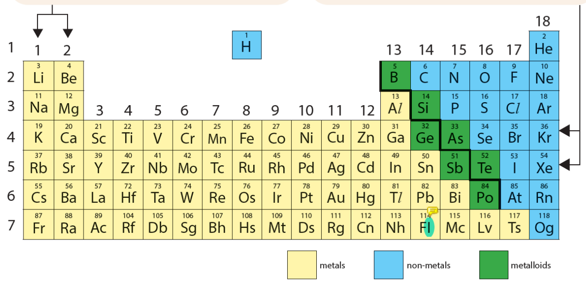
Change “aqueous phosphoric acid, H_3PO_4” in the diagram label to “aqueous potassium hydroxide, KOH”.

Change figure caption to “A possible hydrogen fuel cell set-up”.

</td></tr>
<tr><td>14</td><td>244</td><td>

Groups
- A group is a vertical column of elements.
- The periodic table consists of 18 groups of elements, numbered 1 to 18.
- The groups run from top to bottom.

Periods
- A period is a horizontal row of elements.
- The periodic table consists of seven periods of elements, numbered 1 to 7.
- The periods run from left to right.



</td><td>

Change font type for “Fl” (flerovium) to serif “F*l*”.

</td></tr>
<tr><td>14</td><td>246</td><td>

Table 14.2 Relationship between the group number and the ion formed by an element

<table>
<tr><th>Group</th><th>Number of Valence Electrons</th><th>Type of Ion Formed</th><th>Charge on Ion</th><th>Examples</th><th>Explanation</th></tr>
<tr><td>1</td><td>1</td><td rowspan="3">positive ions (cations)</td><td>+1</td><td>Na^+, K^+</td><td rowspan="3">The elements in Groups 1, 2 and 13:
• are metals; and
• tend to lose electrons to form positive ions.</td></tr>
<tr><td>2</td><td>2</td><td>+2</td><td>Mg^{2+}, Ca^{2+}</td></tr>
<tr><td>13</td><td>3</td><td>+3</td><td>Al^{3+}</td></tr>
<tr><td>14</td><td>4</td><td colspan="2" rowspan="2"></td><td>CH_4</td><td rowspan="2">The elements in Group 14 share electrons to form covalent bonds.</td></tr>
<tr><td>15</td><td>5</td><td>PCl_5</td></tr>
<tr><td>16</td><td>6</td><td rowspan="2">negative ions (anions) (elements tend to form covalent substances)</td><td>–2</td><td>O^{2-}, S^{2-}</td><td rowspan="2">The elements in Group 15 to 17:
• share electrons to form covalent bonds with non-metals; and
• tend to gain electrons to form negative ions when bonded to a metal.</td></tr>
<tr><td>17</td><td>7</td><td>–1</td><td>F^-, Cl^-</td></tr>
<tr><td>18</td><td>8</td><td>elements do not form ions</td><td colspan="2"></td><td>The elements in Group 18:
• have full valence shells of electrons; and
• do not form compounds.</td></tr>
</table>

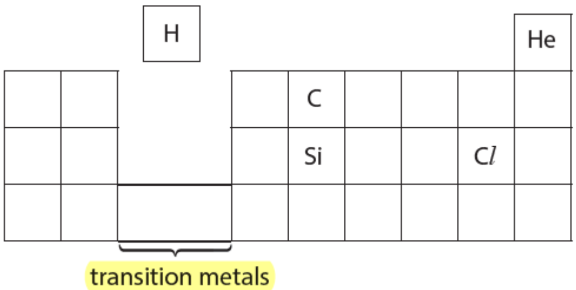
Elements in Groups 3 to 12 belong to a special class of elements called the transition elements. We will learn about them in Section 14.3.

</td><td>

Remove explanation in brackets.

Change “Groups 3 to 12” to “Groups 3 to 11”.

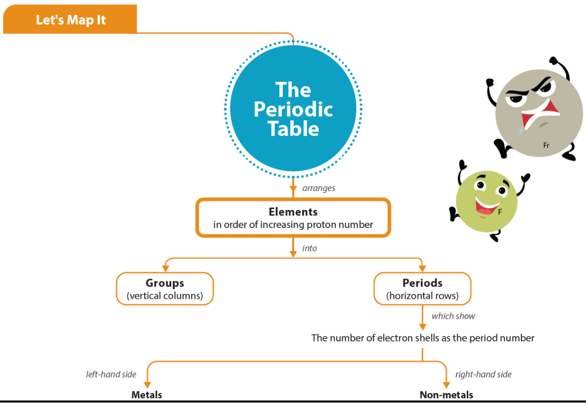
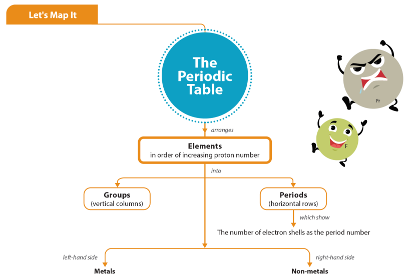
</td></tr>
<tr><td>14</td><td>247</td><td>

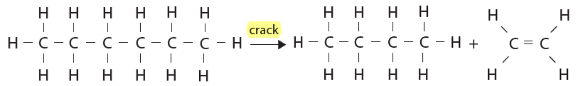
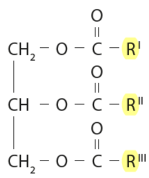


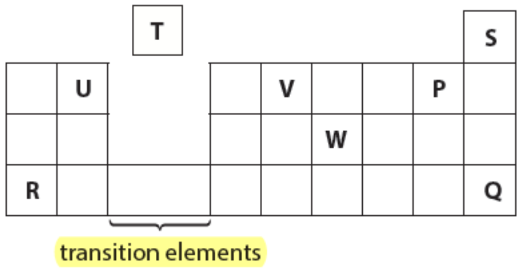
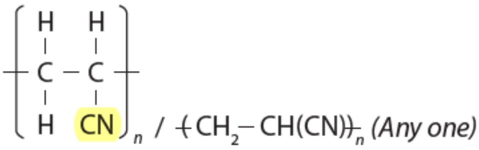
</td><td>

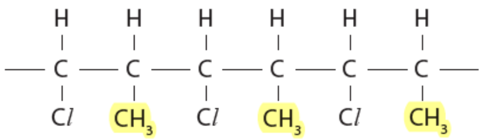
Remove curly bracket and “transition metals” label.

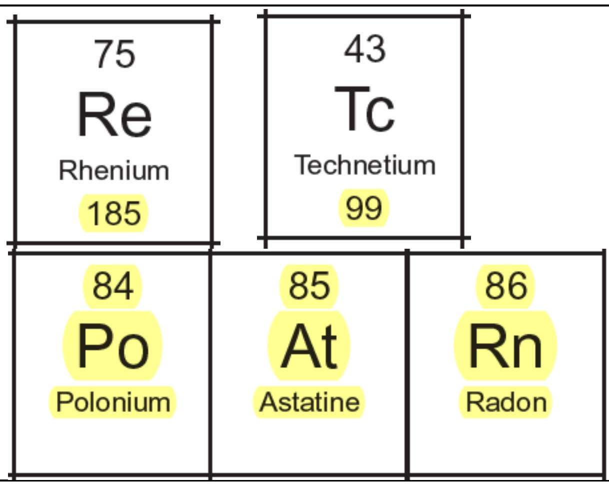
</td></tr>
</table>

Chapter	Page No.	Original	Change
15	258		Extend middle vertical arrow as shown: 
15	270	**Reaction Between a Metal and the Oxide of Another Metal** We can use the reactivity series to predict how metals and metals oxides will react together.	Change "metals oxide" to "metal oxide".
15	272	**Worked Example 15C** Nitrates of metals behave in a similar way as their carbonates. Nitrates of reactive metals are more stable than nitrates of metals lower in the reactivity series. Table 15.7 shows the results of heating the carbonates and nitrates of three metals to the same temperature. Table 15.7 Metal / Products of Decomposition: Carbonates / Nitrates X: No change is observed. / metal nitrite and oxygen Y: oxide and carbon dioxide / metal oxide, nitrogen dioxide and oxygen Z: No change is observed. / metal oxide, nitrogen dioxide and oxygen Arrange metals **X**, **Y** and **Z** in order of decreasing reactivity. **Thought process** **X** and **Z** are more stable than **Y**. They do not decompose on heating. **X** is more stable than **Y** and **Z**. **Y** and **Z** decompose more on heating (less stable). **Answer** **Y > Z > X**	Change "Y > Z > X" to "X > Z > Y"
15	279	Window grilles, vehicle bodies and outdoor furniture are now made of aluminium instead of iron (Figure 15.22). However, in the construction industry, the strength of iron is still more crucial. The choice of metal to use depends on which characteristics is more important in its application.	Change "characteristics is" to "characteristics are".
15	282	**3** This question is about manganese and its compounds. Manganese is a grey-white metal with a boiling point of 1247 °C. Its density is 7.43 g/cm^3. It was discovered by heating the ore pyrolusite (MnO_2) with carbon. **(c)** Manganese displaces zinc from an aqueous solution of zinc sulfate to form a pink solution, in which the metal compound has an oxidation state of +2. Name the pink solution.	Remove first sentence. Change boiling point from "1247 ºC" to "2061 ºC". Change (c) to "Manganese displaces zinc from aqueous zinc sulfate to form a pale pink solution that is almost colourless. The metal ion in this solution has an oxidation state of +2. Name the pale pink solution."
17	314	**3. They are pH-sensitive.** Enzymes operate best in an optimal pH range. They are mostly inactive above or below this range. However, unlike their temperature-sensitivity, the optimal pH range of enzymes vary greatly. For example, the digestive enzymes in your stomach operate at very low pH conditions, while those in your liver work best at high pH conditions.	Change "vary" to "varies".
18	325	In school laboratories, a glass fractionating column with short glass tubes or glass rings is used for fractional distillation (Figure 18.9). These glass tubes or rings increase the surface area for boiling and condensation in the fractional distillation process. The fraction with the lowest boiling point is collected first, followed by the fraction with the next higher boiling point as the heating continues.	Remove "boiling and".
18	327	boiling point increases as the number of carbon atoms in the hydrocarbons increase	Change "increase" to "increases".
19	341	**General Formula of Alkanes** The general molecular formula of alkanes is C_nH_{2n+2}, where *n* is the number of carbon atoms in each molecule (*n* = 1, 2, 3, 4 and so on).	Change "general molecular formula" to "general formula".

Chapter	Page No.	Original	Change
19	342	**Formulae of Alkanes** The **structural formula** of a covalent compound shows the arrangement of atoms in the molecule. The **full structural formula** includes all the bonds in the molecule (Table 19.5).	Add a Helpful Note: "The structural formula of a compound is sometimes referred to as its condensed structural formula."
19	346	**General Formula of Alkenes** The general molecular formula of alkenes with one carbon–carbon double covalent bond is $\mathbf{C_nH_{2n}}$, where *n* is the number of carbon atoms in each molecule (*n* = 2, 3, 4 and so on).	Change "general molecular formula" to "general formula".
19	350	hexane $\xrightarrow{\text{crack}}$ butane + ethene $C_6H_{14} \xrightarrow{\text{crack}} C_4H_{10} + C_2H_4$ 	Remove "crack" on the three equations.
19	351	The general equation for catalytic cracking is as follows: long-chain alkanes $\xrightarrow{\text{catalytic cracking}}$ (mixture of short-chain alkenes) + (mixture of short-chain alkanes or hydrogen gas)	Remove "catalytic cracking" on the equation.
20	363	When the COVID-19 pandemic broke out, a heavy emphasis was placed on good hygiene. Hand sanitisers were high in demand. When they were sold out, Singaporeans shared what they had with their family, friends and neighbours. Bottles of hand sanitisers were placed in lifts, malls and train stations to ensure that everyone had access to it. Many hand sanitisers are alcohol-based. Alcohol is able to disrupt a virus' outercoat and a bacteria's cell membrane, killing them.	Change to "Bottles of hand sanitiser were placed in lifts, malls and train stations to ensure that everyone had access to them." Change to "Alcohol is able to disrupt a virus' outer coat and a bacterium's cell membrane, destroying them."
20	364	**General Formula of Alcohols** The general molecular formula of alcohols with one hydroxyl (–OH) group is $\mathbf{C_nH_{2n+1}OH}$ where *n* is the number of carbon atoms in each molecule (*n* = 1, 2, 3 and so on).	Change "general molecular formula" to "general formula".
20	369	Oxalic acid is a dicarboxylic acid used in many cleaning products as it removes stains and rust (Figure 20.10). Dicarboxylic acids contain two carboxyl functional group. The carboxyl functional group will be covered below. **General Formula of Carboxylic Acid** The general molecular formula of carboxylic acids with one carboxyl (–COOH) group is $\mathbf{C_nH_{2n+1}COOH}$ where *n* is the number of carbon atoms in each molecule minus one (*n* = 0, 1, 2, 3 and so on).	Change "functional group" to "functional groups". Change "general molecular formula" to "general formula".
20	371	**Chemical Properties of Carboxylic Acids** Carboxylic acids are weak acids because they partially ionise in water to form a carboxylate ion and hydrogen ion. The partial ionisation of carboxylic acids could be represented by the following equation: carboxylic acid $\rightleftharpoons$ carboxylate ion + hydrogen ion **R**COOH(aq) $\rightleftharpoons$ **R**COO$^-$ (aq) + H$^+$ (aq) "**R**" represents an alkyl group.	Add a Link: "Recall from Chapter 19: An alkyl group is a side chain formed by removing a hydrogen atom from an alkane molecule."
20	374	 Figure 20.17 Fats are also known as triesters. They are formed when a compound with three hydroxyl (–OH) groups react with carboxylic acids.	Bold the R groups. Add label below diagram: "**R**I", "**R**II" and "**R**III" represent alkyl groups.

<table>
<tr><th>Chapter</th><th>Page No.</th><th>Original</th><th>Change</th></tr>
<tr><td>Answer Key</td><td>432</td><td>1

</td><td>Remove curly bracket and “transition elements” label.</td></tr>
<tr><td>Answer Key</td><td>436</td><td>Let’s Practise 21.2
1


2 (a)
</td><td>Shift the –CN group to align the “C” below the bond.

Shift the $-CH_3$ groups to align the “C” below the bond.</td></tr>
<tr><td>Periodic Table</td><td>Inside Back Cover</td><td>
</td><td>Change relative atomic mass of rhenium from “185” to “186”.

Change relative atomic mass of technetium from “99” to “–”.

Add “–” for the relative atomic masses of polonium, astatine and radon.</td></tr>
</table>