

Diploma of Kinesiology
HLT51507



Chemistry, Biochemistry, Pathology

A&P2 Workbook Answers

Part 1 of 5: Chemistry

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Element 1

1. Potential energy is the energy of movement of a particle. True / **False**
2. Which of the following scales is based on the freezing and boiling point of water

a) **Celcius**
 b) Fahrenheit
 c) Kelvin
3. Define absolute zero:- **the temperature at which all atomic movement ceases**
4. State the normal body temperature in Celcius: **37 degrees Celcius**
5. How many calories are required to heat 1 g of water by 1 degree Celcius: **one**
6. The volume of a liquid is measured in metres. True / **False**
7. State the name of the following Greek letters:-

μ **mu**
 γ **gamma**
 α **alpha**
 β **beta**
 δ **delta**

8. Complete the following table showing scientific notation and actual figures:-

Factor of 10	Common name	Actual figure
$1 * 10^{-9}$	nano-	0.000 000 001
$1 * 10^{-6}$	micro (μ)	0.000 001
$1 * 10^{-2}$	centi -	0.01
$1 * 10^{-1}$	deci-	0.1
$1 * 10^1$	deka -	10
$1 * 10^2$	hecto-	100
$1 * 10^3$	kilo -	1000
$1 * 10^6$	mega-	1 000 000 000

9. Complete the following table with respect to states of matter:-

	Solid	Liquid	Gas
shape	has its own shape	takes the shape of the container	takes the shape of the container
volume	has its own volume	has its own volume	fills the volume of the container
arrangement of particles	fixed, very close	random, close	random, far apart
interaction between particles	very strong	strong	essentially none
movement of particles	very slow	moderate	very fast
examples	ice salt iron	water oil vinegar	water helium air

10. If a substance passes directly from a solid state into a gaseous state, then it is described as having undergone: **sublimation**

11. Classify each of the following as a physical or chemical change:

- | | |
|------------------------------|-----------------|
| a) boiling water | physical |
| b) burning a log | chemical |
| c) grilling a steak | physical |
| d) dissolving sugar in water | physical |
| e) fermenting grapes | chemical |

12. Pure substances can be separated by

- | |
|------------------------|
| a) chemical means only |
|------------------------|
- b) physical means only
- c) either chemical or physical means
- d) neither chemical or physical means

13. Who is credited with the formation of the periodic table as it now exists?

Mendeleev

14. The periodic table consists of vertical lines called groups and horizontal rows called periods.

15. Write the symbols for the following elements:

a)	copper	<u>Cu</u>	b)	silicon	<u>Si</u>
c)	potassium	<u>K</u>	d)	cobalt	<u>Co</u>
e)	iron	<u>Fe</u>	f)	barium	<u>Ba</u>
g)	lead	<u>Pb</u>	h)	neon	<u>Ne</u>
i)	oxygen	<u>O</u>	j)	lithium	<u>Li</u>
k)	sulphur	<u>S</u>	l)	aluminium	<u>Al</u>

16. Write the correct name of the element for each symbol:

a)	C	<u>carbon</u>	b)	Cl	<u>chlorine</u>
c)	I	<u>iodine</u>	d)	P	<u>phosphorus</u>
e)	Ag	<u>silver</u>	f)	F	<u>fluorine</u>
g)	Ar	<u>argon</u>	h)	Zn	<u>zinc</u>
i)	Mg	<u>magnesium</u>	j)	Na	<u>sodium</u>
k)	He	<u>helium</u>	l)	Ni	<u>nickel</u>
m)	Hg	<u>mercury</u>	n)	Ca	<u>calcium</u>

17. Which element is the most common in the human body? oxygen

18. Which of the following is not a feature of metals

- a) conduct heat
- b) high melting point
- c) form anions
- d) malleable

Element 2

1. The atoms of each element are the same as each other and different from the atoms of other elements.

True / False

2. Use proton (P), neutron (N) or electron (E) to identify the subatomic particle or particles that each of the following statements describes:

a)	has the smallest mass	<u>E</u>
b)	carries a positive charge	<u>P</u>
c)	is located outside the nucleus	<u>E</u>
d)	is electrically neutral	<u>N</u>
e)	carries a negative charge	<u>E</u>
f)	has a mass about the same as a proton	<u>N</u>
g)	is located in the nucleus	<u>P / N</u>
h)	is found in the largest part of the atom	<u>E</u>

3. Define the atomic number:- the number of protons within an atom

4. Write the symbol showing the subscript and superscript for the following:

a)	an atom having mass number 44 & atomic number 20	<u>$^{44}_{20}\text{Ca}$</u>
b)	an atom having 28 protons & 31 neutrons	<u>$^{59}_{28}\text{Ni}$</u>
c)	an atom having mass number 24 & 13 neutrons	<u>$^{24}_{11}\text{Na}$</u>
d)	an atom having 35 electrons and 45 neutrons	<u>$^{80}_{35}\text{Br}$</u>
e)	a chlorine atom having 18 neutrons	<u>$^{35}_{17}\text{Cl}$</u>
f)	a silver atom having 62 neutrons	<u>$^{109}_{47}\text{Ag}$</u>

5. Complete the following table for the indicated atoms:

Atomic number	Mass number	Protons	Neutrons	Electrons	Name	Symbol
13	27	13	14	13	aluminium	Al
12	24	12	12	12	magnesium	Mg
6	12	6	7	6	carbon	C
16	31	16	15	16	Sulphur	S
16	34	16	18	16	Sulphur	S
20	42	20	22	20	calcium	Ca

6. Calculate the number of neutrons in each of the following atoms:

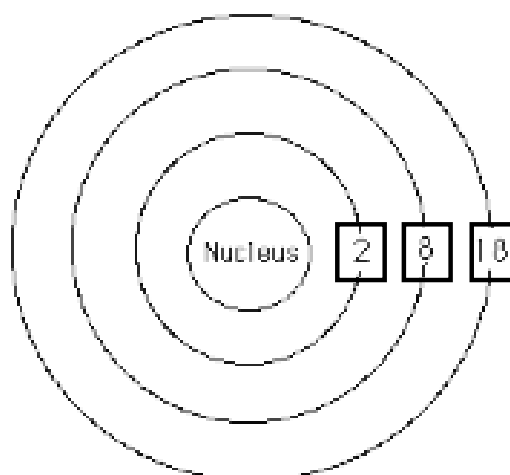
- | | | |
|----|--|-----------|
| a) | an atom with atomic number 17 & mass number 37 | <u>20</u> |
| b) | an atom with 20 electrons & mass number 40 | <u>20</u> |
| c) | a calcium atom with mass number 44 | <u>24</u> |
| d) | an atom of copper with mass number 65 | <u>36</u> |

7. Define an isotope **different versions of an atom with a differing number of neutrons**

8. Define the abundant isotope **the most common isotope found in nature**

9. State why the atomic mass of an atom is almost never a whole number
because the atomic mass is an average of the different ratios of the isotopes

10. In the following picture of the electron orbits, fill in the spaces of how many electrons fit into each orbit:-



11. Define valence electrons **the electrons in the outer shell of an atom**

12. State the octet rule the atom will attempt to get 8 electrons in the outer shell

13. It is harder to pull an electron off of a group 2 element than it is to pull the electron from a group 7 element. **True** False

14. Complete the following table by drawing electron dot diagrams for the first 8 elements:-

Atomic #	1	2	3	4	5	6	7	8
Electron dot diagram	H ⁺	He ⁺	Li ⁺	Be ⁺	B ⁺	C ⁺	N ⁺	O ⁺

15. Write the electron configuration for the following elements (the first has been done for you)

- a) phosphorus 2, 8, 5
- b) aluminium 2, 8, 3
- c) sulphur 2, 8, 6
- d) potassium 2, 8, 8, 1
- e) carbon 2, 4

16. Identify the elements with the following electron configuration:

- a) 2, 6 oxygen
- b) 2, 8, 2 magnesium
- c) 2, 8, 7 chloride
- d) 2, 8, 8, 2 calcium

17. Compounds can have

- a) ionic bonds only
- b) covalent bonds only
- c) either ionic or covalent bonds
- d) neither ionic or covalent bonds

18. Define an ion:- **an atom that has gained or lost electrons to alter the electric charge**
19. Differentiate between a cation and an anion.
a cation has a positive charge (derived from losing one or more electrons)
an anion has a negative charge (derived from gaining one or more electrons)
20. State the number of electrons lost or gained when ions are formed by each of the following:
- | | | |
|----|----|----------------------------------|
| a) | Mg | <u>2 electrons lost</u> |
| b) | Cl | <u>1 electron gained</u> |
| c) | Na | <u>1 electron lost</u> |
| d) | Al | <u>3 electrons lost</u> |
| e) | O | <u>2 electrons gained</u> |
| f) | S | <u>2 electrons gained</u> |
21. Give the symbol and name for an ion of each element:
- | | | |
|----|-----------|-------------------------------|
| a) | chlorine | <u>Cl⁻</u> |
| b) | magnesium | <u>Mg²⁺</u> |
| c) | potassium | <u>K⁺</u> |
| d) | oxygen | <u>O²⁻</u> |
| e) | aluminium | <u>Al³⁺</u> |
| f) | fluorine | <u>F⁻</u> |
22. Write the ions that have the following numbers of protons & electrons:
- | | | |
|----|--------------------------|-------------------------------|
| a) | 9 protons, 10 electrons | <u>F⁻</u> |
| b) | 12 protons, 10 electrons | <u>Mg²⁺</u> |
| c) | 3 protons, 2 electrons | <u>Li⁺</u> |
| d) | 19 protons, 18 electrons | <u>K⁺</u> |
| e) | 20 protons, 18 electrons | <u>Ca²⁺</u> |
23. Differentiate the mechanism of ionic bonding and covalent bond formation:
Ionic bonds are formed from a cation and an anion electrically attracting each other due to the opposing electrical charges, whilst a covalent bond is created from two atoms sharing electrons

24. Covalent bonds are very strong bonds.

True / False

25. Define a diatomic molecule and give two examples:-

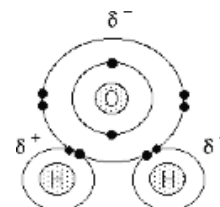
A diatomic molecule is a molecule that is formed from two atoms of the same element that bond covalently and share electrons. Examples of diatomic molecules are hydrogen (H₂), oxygen (O₂) and iodine (I₂)

26. Mixtures can be separated by

- a) chemical means only
- b) physical means only**
- c) either chemical or physical means
- d) neither chemical or physical means

Element 3

1. Define electronegativity the ability of an atom to attract electrons
2. Name the most electronegatively strong element of the periodic table fluorine (F)
3. Draw a water molecule, showing the electronegatively positive and negative ends.



4. Complete the following table about the mode of bonding that elements undergo

typical elements	two non-metals (identical)	two non-metals (different)	metal and non metal
electron bonding	shared equally	shared unequally	electron transfer
electronegativity difference	0	1.6 or less	greater than 1.6
bond type	nonpolar covalent	polar covalent	ionic
examples	H₂ Cl₂ Br₂	H₂O CCl₄ HBr	Li₂O NaCl BaCl₂

5. Complete the following list of the prefixes of covalent bonds:-

a)	one	<u>mono</u>
b)	three	<u>tri</u>
c)	four	<u>tetra</u>
d)	six	<u>hexa</u>
e)	eight	<u>octa</u>
f)	nine	<u>nona</u>

6. Name the following covalent compounds

a)	H ₂	<u>hydrogen</u>
b)	HF	<u>hydrogen fluoride</u>
c)	SO ₂	<u>sulphur dioxide</u>
d)	SCl ₂	<u>sulphur dichloride</u>
e)	CO	<u>carbon monoxide</u>
f)	NI ₃	<u>nitrogen tri-iodide</u>

7. Balance the following ionic compounds by adding the appropriate number to one of the elements, and for each combination give the entire formula:

- a) Ca + S CaS
- b) H + F HF
- c) Li + O Li₂O
- d) Al + O Al₂O₃
- e) H + Cl HCl

8. Write the correct ionic formula for compounds formed between the following ions:

- a) Mg²⁺ & O²⁻ MgO
- b) Zn²⁺ & Cl⁻ ZnCl₂
- c) K⁺ & I⁻ KI
- d) Al³⁺ & Cl⁻ AlCl₃
- e) Ba²⁺ & Cl⁻ BaCl₂
- f) Al³⁺ & S²⁻ Al₂S₃

9. Write names for the following ionic compounds

- a) Al₂O₃ aluminum oxide
- b) CaCl₂ calcium dichloride
- c) Na₂O sodium oxide
- d) Na₂S sodium sulphide
- e) MgO magnesium oxide

10. Write formulae for the following ionic compounds

- a) magnesium chloride MgCl
- b) sodium sulphide Na₂S
- c) copper (I) oxide Cu₂O
- d) iron (III) oxide Fe₂O₃
- e) barium fluoride BaF₂

11. Define a polyatomic compound a molecule with extra electrons that acts like an ion

12. Name the following polyatomic ions

- | | | |
|----|--------------------|------------------|
| a) | SO_4^{2-} | <u>sulphate</u> |
| b) | CO_3^{2-} | <u>carbonate</u> |
| c) | PO_4^{3-} | <u>phosphate</u> |
| d) | OH^- | <u>hydroxide</u> |
| e) | NO_3^- | <u>nitrate</u> |

13. Circle the polyatomic ion in the following and write the correct name of the compound

- | | |
|----|--------------------------|
| a) | Na_2CO_3 |
| b) | NH_4Cl |
| c) | BaSO_4 |
| d) | KOH |
| e) | NaNO_3 |

14. Write the names of the following ions (include the Roman numeral when necessary)

- | | | |
|----|------------------|----------------------------|
| a) | Fe^{2+} | <u>ferrous iron (II)</u> |
| b) | Pb^{2+} | <u>plumbous lead (II)</u> |
| c) | Cu^{3+} | <u>cupric copper (III)</u> |

15. Differentiate between mass and weight mass is the amount of matter that is present in an object whilst weight is mass multiplied by gravity

16. Using the periodic table state the molecular mass of each of the following elements:

- | | | |
|----|----|-----------------|
| a) | Cl | <u>35.5 AMU</u> |
| b) | Pb | <u>207 AMU</u> |
| c) | Cu | <u>63.6 AMU</u> |
| d) | Fe | <u>55.9 AMU</u> |
| e) | Mg | <u>24.3 AMU</u> |

17. Calculate the formula mass each of the following compounds:

a)	SO ₂	<u>64.1 AMU</u>
b)	CO	<u>28 AMU</u>
c)	KOH	<u>56.1 AMU</u>
d)	NaNO ₃	<u>85 AMU</u>
e)	HF	<u>20 AMU</u>
f)	CuO	<u>79.6 AMU</u>

18. State how many atoms are present in one mole of a substance 6.022 x 10²³

19. How many moles of carbon are present in 36 g of carbon 3 moles

20. State the molar mass of the first 3 elements of the periodic table

1	<u>1g</u>
2	<u>4g</u>
3	<u>6.9 g</u>

21. Differentiate between heterogenous and homogenous solutions **heterogenous solutions are mixed unevenly and can separate whilst a homogenous solution is evenly mixed and cannot separate**

22. Nonpolar substances **can** / **can not** dissolve in water.

23. How many grams of sodium chloride are there in a 0.9 % saline solution.
0.9 g per 100ml (9 g per litre)

24. How many g of glucose are in 200 ml of a 12 % W / V solution.
24 g (12 g per 100ml)

25. In a 5% w / v solution, there are 5g in 100 ml. **True** False

26. A 3.5M solution of HCL contains 3.5 moles of HCL per litre of solution. 1 litre of this solutions contains 127.75 g HCl

27. Describe how concentration can be increased increasing the solute or decreasing the amount of solvent
28. Define saturation as related to solutions the maximal amount of solute dissolved into the solvent
29. Placing a red blood cell in a hypotonic solution (in which the concentration of solutes in the fluid is less than the concentration of solutes within the red blood cell) causes the cell to shrink / swell.

Element 4

1. Water is commonly called the universal solvent because it does not have any polarity.

True / **False**

2. Describe surface tension the attraction of water molecules for each other

3. According to the Brønsted - Lowry theory of acids & bases, an acid is a substance that can accept a proton (H^+) and a base is a substance that can donate a proton (H^+).

True / **False**

4. Conjugate acids and bases form pairs with each other.

True / False

5. A strong acid is one that almost completely ionises to donate nearly all of its protons.

True / False

6. State two example of strong acids

hydrochloric acid

nitric acid

7. The **0** / **14** end of the pH scale is alkaline.

8. Are the following solutions acidic, neutral or basic
(note: $[H^+]$ means hydrogen ion concentration)

a)	$[H^+] = 10^{-4} \text{ mol / L}$	<u>acidic</u>
b)	$[H^+] = 10^{-7} \text{ mol / L}$	<u>neutral</u>
c)	$[H^+] = 5 \times 10^{-2} \text{ mol / L}$	<u>acidic</u>
d)	$[H^+] = 0.01 \text{ mol / L}$	<u>acidic</u>
e)	$[H^+] = 0.0001 \text{ mol / L}$	<u>acidic</u>
f)	$[H^+] = 10^{-9} \text{ mol/L}$	<u>basic</u>

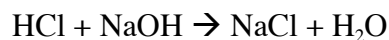
9. State whether the following solutions are acidic, neutral or basic

a)	blood, pH 7.4	<u>basic</u>
b)	coffee, pH 5.5	<u>acidic</u>
c)	Pancreatic juice, pH 8.2	<u>basic</u>
d)	Vinegar, pH 2.8	<u>acidic</u>
e)	Milk, pH 7.0	<u>neutral</u>
f)	pH balanced shampoo, pH 6.5	<u>acidic</u>
g)	hot tub water, pH 7.8	<u>basic</u>
h)	drain cleaner, pH 11.2	<u>basic</u>
i)	laundry detergent, pH 9.5	<u>basic</u>

10. Name the structure that can be used to test the acidity of a solution

indicator

11. State the type of reaction that is written below:- neutralisation



12. Name three buffer systems that are active in the body:

carbonic acid - bicarbonate buffer system

protein buffer system

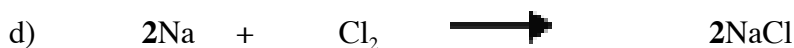
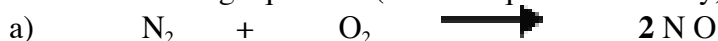
phosphate buffer system

13. **Reactants** / **products** are written on the left side of an equation.

14. State the theory of conservation of energy:-

energy can not be created nor destroyed, merely transformed or transferred

15. Balance the following equations (rewrite equation correctly):



Element 5

1. Chemical reactions are usually due to interaction of electrons. True / False
2. Enzymes are degraded by the reaction that they catalyse. True / False
3. Oxygenase adds / removes an oxygen from a substance.
4. Anabolism / catabolism is the process of joining two substrates together.
5. If energy is released during a reaction, the reaction is an exothermic reaction
6. Define the activation energy:
the energy required for a chemical reaction to occur
7. State two factors that affect the rate of a reaction
temperature
pressure
8. When discussing enzyme kinetics, K_m refers to
 - a) 25% of V_{max}
 - b) 50% of V_{max}
 - c) 75% of V_{max}
 - d) 100% of V_{max}
9. Which of the following types of inhibition refers to a substance binding to the active site of an enzyme to prevent access of the normal substrate.
 - a) competitive inhibition
 - b) noncompetitive inhibition
 - c) uncompetitive inhibition
10. Define equilibrium in chemistry terms
when the rate of the reaction proceeding forward is the same as the rate of the reaction proceeding backward

11. Define Le Chateliers principle

If we alter something in an equilibrium, it alters everything, the system will try to regain equilibrium. If a system which has reached equilibrium is disturbed then the system will readjust to minimise the disturbance and establish a new equilibrium position.

12. Use the words moves to the right or moves to the left. What happens to the following reaction at equilibrium if:



a) more CO₂ is added moves to the left

b) CaCO₃ is removed moves to the left

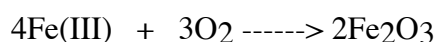
13. Endothermic and Exothermic energy transfer.

a) If the temperature is reduced, it is an exothermic reaction.

b) If the temperature is increased, it is an endothermic reaction.

14. Differentiate oxidation and reduction oxidation is the process of losing oxygen atoms (or gaining electrons or hydrogens) whilst reduction is the process of gaining atoms (or losing electrons or hydrogens).

15. In the following reaction:



a) what is oxidised and why iron is oxidised as it loses electrons

b) what is reduced and why oxygen is reduced as it gains electrons

16. Define a free radical a highly reactive substance with unpaired electrons

17. State an example of an antioxidant vitamin C

18. Describe the role of antioxidants in the body

to bind with free radicals before the free radical binds to and damages structures of the cell

Element 6

1. Define organic chemistry the chemistry of carbon based structures

2. Complete the following table:-

Organic	Inorganic
all are carbon compounds	contain metals in salts and oxides
all have covalent bonds	all have ionic or polar bonds
all have low melting points	all have high melting points
all have low boiling points	all have high boiling points
most burn in air	few burn in air
most are soluble in nonpolar solvents	most are soluble in polar solvents
most are non-electrolytes	most are non-electrolytes
can be large with many atoms	all are usually small with few atoms

3. What elements do hydrocarbons contain carbon and hydrogen

4. Alkynes are a type of hydrocarbon. True / False

5. What does the general formula C_nH_{2n+2} tell you about a hydrocarbon compound?

that there are no double bonds and the substance is an alkane

6. Structural formulae give exact numbers of molecules whilst molecular formulae give the locations of the atoms. True / False

7. Identify the following prefixes:-

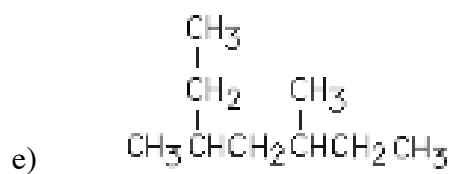
one carbon	meth-	two carbons	eth-
three carbons	prop-	four carbons	but-
five carbons	pent-	six carbons	hex-
seven carbons	hept-	eight carbons	oct-
nine carbons	non-	ten carbons	dec-

8. Define an alkane a hydrocarbon chain with no double bonds

9. Complete the following table:-

Number of carbons	IUPAC prefix	name	molecular formula	Condensed structural formula
1	meth -	methane	CH ₄	CH₄
2	eth-	ethane	C₂H₆	CH ₃ CH ₃
3	prop-	propane	C₃H₈	CH ₃ CH ₂ CH ₃
4	but -	butane	C ₄ H ₁₀	CH₃CH₂CH₂CH₃
5	pent-	pentane	C₅H₁₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₃
6	hex -	hexane	C₆H₁₄	CH₃CH₂CH₂CH₂CH₂CH₃
7	hept-	heptane	C₇H₁₆	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
8	oct -	octane	C ₈ H ₁₈	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
9	non -	nonane	C ₉ H ₂₀	CH₃CH₂CH₂CH₂CH₂CH₂CH₂CH₂CH₃
10	dec-	decane	C₁₀H₂₂	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃

10. Differentiate between alkenes and alkynes alkenes have double bonds whilst alkynes have triple bonds between carbon atoms

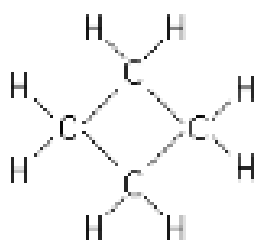


3,5 dimethyl heptane

Element 7

1. State the difference between a straight chain alkane and a cycloalkane:-
a straight chain alkane has no double bonds and has a basic structure of C_nH_{2n+2} , whilst in a cycloalkane, two carbons bond, and two hydrogens are lost

2. Identify the following compound:



cyclobutane

3. Complete the following table:-

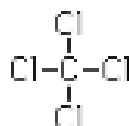
group	element	name
-F	fluorine	fluoro-
-Cl	chlorine	chloro-
-Br	bromine	bromo-
-I	iodine	iodo-

4. Draw the structural formulae for the following compounds:-

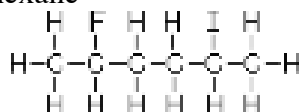
- a) chloropentane



- b) tetrachloromethane



- c) 2- fluoro, 5- iodo hexane



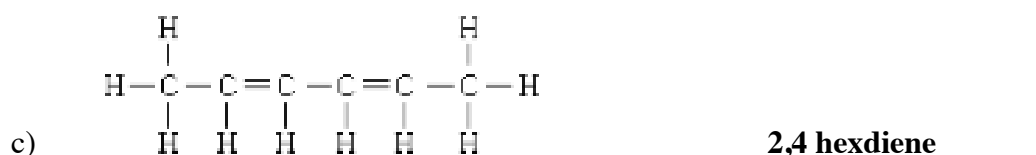
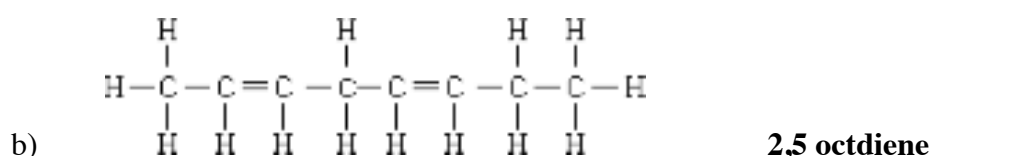
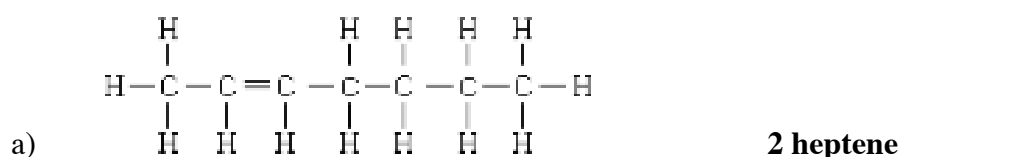
5. Give the general reaction of combustion of an alkane in oxygen:-

alkane + oxygen gives carbon dioxide, water and energy (heat)

6. Describe substitution:- when another atom or group of atoms are substituted for one or more of the hydrogens

7. Define an alkene:- a hydrocarbon with double bonds and has a basic structure of C_nH_{2n}

8. Name the following alkenes:



9. If an alkene has two double bonds, indicate the prefix in its name: di-

10. Complete the following statement regarding oxidation of an alkene:-

alkene + oxygen = carbon dioxide + water

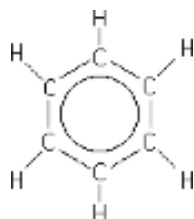
11. Name the three most common addition reactions of alkenes:-

a) hydrogenation

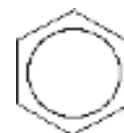
b) hydrohalogenation

c) hydration

12. Define polymerisation:- joining smaller units called monomers into a polymer
13. Define an alkyne:- a hydrocarbon with triple bonds and has a basic structure of C_nH_{2n-2}
14. Alkynes are commonly found in the body. True / False
15. Identify the following structure and draw its more common diagrammatic representation.



benzene ring



16. Complete the following table:-

functional group	class of compound	typical compound	name of compound
$R-OH$	alcohol	CH_3CH_2-OH	ethanol
$R-O-R'$	ether	$CH_3-O-CH_2CH_3$	ethyl methyl ether
$R-\overset{\overset{O}{\parallel}}{C}-H$	aldehyde	$CH_3CH_2-\overset{\overset{O}{\parallel}}{C}-H$	propanal
$R-\overset{\overset{O}{\parallel}}{C}-R'$	ketone	$CH_3-\overset{\overset{O}{\parallel}}{C}-CH_3$	propanone (acetone)
$R-\overset{\overset{O}{\parallel}}{C}-OH$	carboxylic acid	$CH_3CH_2-\overset{\overset{O}{\parallel}}{C}-OH$	propanoic acid
$R-\overset{\overset{O}{\parallel}}{C}-O-R'$	ester	$CH_3CH_2-\overset{\overset{O}{\parallel}}{C}-O-CH_3$	methyl propanoate

17. Define an alcohol:- a substance with one or more OH groups
18. Distinguish between ethanol and methanol:- ethanol consists of two carbons and a hydroxyl group whilst methanol only has one carbon and a hydroxyl group

19. Differentiate primary, secondary and tertiary alcohols:-

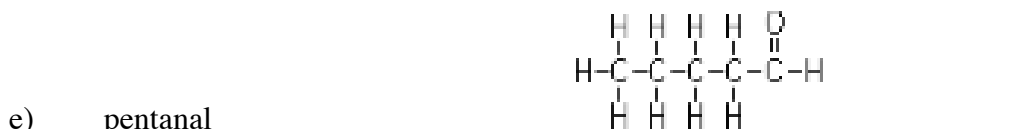
primary - the OH group attaches to a carbon that is bonded to 1 other carbon

secondary - the OH group attaches to a carbon that is bonded to 2 other carbons

tertiary - the OH group attaches to a carbon that is bonded to 3 other carbons

Element 8

1. Draw the structural formulae for the following aldehydes:



2. Describe the main difference between an aldehyde and a ketone:
the carbonyl group (C=O) is bonded to the terminal (end) carbon in an aldehyde and any carbon but the terminal carbon in a ketone

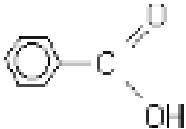
3. State the products of the following reactions:-

- a) oxidation of a primary alcohol **aldehyde**
- b) oxidation of a secondary alcohol **ketone**
- c) oxidation of tertiary alcohol **tertiary alcohols cannot be oxidised**

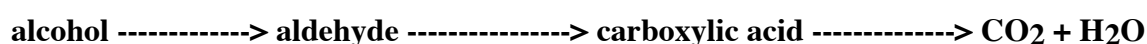
4. State what elements are present to form a carboxylic acid:

carbon oxygen hydrogen

5. Complete the following table:

common name	IUPAC name	formula
formic acid	methanoic acid	$\begin{array}{c} \text{O} \\ \\ \text{H}-\text{C}-\text{OH} \end{array}$
acetic acid	ethanoic acid	$\begin{array}{c} \text{O} \\ \\ \text{CH}_3-\text{C}-\text{OH} \end{array}$
lactic acid	2-hydroxypropanoic acid	$\begin{array}{c} \text{OH} \quad \text{O} \\ \quad \\ \text{CH}_3\text{CH}-\text{C}-\text{OH} \end{array}$
butyric acid	butanoic acid	$\begin{array}{c} \text{O} \\ \\ \text{CH}_3\text{CH}_2\text{CH}_2-\text{C}-\text{OH} \end{array}$
capric acid	decanoic acid	$\begin{array}{c} \text{O} \\ \\ \text{CH}_3(\text{CH}_2)_8-\text{C}-\text{OH} \end{array}$
tartaric acid	2,3-dihydroxybutanedioic acid	$\begin{array}{c} \text{O} \quad \text{OH} \quad \text{OH} \quad \text{O} \\ \quad \quad \quad \\ \text{HO}-\text{C}-\text{CH}-\text{CH}-\text{C}-\text{OH} \end{array}$
salicylic acid	benzoic acid	

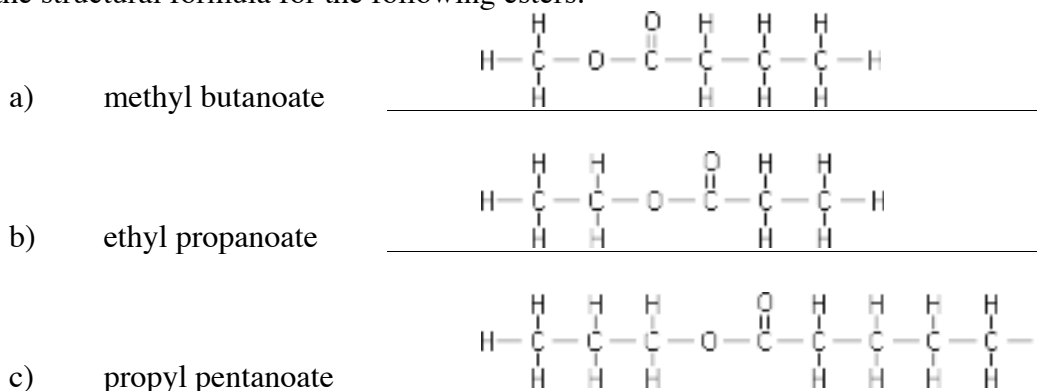
6. Describe the pathway for alcohol metabolism.



7. Define esterification:

the bonding of an alcohol and a carboxylic acid

8. Draw the structural formula for the following esters:-



9. Salicylic acid can undergo esterification at either the hydroxyl group, or the carboxylic acid group.

True / False

10. Name the process that reverses esterification.

hydrolysis

11. State the components of the amine functional group:

nitrogen and two hydrogen atoms

12. Differentiate primary, secondary, and tertiary amines.

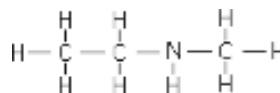
primary amine - the nitrogen is bonded with one carbon and two hydrogens

secondary amine -the nitrogen is bonded to two carbon atoms and one hydrogen

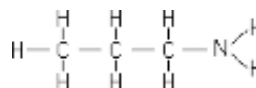
tertiary amine - the nitrogen is bonded with three carbons

13. Draw the structural formulae for the following amines:-

a) methyl- ethylamine



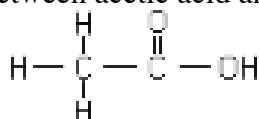
b) propylamine



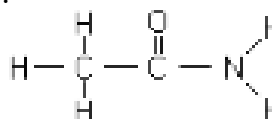
14. Define an amide:

Amides are derived from carboxylic acids, in which the -OH group has been replaced with an amino group (-NH₂)

15. Differentiate between acetic acid and acetamide:-



acetic acid



acetamide

Element 9

1. State the four main components of a normal cell:-

_____ **cell membrane** _____

_____ **organelles** _____

_____ **cytoplasm** _____

_____ **inclusions** _____

2. The fatty acids of phospholipids are **hydrophilic** / **hydrophobic**.

3. Glycolipids contain

- a) lipids attached to lipids
- b) carbohydrates attached to lipids**
- c) proteins attached to lipids

4. The electrical charge of a substance does not affect the ability of a substance to move across a membrane.

True / **False**

5. State the function of the following organelles

- a) ribosomes _____ **protein synthesis** _____
- b) lysosomes _____ **defence of the cell** _____
- c) Golgi complex _____ **packaging of proteins for export from the cell** _____

6. **ATP** / **ADP** contains three phosphates.

7. Adipocytes contain more intracellular fluid than skeletal muscle cells. **True** / **False**

8. The **intracellular** / **extracellular** fluid compartment is the largest.
9. In general, substances move **up** / **down** their concentration gradients.
10. Which of the following requires a pressure gradient rather than a concentration gradient
- a) simple diffusion
 - b) facilitated diffusion
 - c) osmosis
 - d) **filtration**
11. Describe the process of osmosis.
movement of the solvent across a membrane that is impermeable to the solutes

12. Pinocytosis allows fluid to **enter** / **exit** the cell.
13. The sodium potassium pump causes the removal of three **potassium** / **sodium** from the intracellular fluid.
14. Which of the following is not a type of transporting channel
- a) symporter
 - b) antiporter
 - c) **coporter**

Element 10

1. Which of the following is not a nitrogenous base that is found in DNA:

a) adenine

b) guanine

c) uridine

d) thymine

2. Differentiate a nucleoside and a nucleotide.

a nucleoside is formed from a base and a sugar whilst a nucleotide is formed from a base, a sugar and a phosphate

3. The energy liberated from cleaving phosphates allows DNA synthesis to occur.

True / False

4. Describe the term “complementary base pairing”: _____

due to the position of the hydrogen, oxygen and nitrogen atoms within DNA, certain bases will bond with predictable other bases. Specifically adenine will bind with thymine and guanine will bind with cytosine

5. Hydrogen bonding occurs between hydrogen atoms and the adjacent carbons of nitrogenous bases.

True / False

6. Describe the double helix structure of DNA

due to the rotated nature of nucleotides, the DNA molecule spirals with the bases and sugars forming the sides and the combined bases forming horizontal rungs

7. The DNA molecule wraps around **histones** / ribosomes.

8. Briefly describe the events occurring in replication:

The DNA strands are separated by breaking the hydrogen bonds between the bases.

New nucleotides are brought in to bond with the exposed bases on each of the strands to form two separate DNA molecules that are identical to each other

9. Which of the following is not a stage of interphase

a) G1

b) G2

c) G3

10. Put the following stages of mitosis in the correct order:

anaphase metaphase prophase telophase

prophase

metaphase

anaphase

telophase

11. Describe the function of the centrioles in the process of mitosis.

The formation of the mitotic spindle and the subsequent migration of the centrioles to opposite ends of the cells allows the chromosomes to be separated by the centrioles retracting the mitotic spindle

12. Cytokinesis is the process of division of the cytoplasm, and allows the cell to completely divide into two daughter cells.

True / **False**

13. Define the following terms:-

labile cells - cells that can undergo mitosis continuously

stable cells - cells that can undergo mitosis if required

permanent cells - cells that can not undergo mitosis even when required