

Kirkcaldy High School



Chemistry

Higher

Unit 2 - Nature's Chemistry

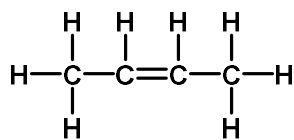
TUTORIAL ANSWERS

(a) Alcohols

1. C

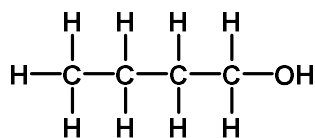
2.

(a)



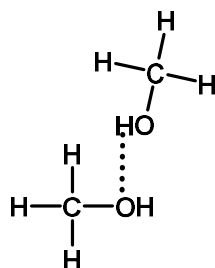
(b) 1

3.



4.

(a)

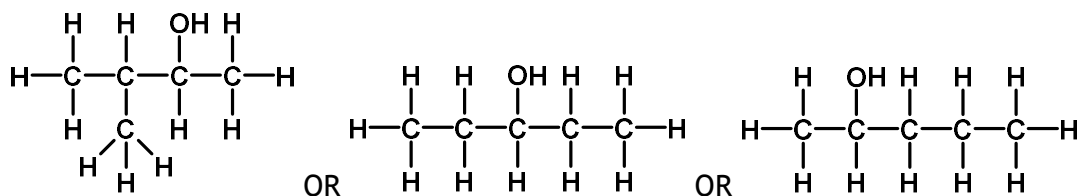


(b) It is more volatile than hexan-2-ol and will evaporate more quickly.

5. Geraniol is less volatile due to hydrogen bonding

6.

(a)



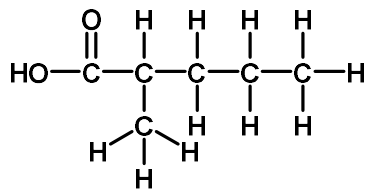
(b) Triethanol amine has 2 x OH groups for hydrogen bonding whereas triisopropyl amine has no hydrogen bonding sites.

(b) Carboxylic Acids

1. D

2. A

3.



4.

(a) Hydroxyl and Carboxyl

(b) It contains OH groups that can hydrogen bond to water molecules.

(c) Esters, Fats and Oils

1. C
2. A
3. A
4. C
5. B
6. D
7. B
8. D
9. C
10. B
11. B
12. C
13. A
14. C
15. B
16. A
17. B
18. B
19. A
- 20.

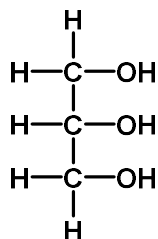
(a) Glycerol and/or propan-1,2,3-triol

(b) Unsaturated fatty acid chains are more rigid. This prevents close packing of molecules leading to weaker London Dispersion Forces.

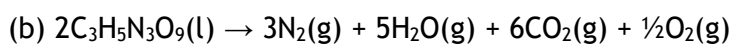
21.

(a)

(i)



(ii) Fats/oils/lipids



22.

(a) Octadec-9,12,15-trienoic acid

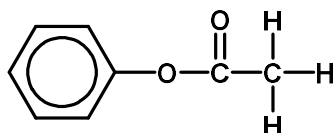
(b) hydrolysis

23.

(a) Anything except fire! e.g. water bath/heating mantle

(b) Condensation

(c)



24.

(a) Ester

(b) The double bonds undergo an addition reaction with H_2 . The molecule becomes saturated

(c) Energy storage

Brain is mostly fat

Regulates insulin

25.

(a) It is saturated, so molecules can pack more closely together so stronger London Dispersion Forces

(b) Polyunsaturated (saturated would start with $\text{C}_{17}\text{H}_{35}$)

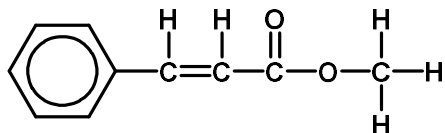
26.

(a)

(i) Diagram showing steam passing THROUGH strawberry gum leaves and then condensed using a water condenser/wet paper towel. System must not be "closed".

(ii) Distillation.

(b)



27.

(a) Ethanoic acid

(b)

(i) Concentrated sulfuric acid (H^+)

(ii) Wet paper towel/reflux condenser

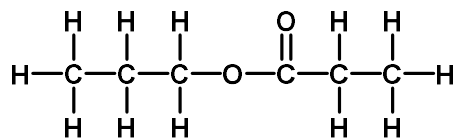
28.

(a) Methyl ethanoate

(b)

(i) An oily layer and a fruity smell

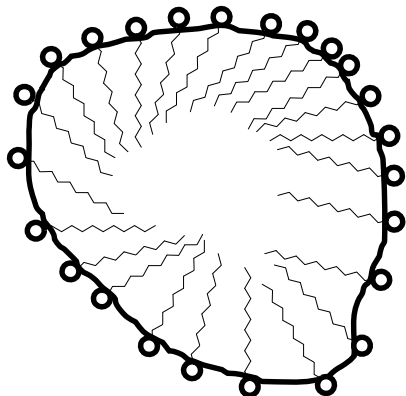
(ii)



(d) Soaps, detergents and emulsions

1. A
2. A
3. D
- 4.

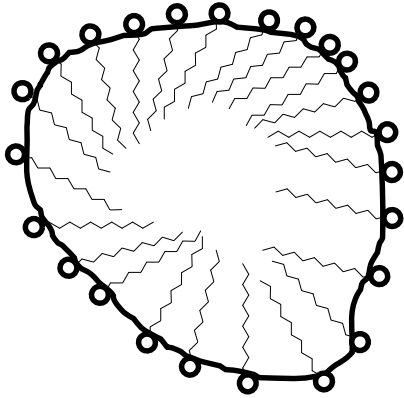
(a) The molecule has a hydrophilic head and a hydrophobic tail. The tail dissolves in oil, the head in water:



(b) Soap/detergent/emulsifier

5.

(a) The molecule has a hydrophilic head and a hydrophobic tail. The tail dissolves in oil, the head in water:



(b)

(c)

(i) ~2.25 %

1 l handwash = 1100 g, mass NaCl = $1100 \times 0.0225 = 24.75$ g

(ii) Adding too much/too little NaCl will reduce viscosity.

(d) Green (approx. 510 nm not absorbed)

6. Hydrocarbons are hydrophobic

Feather waterproofing also hydrophobic

Veg. oil is hydrophobic but will dilute the hydrocarbons

Dilute washing liquid will remove some, but not all of the hydrophobic residue

This leaves behind some veg. oil to keep bird waterproof - safer for their stomach than hydrocarbon.

This question is a good opportunity to explain how detergents work!

(e) Proteins

1. B
2. A

(f) Oxidation of Food

1. B
2. D
3. D
4. A
5. A
6. A
7. C
8. D
9. D
10. B
11. C
12. C
13. C
14. B
15. D
16. D
- 17.

(a) Lycopene is a hydrocarbon so is non-polar. Therefore it should be cooked water (polar)

(b) The flavour molecule is polar

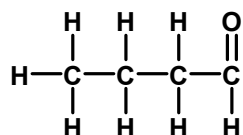
18. C
- 19.

(a) Propanal

(b) Condensation

20.

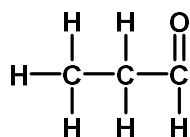
(a)



(b) Aldehydes/alkanals

(c) Silver mirror forms

21.



22. C

23.

(a) Carbonyl

(b) Silver mirror due to formation of silver atoms from silver ions (reduction as a result of the oxidation of propanal to propanoic acid)

24. Propanone

25.

(a) Orange to green

(b) ethanol

(c) Tollen's Reagent/Benedict's Solution

(d) Carboxylic Acids

26. A

27. D

28.

(a) OH groups or CHO group

(b) Sample and Benedict's solution in a test tube in a hot water bath

(c) Blue to orange

29. Open question - could mention

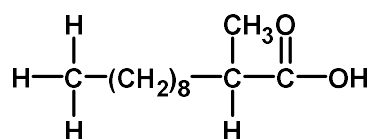
Oxidise C=O to COOH

Hydrolyse fats

30.

(a) Aldehydes

(b)

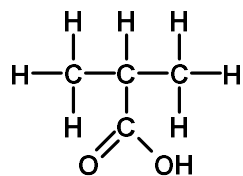


31.

- (a) Increase in O:H ratio
- (b) Orange to green

32.

(a)



- (b) Silver mirror formed
- (c) Water bath
- (d) Primary

(g) Fragrances

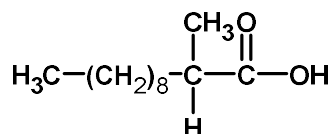
1. A
2. B
3. A
4. D
5. C
6. D
7. B
8. A
- 9.

(a) Hydrogen bonding makes it less volatile

(b)

(i) Aldehydes/alkanals

(ii)



(c) Open question. Could comment on...

Oxidation of ethanol

Hydrogen bonding and volatility in alcohol and water

Terpenes

Structure

Reactions (addition reactions)

10. C

11.

(a)

(i) Diagram showing steam passing THROUGH strawberry gum leaves and then condensed (wet paper towel/condenser) and collected

(ii) Distillation

(b)

(i)

$$\text{moles cinnamic acid} = \frac{6.5}{148} = 0.0439 \text{ mol}$$

$$\text{moles methanol} = \frac{2}{32} = 0.0625 \text{ mol}$$

should be 1:1 ratio so methanol is in excess by 0.186 mol.

(ii)

(A) 52 %

(B) £24.59

12.

(a) Anisyl alcohol

(b) Counterfeit perfumes contain less of perfume E/smaller quantities of other compounds

(c)

(i) It is non-polar and very unreactive

(ii) Size of molecules

(d)

(i) Terpenes

(ii)

(A) 3,7-dimethylocta-1,6-diene-3-ol

(B) The carbon atom attached to the OH has three other carbon atoms attached.

(e) 1.70 g

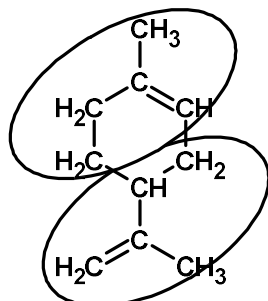
13.

(a) Contains ester group and terpene structure

(b) Ethanoic acid

(c)

(i)



(d) It's non-polar

Geranyl acetate has a larger number of electrons so will have stronger London Dispersion forces.

Geranyl acetate also as Permanent Dipole - Permanent Dipole from C=O.

14.

(a) $C_{25}H_{40}$

(b) Their flavour/aroma attracts animals to eat the fruit.

15. B

16.

(a) It is made from 2 isoprene units

(b) Lots of OH groups so very polar. Will hydrogen bond with water molecules.

(h) Skin Care

1. C

2. A

3. D

4. A

5. B

6. B

7.

(a)

(i) A very reactive species with unpaired electrons

(ii) UV light breaks the bond

(iii) Propagation

(b) $O=C=C=C=O$

8.

(a) It undergoes a termination reaction with $\bullet NO_2$.

(b) $C_6H_8O_6(aq) \rightarrow C_6H_6O_6(aq) + 2H^+ + 2e^-$

9.

(a) F_2 is below MnO_4^- in the electrochemical series

(b)

(i) Initiation

(ii) $\bullet CH_3 + \bullet CH_3 \rightarrow C_2H_6$ OR $\bullet F + \bullet F \rightarrow F_2$

10.

(a) Water (lycopene is non-polar)

(b) Flavour molecule is polar

11. B

12. A

13. B

14.

- (a) To prevent damage from free radicals to skin cells
- (b) They block UV light preventing the formation of free radicals

15.

- (a)
 - (i) Free radicals
 - (ii) Increase in O:H ratio (loss of H)

(b) £1.07

16.

- (a) Correct geometry of collision
Energy greater than E_a (activation energy)

(b)

(i) 4.17×10^9 mol.

(ii)

(A) Initiation

(B) $\cdot\text{H} + \cdot\text{Cl} \rightarrow \text{HCl}$ OR $\cdot\text{H} + \cdot\text{H} \rightarrow \text{H}_2$