



**ALL SAINTS'
COLLEGE**

Science Department

Year 12 Chemistry ATAR

Organic Synthesis 2018

Name: _____

Instructions to Students:

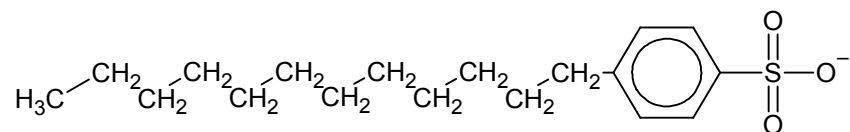
1. 50 minutes permitted
2. Attempt all questions
3. Write in the spaces provided
4. Show all working when required
5. All answers to be in blue or black pen, diagrams in pencil.

Multiple Choice	Short Answer	TOTAL
/10	/58	/68

Final Percentage

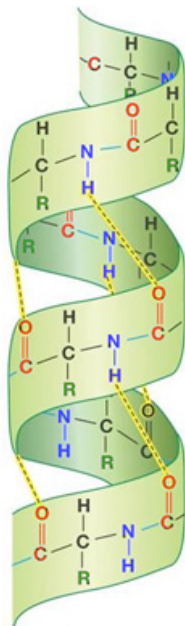
Multiple choice

1. The molecule below is a common detergent - the production of which is specifically named in your year 12 syllabus.



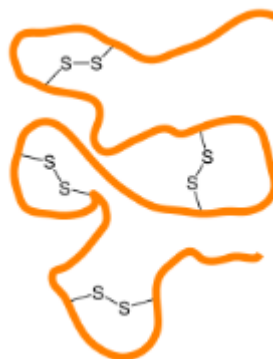
The correct name is:

- a. Sodium stearate
 - b. Benzene sulfonate ion
 - c. Dodecylbenzene sulfonate
 - d. Dodecylbenzene stearate
2. The diagram below depicts:



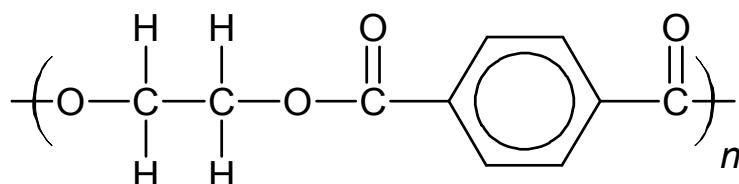
- a. An alpha helix, tertiary structure
 - b. An alpha helix, secondary structure
 - c. A beta pleated sheet, secondary structure
 - d. A beta pleated sheer, tertiary structure
3. The diagram shown depicts

- a. Covalent sulfur links
- b. Elastomer linkages
- c. A silk fibre
- d. Disulphide bridges



4. Which of the following is NOT a principle of green chemistry
- Real-time analysis for pollution prevention
 - Land rights
 - Less hazardous chemical syntheses
 - Catalysis
5. Which of the following substances could not be used to produce a viable amount of soap from a vegetable oil?
- Sodium hydroxide
 - Potassium hydroxide
 - Lead Hydroxide
 - Barium Hydroxide
6. Biodiesel can be produced from a triglyceride using either a base catalysed or lipase-catalysed process. An advantage of using the lipase method is:
- It is a batch process
 - Fresh catalyst must be regularly supplied
 - It operates at ambient temperatures
 - It has a high operating cost.

7. The polymer shown below is known as:

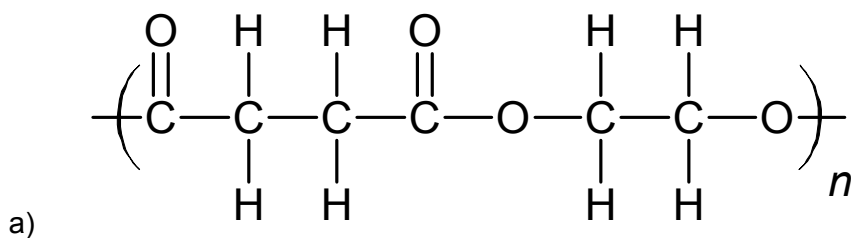


- High Density Polyethene (HDPE)
 - Poly-paraphenylene terephthalamide (Kevlar)
 - Polyethylebenzoic acid
 - Polyethylene terephthalate (PET)
8. A polymer that can be melted and recast into a new shape is known as a:
- Thermoplastic
 - Polymorphic plastic
 - Thermoset
 - Elastomer

9. A characteristic property of polytetrafluoroethene (PTFE) is:
- It has the lowest coefficient of friction known
 - It has the greatest ability to stretch
 - It has an incredibly high heat resistance
 - It is incredible resistant to wear and abrasion
10. In the micelle that is created when soap dissolves in water:
- The hydrophobic heads repel each other to form a sphere.
 - The hydrophobic portions of the molecule bond with dipole-dipole forces.
 - The hydrophilic parts of the molecule are attracted to each other.
 - The charged ionic portions of the molecule interact with water.

Short Answer

1. Give the structure of the monomers used to form the following polymers. You must also list any **by-products** formed in the reaction and you must state the **type of polymerization**. Finally, provide a possible **use** of the polymer.



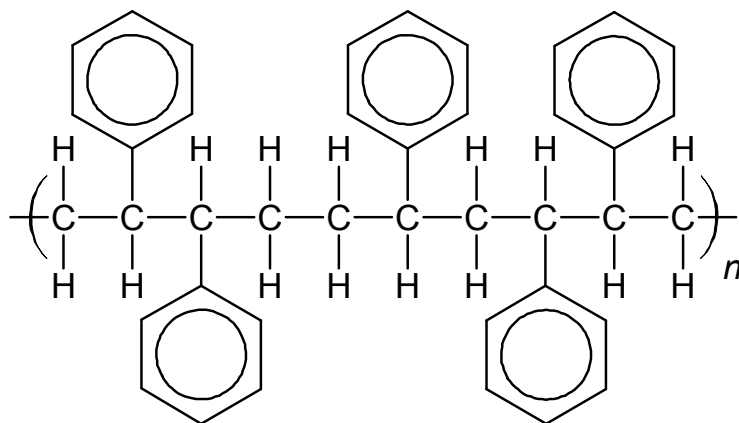
Monomers

By-product (if any)

Polymerisation type

Use

b)



Monomers

By-product (if any)

Polymerisation type

Use

[9 marks]

2. Green chemistry is the utilisation of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. There are 12 main principles, for the three specified below provide an explanation as to how the principle provides a benefit.

(a) Atom Economy

(b) Reduce Derivatives

(c) Design for Degradation

[6 marks]

3. Biofuels like bioethanol and biodiesel are produced from biomass and are considered fossil fuel alternatives. Although their current contribution to total global fuel requirements is small their production is predicted to double by 2025 from 2012 levels.

Replacing petroleum fuels with biofuels is consistent with the principles of green chemistry and a sustainable chemical industry for a number of reasons.

Bioethanol is produced from biomass such as sucrose ($C_{12}H_{22}O_{11}$)

- (a) Show a balanced reaction of the hydrolysis of sucrose to glucose ($C_6H_{12}O_6$).

[2 marks]

- (b) Show the fermentation of glucose to ethanol

[2 marks]

- (c) Show the overall equation for the conversion of sucrose to ethanol.

[2 marks]

- (d) What are two advantages in using bioethanol as a fuel to ethanol produced via another method that you have studied?

- i. _____

- ii. _____

[2 marks]

(e) Show the equation for the production of ethanol from ethene.

[2 marks]

(f) Why is this process not considered a “green” source of ethanol?

[1 mark]

(g) What are the advantages of this method?

[1 mark]

4. (a) Suggest a reason why soaps are more effective in suburban Perth than they are on a cattle station in the Pilbara where household water is obtained from a bore.

[1 mark]

(b) When 1 mL of a soap solution was added to each litre of hard water, the water would not lather and it had poor detergent qualities. When 10 mL of the soap solution was added to each litre, the resultant solution cleaned clothes effectively. Explain these observations.

[2 marks]

4. Valine is an alpha amino acid that can exist as a Zwitterion under different pH conditions.

(a) Using your data sheet, draw a full structural diagram of the zwitterion form of valine.

[1 mark]

(b) Show the ionic equation of valine reacting with hydrochloric acid.

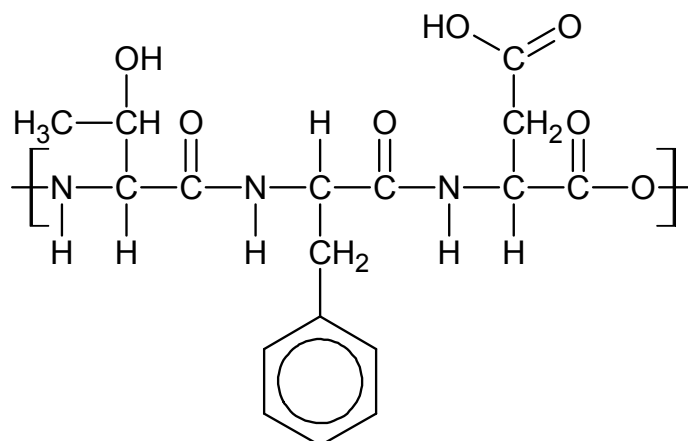
[2 marks]

(c) Show the ionic equation of valine reacting with sodium hydroxide.

[2 marks]

5. Proteins are formed when amino acids are combined.

(a) The structure below represents a portion of a protein molecule



Using your data sheet, give the names of the amino acids involved in creating this portion of the protein.

One: _____

Two: _____

Three: _____

[3 marks]

(b) The most important level of organisation in a protein is the **tertiary structure** – the 3D shape. The overall tertiary shape may be long and narrow (fibrous proteins) or a roughly globular shape (such as enzymes). There are five types of **interactions** in determining the tertiary structure.

Using the three amino acids shown in the picture above, name and describe **three (3)** of the interactions that will determine the tertiary structure of a protein.

(d) _____

(e) _____

(f) _____

[9 marks]

- (c) The portion of the protein given in the diagram will denature in environments where the pH is low. Using your knowledge of chemistry and the interactions that happen at the tertiary level of protein structure, explain this observation. (a diagram may aid your explanation).

[3 marks]

End of Test