Q1.

(a) Describe the difference between the structure of a triglyceride molecule and the structure of a phospholipid molecule.

_____

_____

_____

(1)

(b) Animal fats contain triglycerides with a high proportion of saturated fatty acids. If people have too much fat in their diet, absorption of the products of fat digestion can increase the risk of obesity. To help people lose weight, fat substitutes can be used to replace triglycerides in food.

Describe how a saturated fatty acid is different from an unsaturated fatty acid.

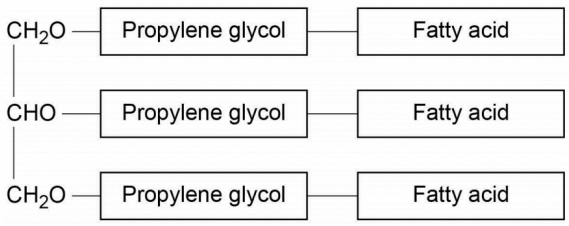
_____

_____

_____

(1)

The diagram shows the structure of a fat substitute.



(c) This fat substitute **cannot** be digested in the gut by lipase.

Suggest why.

_____

_____

_____

_____

_____

(2)

(d) This fat substitute is a lipid. Despite being a lipid, it cannot cross the cell-surface membranes of cells lining the gut.

Suggest why it **cannot** cross cell-surface membranes.

_____

_____

_____

(1)

(Total 5 marks)

Q2.

(a) Omega-3 fatty acids are unsaturated. What is an unsaturated fatty acid?

_____

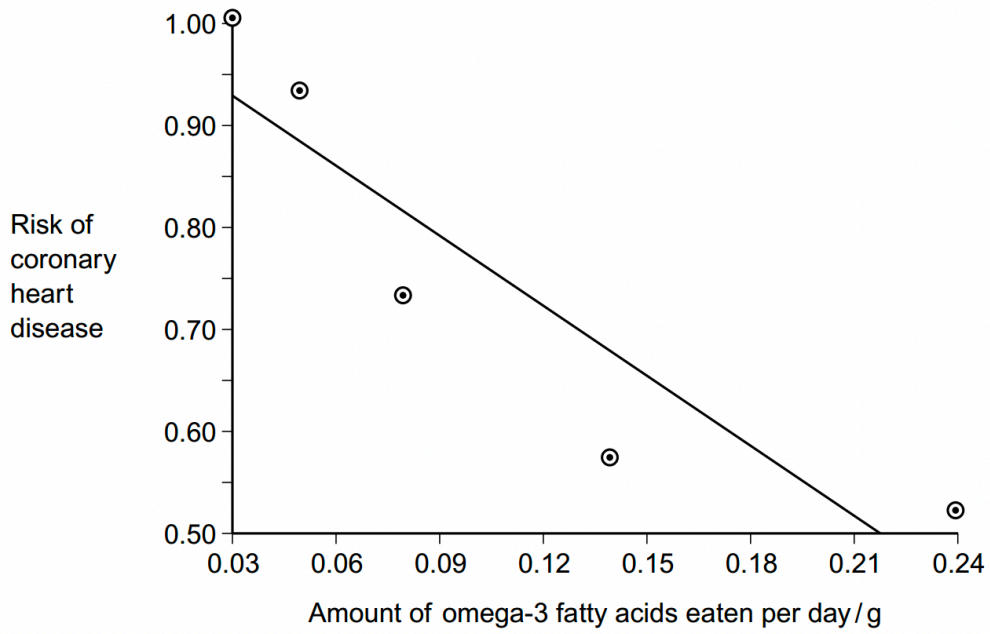
_____

_____

_____

(2)

(b) Scientists investigated the relationship between the amount of omega-3 fatty acids eaten per day and the risk of coronary heart disease. The graph shows their results.



Do the data show that eating omega-3 fatty acids prevents coronary heart disease? Explain your answer.

_____

_____

_____

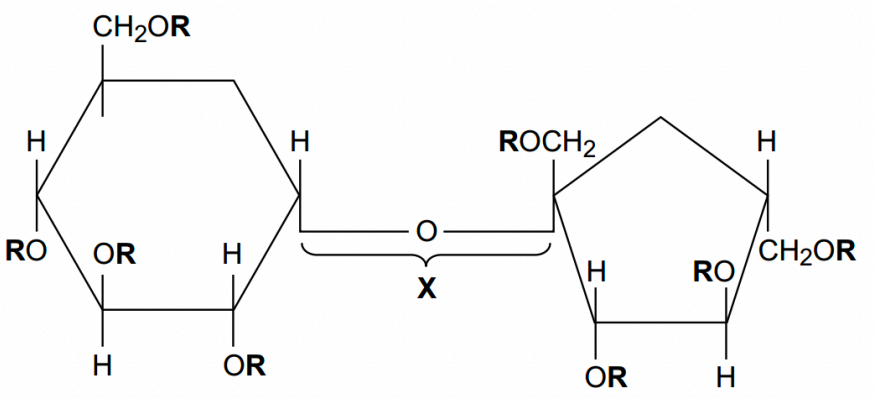
_____

_____

_____

(3)

(c) Olestra is an artificial lipid. It is made by attaching fatty acids, by condensation, to a sucrose molecule. The diagram shows the structure of olestra. The letter **R** shows where a fatty acid molecule has attached.



(i) Name bond **X**.

_____

(1)

(ii) A triglyceride does **not** contain sucrose or bond **X**. Give **one** other way in which the structure of a triglyceride is different to olestra.

_____

_____

(1)

(iii) Starting with separate molecules of glucose, fructose and fatty acids, how many molecules of water would be produced when one molecule of olestra is formed?

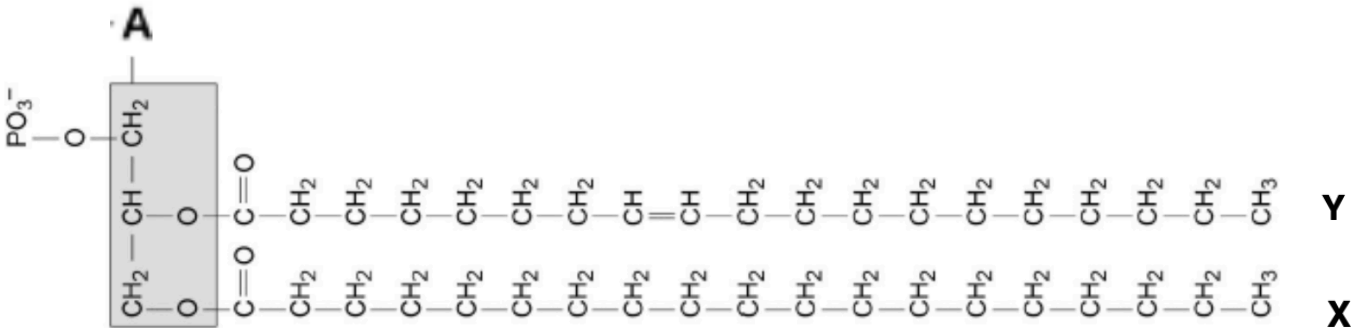
_____

(1)

(Total 8 marks)

Q3.

The figure below shows a phospholipid.



(a) The part of the phospholipid labelled **A** is formed from a particular molecule. Name this molecule.

_____

(1)

(b) Name the type of bond between **A** and fatty acid **X**.

_____

(1)

(c) Which of the fatty acids, **X** or **Y**, in the figure above is unsaturated? Explain your answer.

_____

_____

(1)

Scientists investigated the percentages of different types of lipid in plasma membranes from different types of cell. The table shows some of their results.

Type of lipid	**Percentage of lipid in plasma membrane by**		
	Cell lining ileum of mammal	**Red blood cell of mammal**	**The bacterium *Escherichia coli***
Cholesterol	17	23	0
Glycolipid	7	3	0
Phospholipid	54	60	70
Others	22	14	30

(d) The scientists expressed their results as **Percentage of lipid in plasma membrane by mass**. Explain how they would find these values.

_____

_____

_____

_____

(2)

Cholesterol increases the stability of plasma membranes. Cholesterol does this by making membranes less flexible.

(e) Suggest **one** advantage of the different percentage of cholesterol in red blood cells compared with cells lining the ileum.

_____

_____

_____

(1)

(f) *E. coli* has no cholesterol in its cell-surface membrane. Despite this, the cell maintains a constant shape. Explain why.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q1.

(a) 1. In phospholipid, one fatty acid replaced by a phosphate;

Ignore references to saturated and unsaturated
Accept
Reject P/Phosphorus
Accept annotated diagrams

1

(b) Saturated single/no double bonds (between carbons)
OR
Unsaturated has (at least one) double bond (between carbons);

Accept hydrocarbon chain/R group for 'between carbons' for either
Accept Sat = max number of H atoms bound
'It' refers to saturated

1

(c) 1. (Fat substitute) is a different/wrong shape/not complementary;
OR
Bond between glycerol/fatty acid and propylene glycol different
(to that between glycerol and fatty acid)/no ester bond;

2. Unable to fit/bind to (active site of) lipase/no ES complex formed;

If wrong bond name given (e.g. peptide/glycosidic), then penalise once

2

(d) It is hydrophilic/is polar/is too large/is too big;

Ignore 'Is not lipid soluble'

1

[5]

Q2.

(a) Double bond(s);

(Bonds) between carbon;

C=C bond(s) = 2 marks
'No' C=C bond(s) disqualifies 1 mark only
Accept: does not contain maximum number of H for 1 mark
Neutral: contains C=O bonds

2

(b) Graph shows negative correlation / description given;

Correlation does not mean causation / prevention / shows lower risk not prevention;

May be due to another factor / example given;

Neutral: refs. to methodology e.g. sample size / line of best fit
***Q**: Do not allow 'casual' relationship*

3

(c) (i) Glycosidic;

Accept: if phonetically correct
Reject: ester bond

1

(ii) Contains glycerol / three fatty acids / forms three ester bonds;

Neutral: contains less fatty acids
Answers must refer to a triglyceride
Ignore refs. to incorrect bond names
Neutral: olestra has eight fatty acids / R groups
Reject: contains three glycerols

1

(iii) 9;

1

[8]

Q3.

(a) Glycerol.

1

(b) Ester.

1

(c) **Y** (no mark)
Contains double bond between (adjacent) carbon atoms in hydrocarbon chain.

1

(d) 1. Divide mass of each lipid by total mass of all lipids (in that type of cell);
2. Multiply answer by 100.

2

(e) Red blood cells free in blood / not supported by other cells so cholesterol helps to maintain shape;

Allow converse for cell from ileum – cell supported by others in endothelium so cholesterol has less effect on maintaining shape.

1

(f) 1. Cell unable to change shape;
2. (Because) cell has a cell wall;
3. (Wall is) rigid / made of peptidoglycan / murein.

2 max

[10]