Plant oils and their uses

94 minutes

94 marks

Q1. The label on a bottle of salad dressing shows that the dressing contains the following ingredients.

Ingredients	
Water Vegetable oil Egg yolk Sugar Flour Vinegar Salt	Extract of spices Preservative E202 Emulsifier E405

(a) One of the main ingredients in salad dressing is vegetable oil.

(i) Use the correct word from the box to complete the sentence about the extraction of vegetable oil.

crushed	**evaporated**	**hardened**

To extract the vegetable oil, the fruits or seeds of plants are first

..... .

(1)

(ii) The liquids can be separated from the solid parts of the fruits or seeds by filtering.

Suggest **one** reason why separation by filtering is better than separation by distilling.

.....

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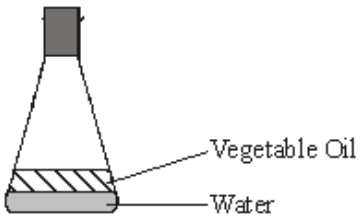
(1)

(b) (i) A mixture of vegetable oil and water is shaken and left to stand for several minutes. The diagram shows the result.



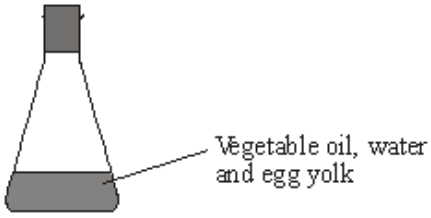
Complete the following sentence.

The vegetable oil and water ..... .

(1)

(ii) A mixture of vegetable oil, water and egg yolk is shaken and left to stand for several minutes.

The diagram shows the result.



Use words from the box to complete the sentence.

additive	**distil**	**emulsion**	**extract**	**mix**	**separate**

The egg yolk causes vegetable oil and water to .....

and form an ..... .

(2)
(Total 5 marks)

Q2. Use the correct words from the box to complete the sentences.

higher	**hydrogen**	**lower**
oxygen	**saturated**	**unsaturated**

(i) Animal and vegetable oils that contain ..... fats can be hardened.

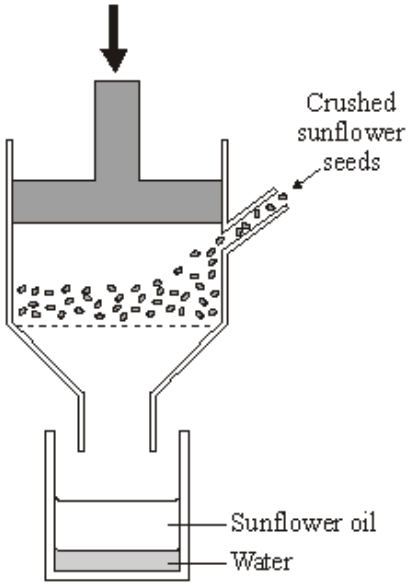
(1)

(ii) When oils are hardened with ..... gas, a chemical change takes place, producing margarine which has a ..... melting point than the original oil.

(2)
(Total 3 marks)

Q3. An advert for crisps claims that they now contain only 30% saturated fat because they are cooked in sunflower oil.

(a) The oil is extracted from sunflower seeds. The diagram shows how this can be done.



Draw a ring around the correct word in each box to complete the sentences.

(i)

The oil is obtained from crushed sunflower seeds by

evaporating.
filtering.
pressing.

(1)

(ii)

The oil does not

burn
dissolve
melt

in water.

(1)

(b) Draw a ring around the correct word in the box to complete the sentence.

Carbon carbon double bonds in sunflower oil can be detected

by reacting with

bromine.
iron.
oxygen.

(1)

(c) Water has a boiling point of 100 °C. Sunflower oil has a boiling point above 232 °C.

Suggest why sunflower oil and not water is used to make crisps from thin slices of potato.

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(2)
(Total 5 marks)

Q4. This information was taken from a label on a packet of crisps.

Main ingredients:	
Potatoes, vegetable oil, Worcester sauce flavour,	
colourings, flavourings, salt.	
Nutritional information (per 100 g):	
Energy	2040 kJ
Protein	6.5 g
Carbohydrate	55 g
of which sugars	3 g
Fat	27 g
of which saturates	9 g
unsaturates	18 g
Fibre	4.5 g
Sodium	1.2 g

Saturated fats are linked to heart problems. In order to claim that their crisps are healthy, the manufacturer keeps the proportion of saturated fats low.

(i) What type of fat contains double carbon carbon bonds?

.....

(1)

(ii) The colour of bromine water is orange.

What is seen when bromine water is shaken with:

an unsaturated fat .....

a saturated fat? .....

(2)

(iii) Unsaturated vegetable oils can be hardened to make them useful as spreads. Describe how unsaturated vegetable oils are hardened.

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(2)

(Total 5 marks)

Q5. Margarine is manufactured using 'hard' plant oils. A margarine company tested several plant oils to determine their hardness for use in its margarine.

In the test iodine solution was used to find the iodine value. The units are grams of iodine that react with 100 g of oil.

Plant oils with lower iodine values are harder and are less unsaturated.

Plant oil	**Melting point in °C**	**Iodine value**
Coconut	25	10
Palm	35	54
Olive	–6	81
Castor	–18	85
Peanut	3	93
Rapeseed	–10	98
Sunflower	–17	125
Soya bean	–16	130

(a) Do the results in the table indicate that there is a relationship between the melting point of a plant oil and its hardness?

Explain your answer.

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.....

.....

(2)

(b) The company stated that some of the plant oils were brown and that this may have affected the results.

Explain why the company considered the colour of plant oils to be a problem with this test.

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(2)

(c) A consumer group stated that the test should not be carried out by the margarine company but by independent scientists.

Explain why.

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(2)

(d) The company intends to use sunflower oil to make its margarine.

Explain how the company could process the sunflower oil to make it suitable for the manufacture of margarine.

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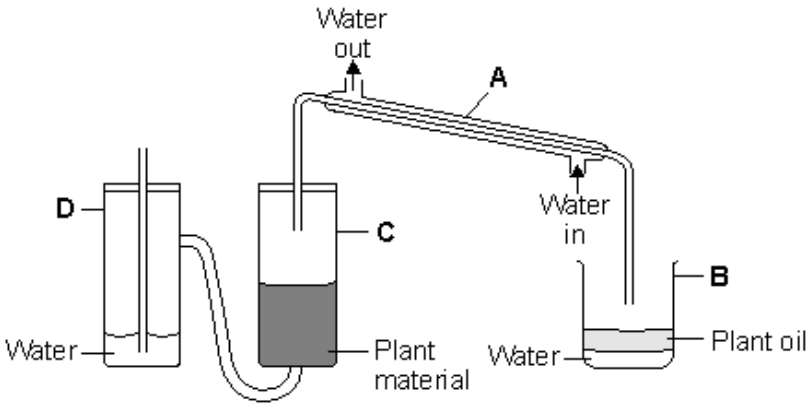
(3)

(Total 9 marks)

Q6. Many plants produce useful oils.

(a) The diagram shows some apparatus used to obtain oil from plant material.



Four parts of the apparatus are labelled, **A**, **B**, **C** and **D**.

Use the information in the diagram to complete the sentences.

Steam is made in part ☐.

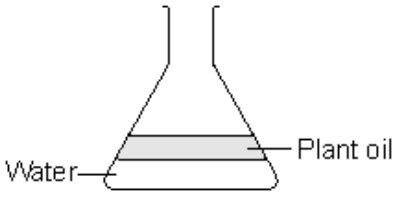
Oil from the plant material is vaporised in part ☐.

Steam and oil vapour are condensed in part ☐.

(3)

(b) A student investigated a mixture of a plant oil and water.

(i) A mixture of the plant oil and water was shaken and left to stand for 10 minutes.



Draw a ring around the correct answer to complete the sentence.

The plant oil separates from the water because it

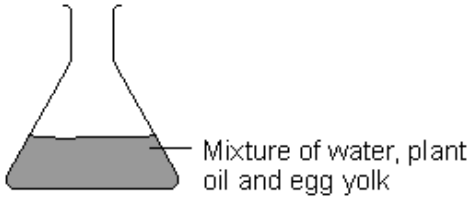
dissolves.

floats.

sinks.

(1)

(ii) A mixture of the plant oil, water and egg yolk was shaken and left to stand for 10 minutes. The mixture did not separate.



Draw a ring around the correct answer to complete the sentence.

The plant oil, water and egg yolk make

a compound.

an emulsion.

a fat.

(1)

(Total 5 marks)

Q7. Some fruits, seeds and nuts are sources of vegetable oils.

The table gives some information about three types of vegetable oil.

	Corn oil	**Olive oil**	**Rapeseed oil**
Saturated fat in %	14.4	14.3	6.6
Unsaturated fat in %	81.2	81.2	88.6
Melting point in °C	−18 to −5	−12 to −6	−10 to +5
Smoke point in °C	229 to 268	204 to 210	230 to 240

The smoke point is the temperature range at which the oil begins to produce smoke when heated.

(a) Use information from the table above to answer these questions.

(i) Tick (✓) **one** correct reason why a vegetable oil has a range for the melting point.

Reason	**Tick (✓)**
A vegetable oil has a high percentage of unsaturated fat.	
A vegetable oil has a range for the smoke point.	
A vegetable oil has a mixture of fats.	

(1)

(ii) Complete the sentence.

The type of vegetable oil with the largest temperature range of smoke point is

..... .

(1)

(b) Bromine water was added drop by drop to 5 cm^3 of each type of vegetable oil.

(i) Draw a ring around the correct answer to complete the sentence.

The colour of the first drop of bromine water changes from orange to

colourless.

green.

white.

(1)

(ii) Which type of vegetable oil will react with the most drops of bromine water?

Give a reason for your answer.

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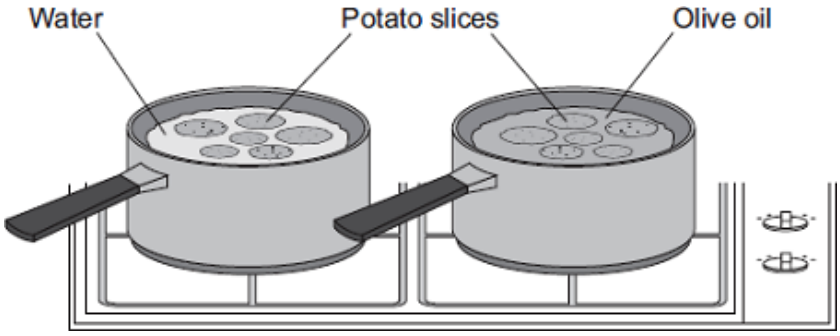
(2)

(c) Potato slices can be boiled in water or fried in olive oil.



(i) Olive oil starts to produce smoke when heated to 204°C.
The smoke contains carbon particles.

Suggest what happens to molecules in olive oil to produce carbon particles.

.....

.....

(1)

(ii) Potato slices boiled in water will be different from potato slices fried in olive oil.

Describe **two** differences.

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.....

(2)
(Total 8 marks)

Q8. Rapeseed oil can be used for cooking.

A label on a bottle of rapeseed oil stated:

> Rapeseed oil is healthy because it is
>
> - low in saturated fat
> - high in poly-unsaturated fat.

Two students investigated if the statement was true. They found the following information about four oils.

	Rapeseed oil	**Sunflower oil**	**Olive oil**	**Corn oil**
Saturated fat (%)	6.6	12.0	14.3	14.4
Mono-unsaturated fat (%)	59.3	20.5	73.0	29.9
Poly-unsaturated fat (%)	29.3	63.3	8.2	51.3
Melting point (°C)	5	-18	-12	-15

(a) Does this information support the two claims made on the label?
Explain your answers.

(i) 'Rapeseed oil is low in saturated fat.'

.....

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(1)

(ii) 'Rapeseed oil is high in poly-unsaturated fat.'

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.....

(1)

(b) Rapeseed oil contains unsaturated fats.

How could the students test the oil to show that it contained unsaturated fats?

Test .....

.....

Result of test .....

.....

(2)

(c) Rapeseed oil can be hardened by reacting it with hydrogen.

(i) What would happen to the melting point of rapeseed oil if it was hardened?

.....

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(1)

(ii) One student claimed that hardening would make the rapeseed oil healthier.

Explain why the student is wrong.

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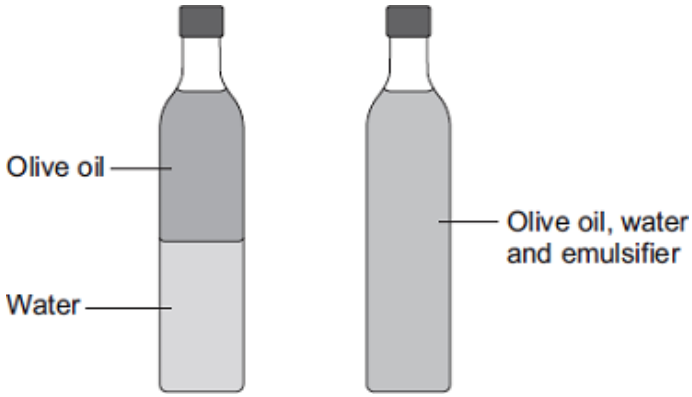
(2)

(Total 7 marks)

Q9. Olive oil has a high content of healthy, unsaturated fats.

(a) Olive oil and water do not mix.
A salad dressing is made by shaking olive oil and water with an emulsifier.



(i) Complete the sentence.

The salad dressing of olive oil, water and emulsifier is a mixture

called an ..... .

(1)

(ii) Give **one** benefit of using emulsifiers in food.

.....

.....

(1)

(b) Olive oil has a boiling point of 300°C.

(i) Complete the sentence.

The boiling point of olive oil compared to the boiling point of water

is ..... .

(1)

(ii) Apart from colour, state **two** ways in which a food cooked in olive oil will be different to a food cooked in water.

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(2)

Q10. Large amounts of cholesterol in the blood can cause heart disease.
Eating saturated fat increases the amount of cholesterol in blood.
Eating polyunsaturated fat decreases the amount of cholesterol in blood.

(a) The amounts of saturated fat and polyunsaturated fat in different types of margarine are shown in the table.

Type of margarine	Description	Saturated fat g per 100 g margarine	Polyunsaturated fat g per 100 g margarine
W	Hard margarine from animal and vegetable oils	30	14
X	Soft margarine from animal and vegetable oils	27	16
Y	Hard margarine from vegetable oils only	30	10
Z	Soft margarine from vegetable oils only	26	18

Which type of margarine would you consider best to use to lower blood cholesterol?

Explain your answer.

Best type of margarine to use is ..... .

Explanation.....

.....

.....

.....

(2)

(b) Use the correct words from the box to complete the sentences.

higher	**hydrogen**	**lower**
oxygen	**saturated**	**unsaturated**

Animal and vegetable oils that contain ..... fats can be hardened.

Oils are hardened by a chemical reaction with ..... gas.

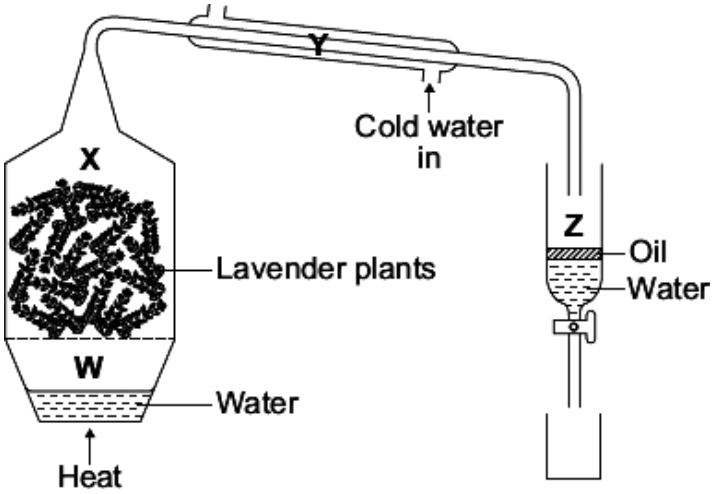
The product of the chemical reaction has a ..... melting point than the original oil.

(3)
(Total 5 marks)

Q11. This question is about plant oils.

(a) Steam distillation is used to separate oils from plants.

The diagram shows some apparatus that can be used to separate oil from lavender plants.
Four parts of the apparatus are labelled **W**, **X**, **Y** and **Z.**



Describe how lavender oil is separated from the plant material.

You need to describe what happens in each of the parts, **W**, **X**, **Y** and **Z**, of the apparatus.

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(4)

(b) Olive oil can be used in the manufacture of margarine.
Olive oil has a melting point of – 6 °C and contains about 11% saturated fat and 89% unsaturated fat.

(i) Describe a test to show that olive oil contains unsaturated compounds.

Give the result of the test.

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.....

.....

(2)

(ii) To make margarine from olive oil the percentage of unsaturated fat needs to be decreased.

Give **one** reason why.

.....

.....

(1)

(iii) Describe how to decrease the percentage of unsaturated fat in olive oil.

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(3)
(Total 10 marks)

Q12. Olive oil has a melting point of −6°C and a boiling point of 300°C.
Olive oil has a high content of healthy, unsaturated fats.

(a) Olive oil can be hardened by reacting it with hydrogen.

(i) State the conditions needed for this reaction.

.....

.....

.....

.....

(2)

(ii) A student said that hardening would make olive oil healthier.

Is this student's hypothesis correct?

Explain your answer in terms of what happens in the hardening process.

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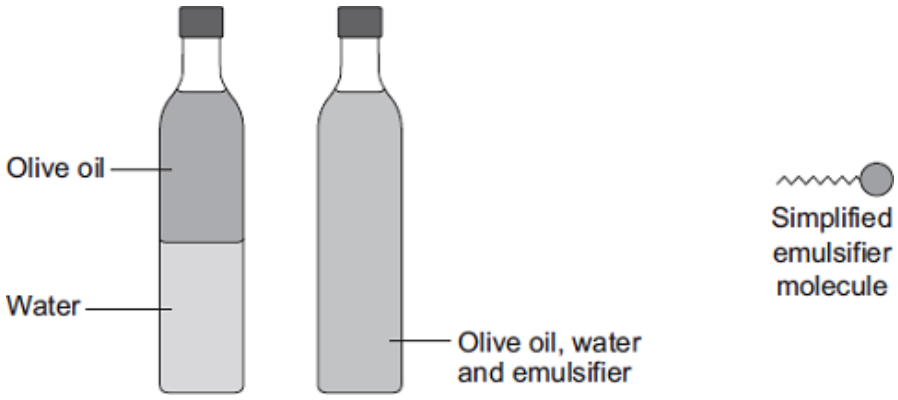
(2)

(b) Olive oil and water do not mix.
A salad dressing is made by shaking olive oil and water with an emulsifier.



Explain how these emulsifier molecules are able to produce a stable mixture after shaking olive oil and water.

Use the diagram of the simplified emulsifier molecule to help you to answer this question.

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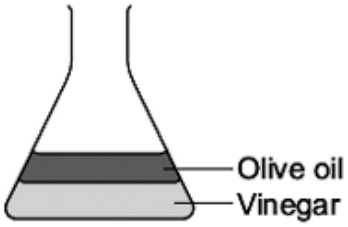
(3)
(Total 7 marks)

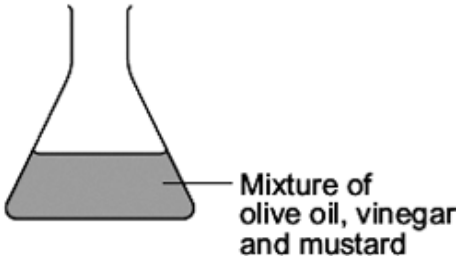
Q13. Olive oil is used to make salad dressings and margarine.

(a) Vinegar is often used to make salad dressings.
Vinegar contains 95% water and 5% ethanoic acid.

Simple salad dressing



French salad dressing



To make a simple salad dressing add olive oil to vinegar and shake. After a few minutes the mixture separates.
To make a French salad dressing add mustard to the olive oil and vinegar and shake.
After several minutes the mixture does **not** separate.

(i) Why does the mixture in the simple salad dressing separate?

.....

.....

(1)

(ii) Mustard in the French salad dressing has molecules with hydrophilic properties and hydrophobic properties.

Explain why the French salad dressing does **not** separate.
You may include a diagram to help you to answer this question.

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(3)

(b) Olive oil contains 89% unsaturated fats and 11% saturated fats.

What is the test and the result for unsaturated fats?

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(2)

(c) Olive oil is hardened to make margarine.

Describe the reaction and conditions needed to harden a vegetable oil.

.....

.....

.....

.....

(3)
(Total 9 marks)

Q14. A company compared the relative 'unsaturation' of five oils. Bromine water was added from a burette to equal amounts of each oil until the bromine water remained orange-yellow.

The volume added was recorded.

Type of oil	**Volume of bromine water added in cm^3**
Maize	25.6
Olive	6.1
Palm	4.9
Soya Bean	29.9
Sunflower	25.1

(i) What would you see when the first few drops of bromine water are added to each oil?

.....

(1)

(ii) What do these results tell you about sunflower oil compared with the other oils?

.....

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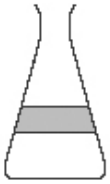
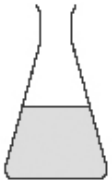
(2)

(Total 3 marks)

Q15. (a) The diagrams show the results of shaking a vegetable oil with the substances indicated.

Vegetable oil and water	Vegetable oil, water and an additive
 Flask 1	 Flask 2

(i) Give a reason for the result in **Flask 1.**

.....

.....

(1)

(ii) Explain the result in **Flask 2.**

.....

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.....

.....

(2)

(b) Saturated fats are linked to heart problems. Oils that are unsaturated help to prevent heart disease. A company wants to make a 'healthy' soft margarine.

The company tested the same volume of different vegetable oils by shaking each with three drops of iodine solution. The results are shown in the table.

Vegetable oil	**Time in minutes for the colour of iodine to 'disappear'**
Olive oil	3.5
Peanut oil	3.0
Soya oil	1.5
Sunflower oil	1.0

(i) Why does iodine react with the molecules in these oils?

.....

.....

(1)

(ii) Use the company results to evaluate which one appears to be the most 'healthy' vegetable oil to use in the soft margarine.

.....

.....

.....

.....

(2)

(c) The ingredients of soft margarine include hydrogenated vegetable oil.

(i) Why is hydrogenated vegetable oil used in soft margarine?

.....

.....

(1)

(ii) Describe how vegetable oils are hydrogenated.

.....

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.....

.....

(2)

(Total 9 marks)

M1. (a) (i) crushed

if line blank allow crushed circled in the box

1

(ii) any **one** from:

- ‘costs’ less / cheaper
- easier / faster
- less complicated equipment
- does not need heating / energy
- distilling could decompose the oil

1

(b) (i) any **one** from:

- do not mix / dissolve
- (stay) separate
- form layers
- are immiscible

1

(ii) mix

words must be in correct places

1

emulsion

1

[5]

M2. (i) unsaturated

1

(ii) hydrogen

1

higher

1

[3]

M3. (a) (i) pressing

1

(ii) dissolve

1

(b) bromine

1

(c) temperature needs to be high / above 100 °C

allow melting point

1

or

(sunflower oil has a) high(er) boiling point

or

boiling point of water is not high enough

any **one** from:

- remove water / make potato crisp(er)

  accept water makes potato soft / soggy

- adds / gives flavour

1

[5]

M4. (i) (poly)unsaturated

accept monounsaturated

1

(ii) (turns) colourless **or** colour disappears / decolourises

*do **not** accept clear*

1

stays the same colour / orange / no change

allow yellow-orange / orange-brown / red-orange

1

(iii) (react) with hydrogen / H2 / hydrogenation

1

any **one** from:

- heated / 60 °C
- catalyst / nickel

1

[5]

M5. (a) yes (there is the general trend) 'as the iodine value increases the melting point decreases' or 'as the hardness decreases the mp decreases'

accept converse statement

*do **not** accept boiling point*

or

no melting points are in random order / go up and down

1

one specific use of comparative data from the table either showing the trend or an anomaly

can be gained from yes or no answer

ignore bp

1

(b) the iodine turns colourless

1

this would be difficult to see (if the oil was dark coloured)

*allow similar colour as iodine **or** iodine is brown*

1

(c) (consumer may think that) the company (scientists) would be biased

1

consumer more likely to trust independent scientists

allow independent scientists not biased

1

(d) add (measured amount of) hydrogen

accept hydrogenation

1

any **two** from:

- (nickel) catalyst
- hot / 60°C temperature
- hardened

*accept add a hard / hydrogenated fat / oil **or** make an emulsion*

2

[9]

M6. (a) D

1

C

1

A

1

letters must be in the order shown

(b) (i) floats

1

(ii) an emulsion

1

[5]

M7. (a) (i) a vegetable oil has a mixture of fats

1

(ii) corn (oil)

allow 229 to 268 (°C)

1

(b) (i) colourless

1

(ii) rapeseed (oil)

1

because this oil has most unsaturated fat

or

because this oil has the most carbon-carbon double bonds

accept because this oil has least saturated fat

allow this oil has more unsaturated fat

ignore figures unless there is an indication that 88.6(%) is the highest percentage of unsaturated fat

ignore melting points / smoke points

*if corn oil or olive oil is chosen then allow **1** mark for has a high amount / percentage of unsaturated fat **or** has a low amount / percentage of saturated fat*

1

(c) (i) (olive oil / molecules) decompose / break down

allow burn

ignore react

1

(ii) any **two** from:
for olive oil

- different flavour / taste
- high(er) energy content
- hard(er) / crisp(er) **or** different texture
- dark(er) / different colour
- have (more) fat
- cooks quick(ly)
  if answered in terms of water:
  - *different flavour / taste*
  - *low(er) energy content*
  - *soft(er) **or** different texture*
  - *light(er)/ different colour*
  - *have less / no fat*
  - *cooks slow(ly)*

  ignore healthier

2

[8]

M8. (a) (i) *ignore no*

(yes as it) has the lowest / least (%)
accept it is <u>only</u> 6.6(%)
accept any correct comparisons

1

(ii) (no as it)
ignore yes

any **one** from:

- is second lowest
  ignore it is only 29.3%
- is 'medium'
  accept neither high or low
- is (only) third highest
  accept not the highest
- depends on which oil it is compared with
  accept any correct comparison
  accept it has more mono - unsaturated fat

1

(b) (test) add bromine / iodine (solution)
ignore bromide / iodide
ignore colours

1

(result) turns colourless / decolourises

ignore clear

ignore changes colour

1

(c) (i) increase(s) / gets higher

ignore boiling point

1

(ii) would increase the saturated (fat)

idea of increase is required

or

reduce the unsaturated (fat)

idea of reduction is required

1

saturated (fat) is not / less healthy

accept hydrogenated (fat) is not / less healthy

or

*accept bad for you **or** causes heart disease*

unsaturated (fat) is healthy

accept good for you

*eg it would not make it healthier = **0** marks*

it would not make it healthier

*because it is saturated (fat) = **2** marks*

1

[7]

M9. (a) (i) emulsion

1

(ii) any **one** from:

- provides better texture

  ignore forms an emulsion
  allow improves the taste
  allow easier to spread

- improves coating ability

  *allow prevents ingredients from separating **or** stays mixed*

- improves appearance

1

(b) (i) higher / greater

allow high

accept 200(°C) more

allow (only) 100°C

1

(ii) any **two** from:

in olive oil the food

allow converse points for water

- has a higher energy content
- has a harder/crisper texture
- has a different flavour / taste
- absorbs olive oil

*allow not as healthy **or** more fat*

*if no other mark awarded allow cooks quicker for **1** mark*

2

[5]

M10. (a) **Z**

accept soft (margarine) vegetable oils only

1

contains the high(est) amount of polyunsaturated fat **or** the low(est) amount of saturated fat

ignore any values / percentages

1

(b) unsaturated

must be in the order given

1

hydrogen

1

higher

1

[5]

M11. (a) *students do not have to use the letters but the descriptions should be in logical order*

W the water boils **or** steam is produced

allow water vapour rises

1

X the oils / substances (in lavender) are vaporised / removed (by the steam)

1

Y (the vapours are) condensed

allow turned back to liquid

ignore cooled

1

Z the water can be run off / tapped off leaving the oil(s)

*allow oil floats on water **or** they form two layers*

1

(b) (i) *incorrect reagent = 0 marks*

add bromine water

1

(bromine water) is decolourised / goes colourless

ignore clear

if colour of bromine water given it must be yellow, orange, red or brown

1

(ii) any **one** from:

- to harden the oil
- to change the oil into a solid
- to make the oil into a spread
- to increase its melting point

ignore boiling point

1

(iii) *incorrect process = max 2*

(olive oil is) reacted with hydrogen

accept hydrogenated

1

using a nickel catalyst

1

at a temperature of about 60 °C

allow 50°C to 160°C

*if last two points not given allow 'heat with a catalyst' for **1** mark*

1

[10]

M12. (a) (i) in the presence of a nickel catalyst

1

at about 60 °C

allow 50 – 150 °C

1

(ii) (no) because hydrogen adds to the unsaturated fat **or** (no) because hydrogen reduces the number of (carbon–carbon) double bonds

accept (no) because hydrogen increases number of (carbon-carbon) single bonds

1

therefore there will be less unsaturated fat

accept therefore there will be more saturated fat

ignore prefixes to unsaturated e.g.trans/mono/poly

*if the answer is 'yes' maximum **1** mark*

1

(b) (shaking breaks up the olive oil into tiny) droplets that are unable to join up

1

because (molecules in the) emulsifier have a 'head' which dissolves in / is attracted to water **or** is hydrophilic

*accept correctly drawn diagram for **2** marks*

1

because (molecules in the) emulsifier have a 'tail' which dissolves in / is attracted to oil **or** is hydrophobic

*if hydrophilic and hydrophobic are given the wrong way round, allow **1** mark*

1

[7]

M13. (a) (i) olive oil does not dissolve in water

accept olive oil and water are immiscible
allow there is no emulsifier
ignore mustard
ignore do not mix / different densities

1

(ii) because mustard is an emulsifier **or** an emulsion forms **or** a suspension of oil in vinegar / water forms **or** vice versa

accept because an emulsifier is added

1

the molecules have a 'head' / hydrophilic end which dissolves in / attracted to water

1

and a 'tail' / hydrophobic end which dissolves in / attracted to oil

accept a diagram for either or both of these two marking points

if diagram contradicts the description or vice versa max one of these two marks

1

(b) (test:) bromine (water)

allow iodine (solution)

1

(result:) turns colourless

allow orange colour disappears / decolourises
ignore clear

1

(c) (olive oil is reacted with) hydrogen

accept hydrogenated

1

using a nickel catalyst

1

(at a temperature of about) 60 °C

allow 50 – 120°C
ignore hot / heat

1

[9]

M14. (i) turns colourless

accept colour disappears
ignore fading

1

(ii) any **two** from:

- unsaturated fat content / healthiness about the same / similar to maize
  accept about the same number of double carbon bonds as maize
  accept '<u>a bit</u> less' for similar

- less unsaturated / less healthy than soya
  accept fewer / less double bonds than soya ignore 'more saturated'

- more unsaturated / more healthy than olive / palm
  accept more double bonds than olive / palm ignore 'less saturated'
  *if no other mark awarded accept sunflower oil has (about) the same result as maize oil for **1** mark*
  ignore comments about saturated fats

2

[3]

M15. (a) (i) water and oil do not mix / are immiscible

ignore density

1

or

don't dissolve each other

ignore emulsifier alone

1

(ii) any **two** from:

- emulsifier
- forms an emulsion

  accept description of an emulsion
- holds the two components together

  accept stops them separating / they mix

  allow bonds / binds for holds
- by lowering the surface tension

  *accept a description of how an emulsifier works for **two** marks*

  eg 'tadpole' diagram or dispersal of oil drops

2

(b) (i) (because they contain) a double (carbon carbon) bond

accept unsaturated

ignore poly or mono

1

(ii) results suggest sunflower oil is best

or

'the one that took the least time'

1

because (sunflower oil) has the highest amount of unsaturation / most double bonds / least saturated

ignore uses up I_2 most quickly

second mark is dependent on first

1

(c) (i) any **one** from:

- have a higher melting point than (vegetable) oil
- are solid at (room temperature) / hardened / harder
  *accept useful as spreads **or** doesn't soak into bread*
  ignore hard / soft(er)

1

(ii) any **two** from:

- hydrogen added
  *do **not** accept 'water'*
- to carbon carbon double bond / to saturate
- (nickel) catalyst / temperature 60 – 150 °C
  wrong catalyst doesn't get this mark
  ignore high / warm temperature

2

[9]