

Lipids

Level: CIE A Level 9700

Subject: Biology

Exam Board: Suitable for all boards

Topic: Lipids

Type: Mark Scheme

To be used by all students preparing for CIE Biology A Level 9700 foundation or higher tier but also suitable for students of other boards.

Mark schemes

- 1** (a) (Omega-3 concentration) falls more rapidly at first;
Levels out at 140 days / concentration of 0.4%; 2
- (b) (i) Two marks for correct answer of 0.04 or 0.043;;
One mark for incorrect answer which clearly identifies total fall of 1.7; 2
- (ii) To take into account variation in fat content of milk / fat content varies from cow to cow;
Allows comparison; 2
- (iii) The graph shows a decrease with time feeding on corn;
No control group;
Might have fallen anyway / might decrease with time rather than with time spend feeding on corn;
Other factors / other named factor might also have changed;
Only one investigation so might not be representative; 4 max
- [10]**
- 2** Standard deviation shows there is overlap of the 2 data sets;
Small sample of wild salmon so may not be representative of population; [2]
- 3** (a) ATP 1
- (b) (i) 2.57:1/2.6:1/18:7;
Correct answer however derived scores two marks
72:28 scores one mark
Correct working from wrong figures scores 1 mark
Accept
0.4 / 0.39 / 0.389 / 0.3889 2 max
- (ii) Low intensity;
At low intensity/below 40% mainly fat used / at high intensity/
above 40% mainly carbohydrate used;
Long duration exercise;
Percentage fat used increases with time / percentage
carbohydrate used decreases with time; 3
- [6]**



- 4** (a) Student was measuring change in pH
OR
Buffer would maintain a constant pH. 1 max
- (b) 1. Volume of suspension of lipids;
2. Concentration of suspension of lipids;
3. Volume of lipase solution;
4. Temperature; 2 max
- (c) Boiled lipase solution; 1
- (d) $-0.34 = 2$ marks
 $0.34 = 1$ mark 2
- (e) 1. Fatty acids produced;
2. Curve levels off as all substrate used up.
accept the lower pH inactivates / denatures the enzyme 2
- (f) 1. Faster fall in pH **and** levels off at same point;
2. More enzyme = substrate complexes formed;
3. Same amount of fatty acids produced / product 3
- [11]**
- 5** (a) 1. Dissolve in alcohol, then add water;
2. White emulsion shows presence of lipid. 2
- (b) Glycerol. 1
- (c) Ester. 1
- (d) **Y** (no mark)
Contains double bond between (adjacent) carbon atoms in hydrocarbon chain. 1
- (e) 1. Divide mass of each lipid by total mass of all lipids (in that type of cell);
2. Multiply answer by 100. 2



- (f) 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

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

2 max

[10]

6

- (a) **Two** suitable suggestions;
E.g.

1. (Are mammals so) likely to have same physiology / reactions as humans;
2. Small enough to keep in laboratory / produce enough milk to extract;
3. (Can use a) large number.

Ignore references to ethical issues

2 max

- (b) 1. Hydrolysis of lipids produces fatty acids;
2. Which lower pH of mixture.

2

- (c) 1. (Bile-activated lipase / it) increases growth rate (of kittens);
2. Results for formula with lipase not (significantly) different from breast milk / are (significantly) different from formula milk alone;
3. Showing addition of (bile-activated) lipase is the likely cause (of increased growth);
4. Lipase increases rate of digestion of lipids / absorption of fatty acids.

3 max

[7]

7

- (a) Hydrolysis (reaction);

- (b) 1. (Phosphate required) to make RNA;
2. (Phosphate required) to make DNA;

1 and 2. If neither DNA or RNA are named allow one mark for nucleotide/nucleic acid/phosphodiester bonds/sugar-phosphate backbone.

3. (Phosphate required) to make ATP/ADP;
4. (Phosphate required) to make membranes;

Ignore: phospholipids without reference to membranes.

5. (Phosphates required) for phosphorylation;

Accept: as additional mark points any named biological molecule containing phosphate e.g. NADP, AMP, RuBP.

2 max

- (c) Accept answer in range from 3.7 : 1 to 4.1 : 1;
Reject any ratio not : 1.

1



- (d) 1. Seeds/embryo remain dormant/inactive in winter/cold
OR
Growth/development of seed/embryo during winter/cold;
Ignore: hibernate.
Accept: 'seed survives winter/cold'.
Reject: plant develops or seed germinates during winter/cold.
2. Seeds/plants develop in spring/summer
OR
Seeds/plants develop when temperature/light increases;
Accept: seeds/plants develop when more light or when temperature is higher.
Accept: seed germinates/'sprouts' during spring/summer or when temp/light increases.
3. Plant photosynthesise (in spring/when warm);
4. Produce (more) seeds/offspring in spring/growing season;

3 max

[7]

- 8** (a) 1. Fewer children / less likely that children with asthma eat fish;
Accept converse.
2. Fewer children / less likely that children with asthma eat oily fish;
MP1 and 2 – Allow use of numbers.
3. Little / only 2% / no difference in (children with or without asthma who eat) non-oily fish.
Do not accept arguments related to amount of fish eaten

3

- (b) 1. (Shake with) ethanol / alcohol;
1. Accept named alcohol
2. Then add (to) water;
2. Order must be correct
3. White / milky / cloudy (layer indicates oil).
3. Ignore forms emulsion as in stem
3. Ignore precipitate

3

[6]

- 9** (a) pH goes down and levels out;
after 30 min / pH 6.5;

2

- (b) Enzyme not used up in reaction;

1

- (c) Curve will be less steep:

*Only accept answers relating to curve **not** rate of reaction*

1

[4]



- 10** (a) Any **one** from:
1. Numerical readings / not subjective / colour change subjective / gives quantitative data / not qualitative / gives continuous data;
 2. Greater accuracy;
Accept greater precision
- 1 max**
- (b) Fatty acids produced; **1**
- (c) 1. No more (fatty) acids produced;
2. All triglycerides/fat/lipids/substrate used up / enzyme denatured; **2**
- (d) 1. Line starting at same point and falling above original line;
2. Levels off at same pH, but later;
Accept the line still falling at 4 minutes
Do not credit if levels off at higher pH **2**
- [6]**

- 11** (a) (i) (Molecule) made up of many identical / similar molecules / monomers / subunits;
Not necessary to refer to similarity with monomers. **1**
- (ii) Cellulose / glycogen / nucleic acid / DNA / RNA; **1**
- (b) (i) To keep pH constant;
A change in pH will slow the rate of the reaction / denature the amylase / optimum for reaction; **2**
- (ii) Purple / lilac / mauve / violet;
Do not allow blue or pink. **1**
- (iii) Protein present / the enzyme / amylase is a protein;
Not used up in the reaction / still present at the end of the reaction; **2**
- [7]**

- 12** (a) (i) in case normal coffee differs in some other way / to control concentration of caffeine; **1**
- (ii) not telling them what the drink contained / purpose of experiment; **1**



- (b) (i) able to continue for longer; (*not just increases performance*)
(*disqualify if also refers to fatty acids and glycerol*) 1
- (ii) breakdown of fats;
at increased rate / by mobilisation of fat stores; 2
- (c) (i) idea that volumes of oxygen and carbon dioxide the same;
reference to equal moles, or quotient as 1 divided by 1 / or 6 by 6; 2
- (ii) glycogen is a carbohydrate / broken down to glucose, linked to RQ;
with no caffeine, RQ nearer 1.0 / less carbon dioxide exhaled and
more oxygen inhaled (or vice versa) / with caffeine higher proportion of fats /
fatty acids respired;
increased time to exhaustion suggests slower use of glycogen: 3

[10]

13

- (a) 1. In phospholipid, one fatty acid replaced by a phosphate;
Ignore references to saturated and unsaturated
Accept $\text{P}/\text{PO}_4^{3-}$ / (P)
Reject P/Phosphorus
Accept annotated diagrams 1
- (b) 1. Add ethanol, then add water;
Reject ethanal/ethonal
Accept 'Alcohol/named alcohol'
2. White (emulsion shows lipid);
Accept milky – Ignore 'cloudy'
Sequence must be correct
If heated then DQ point 1
Reject precipitate 2
- (c) 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



- (d) 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

- (e) It is hydrophilic/is polar/is too large/is too big;
Ignore 'Is not lipid soluble'

1

[7]

14

- (a) 1. Crush / grind;
2. With ethanol / alcohol;
3. Then add water / then add to water;
2. Water must be added after ethanol for third mark.
4. Forms emulsion / goes white / cloudy;
4. Do not accept carry out emulsion test.

3

- (b) (i) 4 / four;

1

- (ii) 1. Phosphate / PO_4 ;
"It" refers to phospholipid.
2. Instead of one of the fatty acids / and two fatty acids;
1. Accept minor errors in formula. Do not accept phosphorus / phosphorus group.

2

- (iii) 1. Double bonds (present) / some / two carbons with only one hydrogen /
(double bonds) between carbon atoms / not saturated with hydrogen;
Answer refers to unsaturated unless otherwise clearly indicated.
May be shown in appropriate diagram.

2. In (fatty acid) **C** / 3;

2

[8]



15

(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]

16

(a)

✓	✓	✓	
			✓
		✓	✓

One mark for each correct column

Mark ticks only and ignore crosses

4



- (b) 1. Two marks for box round two hydrogens and one of the oxygens from OH groups on carbons 1 and 4;;
2. One mark from incorrect answer involving any two hydrogens and an oxygen from carbons 1 and 4;
- Do not award marks if all atoms concerned are on same carbon atom or are on carbon atoms other than 1 and 4 or where the answer does not have two hydrogen and one oxygen*

2

- (c) (i) 1. Holds chains / cellulose molecules together / forms cross links between chains / cellulose molecules / forms microfibrils, providing strength / rigidity (to cellulose / cell wall);
2. Hydrogen bonds strong in large numbers;x
- Principles here are first mark for where hydrogen bonds are formed and second for a consequence of this.*
- Accept microfibrils*

2

- (ii) Compact / occupies small space / tightly packed;
- Answer indicates depth required. Answers such as "good for storage", "easily stored" or "small" are insufficient.*

1

[9]

- 17** Fatty acids used to make phospholipids;
Phospholipids in membranes;
More phospholipids more membranes made;

2 max

Fatty acids respired to release energy;
More triglycerides more energy released;
Energy used for cell production / production of named cell component;

Do not allow credit for 'making' energy

2 max

[4]

- 18** The different diet of the fish;
Omega-3 fatty acids used in respiration / as a source of energy;
Wild trout are more active / use more energy;

[2]

- 19** (a) Two marks for correct answer of 64.285 / 64.3 / 64;
(allow 1 mark for (8100 / 100 × 30) / 37.8)

2

- (b) dissolve in / add ethanol then mix with water;
emulsion / white colour indicates triglycerides present;

2



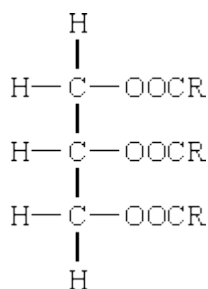
- (c) (i) increase the surface area for absorption;
(ignore wrong ref. to name) 1
- (ii) **R** = tissue fluid / interstitial fluid / extracellular fluid / intercellular space;
S = lymph(atic) vessel / lymph capillary / lacteal; 2
- (iii) proteins are synthesised by **U**;
involvement of ribosomes;
protein isolation / transport (inside RER);
vesicle formation; 2 max
- (iv) exocytosis / description of;
because of size / too large to leave by other methods; 2
- [11]

20

- (a) (i) condensation; 1
- (b) (i) **D**; 1
- (ii) **C**; 1
- (iii) **A**; 1
- (c) absence of a double bond;
in the (hydrocarbon) chain;
unable to accept more hydrogen / saturated with hydrogen; 2 max
- [6]

21

- (a) 3 fatty acids attached;
ester bond correct;
- (H on glycerol component, O attached to carbon, R at other end)*



2



(b) not made of monomers / many repeating units;

1

(c) (many) mitochondria present in brown fat cells;
mitochondria release heat / energy; (*ignore ATP*)
white fat cells for fat storage / reduced fat storage in brown fat cells;

3

[6]