AQA A-LEVEL · 7402

BIOLOGY



MARK SCHEME

3.1.3 LIPIDS

SCORE	PERCENTAGE
/168	%

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Q1.

(a) P – glycerol
Q – fatty acid (chains)
Accept phonetic spelling

2

(b) Ester (bond);

1

(c) 1. (Mix / shake sample) with ethanol, then water;
Sequence is important

2. White / milky (emulsion);
Ignore cloudy
Reject precipitate

2

[5]

Q2.

(a) 1. Named structures – trachea, bronchi, bronchioles, alveoli;
Reject mp1 if structures from other physiological systems are named but award mp2 if the correct structures are in the correct order.

2. Above structures named in correct order
OR
Above structures labelled in correct positions on a diagram;
Reject mp1 if structures from other physiological systems are named but award mp2 if the correct structures are in the correct order.

3. Breathing in – diaphragm contracts **and** external intercostal muscles contract;

4. (Causes) volume increase and pressure decrease in thoracic cavity (to below atmospheric, resulting in air moving in);
For thoracic cavity accept 'lungs' or 'thorax'.
Reference to 'thoracic cavity' only required once.

5. Breathing out - Diaphragm relaxes **and** internal intercostal muscles contract;
*Accept diaphragm relaxes **and** (external) intercostal muscles relax **and** lung tissue elastic (so recoils).*

6. (Causes) volume decrease and pressure increase in thoracic cavity (to above atmospheric, resulting in air moving out);
For thoracic cavity accept 'lungs' or 'thorax'.
Reference to 'thoracic cavity' only required once.
If idea of thoracic cavity is missing or incorrect, allow ECF for mark point 6.

6

(b) 1. Both contain ester bonds (between glycerol and fatty acid);

All statements must be clearly comparative or linked by the candidate, not inferred from separate statements.

Accept mark points shown on adjacent annotated diagrams.

2. Both contain glycerol;

3. Fatty acids on both may be saturated or unsaturated;

4. Both are insoluble in water;

5. Both contain C, H and O but phospholipids also contain P;

Must relate to element.

6. Triglyceride has three fatty acids and phospholipid has two fatty acids plus phosphate group;

7. Triglycerides are hydrophobic/non-polar and phospholipids have hydrophilic and hydrophobic region;

Accept 'non-polar' for hydrophobic and 'polar' for hydrophilic.

8. Phospholipids form monolayer (on surface)/micelle/bilayer (in water) but triglycerides don't;

5 max

(c) 1. Glucose **and** galactose;

Ignore α or β for glucose

2. Joined by condensation (reaction);

3. Joined by glycosidic bond;

4. Added to polypeptide in Golgi (apparatus);;

4

[15]

Q3.

(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]

Q4.

(a) 1. A = β glucose;

B = Adenosine triphosphate;
do not accept ATP

2

(b) 1. Saturated;

1

2. Fatty acid;

1

(c) 1. Peptide bond shown correctly;

2. Rest of dipeptide structure shown correctly;

2

(d) Water;

1

[7]

Q5.

(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]

Q6.

(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]

Q7.

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

Ignore references to saturated and unsaturated

Accept Pi/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]

Q8.

(a) Hydrolysis (reaction);

1

(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]

Q9.

(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]

Q10.

(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]

Q11.

(a) 1. Crush / grind;

2. With ethanol / alcohol;

3. Then add water / then add to water;

2. Water must be added <u>after</u> 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]

Q12.

(a) Double bond(s);

(Bonds) between carbon;

C=C bond(s) = 2 marks

'<u>No</u>' 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 / <u>three</u> fatty acids / forms <u>three</u> 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]

Q13.

(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 microfibres

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]

Q14.

(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]

Q15.

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]

Q16.

(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]

Q17.

Standard deviation shows there is overlap of the 2 data sets;
Small sample of wild salmon so may not be representative of population;

[2]

Q18.

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]

Q19.

(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]

Q20.

(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]

Q21.

(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]

Q22.

(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 <u>hydrogen</u> / saturated with hydrogen;

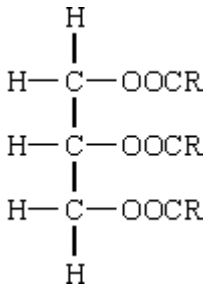
2 max

[6]

Q23.

(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]

Q1.

Parts (a) and (b) were well answered. Some students inverted their answers for (a) and many stated glyceride instead of glycerol for P.

Question (c) was answered fully correctly by nearly half (47.3%) of students. Errors included not adding water, or adding water first then ethanol, using the word cloudy with no colour and using the word precipitate.

Q2.

Question (a) demanded recall from section 3.3.2 of the specification; 25.6% of students gained five or six marks. Many, however, omitted any reference to the structure at all and it was surprising that very few students elected to draw a labelled sketch to show the gross structure. Many lengthy answers were seen detailing exchange of gases and the features of the alveolar epithelium, neither of which was required by the wording in the question. Many answers included tracheoles as a part of the human gas exchange system. Inhalation tended to be described in the best detail. Marking points 3 and 5 were often not awarded because of a lack of precision in describing the role of the pair of antagonistic intercostal muscles. Many students conflated the two, and referred to them generically. The relaxation and contraction of the diaphragm and its corresponding shape were frequently confused. For example, students referred to the 'flattened' or 'domed' shape of the diaphragm without stating how that occurred. This question had the highest discrimination index of the paper.

In question (b), although many students could demonstrate knowledge of phospholipids and triglycerides individually, they struggled to complete the required ‘compare and contrast’ command. When this command is used, every marking point requires a comparative statement that must be clearly made by the student: examiners will not infer links between separate statements – in this case, separate descriptions of phospholipids and of triglycerides. Many students did not include glycerol in their structure of the phospholipid. Some students were distracted into discussions of applications for the molecules, and their energetic values.

Question (c) showed that most students had learned the components of lactose and knew that it would be formed in a condensation reaction, although some omitted that this would result in the formation of a glycosidic bond. Fewer students knew that the lactose would be joined to a polypeptide in the Golgi apparatus. Many described that it would be found on the cell-surface membrane, and some tried to describe where on the polypeptide the lactose would be attached, rather than where in the cell as required by the question. Nearly half of the students scored at least two of the four available marks.

Q7.

About two thirds obtained the mark in (a) for a correct description of the difference between a triglyceride and a phospholipid. Those who failed to score either did not know about the structure of these molecules or just described the structure of a phospholipid (or triglyceride).

In (b), about 40% of students could fully describe how to test for a lipid and obtained both marks. A minority described tests for other biological molecules. Many made errors in their descriptions of the emulsion test or of a positive result. These errors included: adding water before ethanol, heating the mixture, the presence of a precipitate and failing to note that the colour of the emulsion would be white.

Most students scored the mark in (c). Those who didn't got saturated and unsaturated the wrong way round in terms of carbon-carbon double bonds.

In (d), 28% obtained both marks for stating that the fat substitute would not bind to the active site of lipase because it has a different shape to a triglyceride. A similar percentage obtained one mark. Those who failed to score often ignored the question's reference to lipase and wrote about bile salts, micelles and methods of absorption.

Q8.

(a) The vast majority of students correctly named the type of reaction as hydrolysis. Common errors were 'condensation' and 'phosphorylation'.

(b) Approximately 50% of students gained a mark in this question. The most common scoring points referred to phosphate being required for the formation of ATP, DNA, RNA or phospholipids in cell membranes. Many students stated that phosphate was used as a 'nutrient', 'for energy' or to 'form protein'.

(c) Approximately 40% of students were able to calculate a correct ratio. A significant number of students did not gain the mark as they provided the ratio the wrong way round or they simply transcribed their readings from the graph as a ratio, most commonly, 4.1:1.1.

(d) This question proved difficult for most students with almost 60% scoring zero. The most common misconception was that the chilling requirement of seeds would enable plants to grow during the winter so that they would be fully grown by spring and could outcompete other plants. Some students also referred to plants carry out photosynthesis and reproducing during the winter. A significant number of students misinterpreted the question and answered it in terms of natural selection for plants with a chilling requirement. Students who did gain credit often referred to growth of the seed/embryo during the winter followed by photosynthesis in the spring/summer. Very few students referred to seed production in the spring or summer.

Q9.

(a) More than 80% of students correctly stated that the pH probe would give a more accurate or precise reading or that assessing a colour change would be subjective.

(b) It was disappointing that more than half the students did not recognise that the decrease in pH was due to fatty acid production. There were many answers that referred to the products of carbohydrate digestion or of protein digestion in their answer.

(c) Most students knew that the pH remains constant as all the triglycerides had been hydrolysed or that the low pH could have denatured the enzyme. Unfortunately there were many who disqualified their answer by suggesting that the enzyme would be used up or all the active sites would be full. Relatively few students went on to explain why this would result in a constant pH.

(d) It was pleasing to see that almost 70% of students were able express their answer correctly on the graph.

Q10.

(a) Students had difficulty interpreting the data in the pie charts and so tended to score either very well or not at all. Misinterpreting the chart as representing how much fish the children had eaten, rather than the proportion of children who ate that type of

fish was the root cause of this. A significant number of students also tried to link the data in the pie chart with how likely a child was to develop asthma. Those who understood the data in the pie charts usually went on to score two or three marks.

(b) The majority of the students had clearly learned the emulsion test and gained all three marks. The most frequent errors were not adding to water, and not describing the emulsion as white, milky or cloudy. There was a significant number who added hydrochloric acid or sodium hydroxide, with about 10% failing to gain any marks.

Q11.

(a) Students who were familiar with the emulsion test were often able to gain full credit. There was the inevitable confusion between this and other biochemical tests, and some of the less able students were of the opinion that a substance called "emulsion" should be added. Where students appreciated the need to add ethanol and water, they were not always certain about whether or not it was necessary to heat the mixture, or of the order in which ethanol and water should be added.

(b) In their answers to part (i), the majority of students correctly suggested 4. Among the incorrect responses, there were frequent references to 3 and 6. Although many students gained both marks in part (ii), there was much irrelevant comment about hydrophobic and hydrophilic groups. It was also apparent that many of the less able students confused phospholipids and plasma membranes. It was expected that students would refer to the presence of phosphate in a phospholipid. Phosphorus was not considered to be an acceptable alternative. Part (iii) was generally answered well although saturated and unsaturated were occasionally confused. It was particularly pleasing to see that many students followed the instruction to use the diagram and described fatty acid **C** as being unsaturated.

Q12.

(a) 42% of candidates were aware that an unsaturated fatty acid contains carbon-carbon double bonds and gained full credit. However, most candidates gained one mark for the idea of double bonds. Weaker candidates often wrote about the health benefits of unsaturated fatty acids.

(b) Nearly 60% of candidates gained at least two marks. This was typically for appreciating that the graph shows a reduced risk, not prevention, of coronary heart disease or that other factors may also reduce the risk. Many candidates also described the negative correlation. However, weaker candidates sometimes left this as ‘there is a correlation’.

(c) (i) Just over 60% of candidates correctly identified X as a glycosidic bond. Common incorrect responses seen were ‘peptide, ‘ester’, ‘ionic’, ‘covalent’ and ‘hydrogen’.

(ii) Just over half of the candidates gained the mark for stating that a triglyceride contains glycerol or three fatty acids. However, some candidates clearly confused a triglyceride with a phospholipid and made reference to a phosphate group or two fatty acids. Weaker candidates were often let down by poor expression or a lack of detail. These candidates often referred to a triglyceride containing three glycerol molecules and some confused glycerol with glycogen.

(iii) Only 20% of candidates gave the correct response 9.

Q13.

(a) Although this question produced an even spread of marks across the entire ability range, the overall marks were disappointing for a question largely targeted at Grade E candidates. Many appeared uncertain as to the distribution of starch and glycogen, the identity of deoxyribose as a carbohydrate or of DNA helicase as an enzyme.

(b) Most candidates were able to gain some credit for recognising that condensation involved the elimination of a molecule of water, although there were some who apparently failed to appreciate that water molecules contained two hydrogen atoms and an oxygen atom, or that condensation involved linking the molecules shown. The better candidates selected the appropriate atoms and gained both of the available marks.

(c) In part (i), candidates were usually able to make an appropriate reference to the role of hydrogen bonds in strengthening either cellulose or the cell wall. Many, however, were uncertain as to the location of these bonds and produced answers referring to linking the β-glucose residues. Part (ii) was usually well answered and most candidates were able to discuss the compact shape of starch molecules. There were, however, some answers incorrectly based on the idea of a large surface area to volume ratio.

Q14.

(a) This was often generously marked. For the first marking point candidates were required to state that the pH decreased and then levelled off. Centres often gave credit for the second point for any mention of pH 6.5 or 30 minutes, even when there was no reference to levelling.

(b) This was well answered by the majority of candidates. Some candidates misinterpreted this question and responded by explaining what would happen if the enzyme concentration changed during the investigation.

(c) Some centres credited responses that referred to rate, rather than to the gradient or ‘steepness’ of the curve. Many candidates experienced difficulty in expressing this simply. In some centres, candidates who had difficulty describing the difference drew the curve on the resource material. This was sometimes not credited by the centre, despite the curve being shallower than curve Z.

Q15.

Some excellent responses were seen. Candidates were able to establish a link between fatty acids and the phospholipid content of the membranes. Many candidates were aware that fatty acids could be respired and the energy released could be used appropriately. Some centres awarded credit when responses indicated that energy was for respiration or when energy was made during respiration. It was rare to see any evidence of the third marking point.

Q16.

(a) Many centres gave credit to descriptions which only indicated that the omega-3 concentration fell but made no reference to the rapidity of fall. Similarly credit was given to any answer which stated that the concentration reached 0.4% at 140 days, even if there was no mention of the concentration levelling out.

(b) (i) The calculation was carried out correctly by many, and two marks were

scored. A large number gained one mark for correctly identifying a fall of 1.7.

(ii) It was rare to see more than one mark awarded. This was almost universally for the idea of being able to make comparisons between the cattle or milk. Often any reference to a comparison was awarded credit.

(iii) A large majority of candidates recognised that the graph showed the omega-3 concentration decreasing with time. A variety of suggestions was offered to account for the decrease, but few suggested that the concentration might have fallen anyway.

Q17.

Many candidates pointed out that the standard deviations for the two samples were overlapping. Candidates who noted that the samples of fish were small often failed to indicate that samples this small wouldn't necessarily be representative of the populations. Some centres incorrectly gave credit to any reference to standard deviation or small sample sizes. Many candidates appeared to believe that the different sizes of the groups were significant.

Q18.

Well answered and well marked by the majority of centres. Candidates often recognised that the farmed fish would receive more food or receive food more regularly. Many were also able to make a correct link with the activity and restricted movement of the caged fish. Most candidates scored at least one mark, with many scoring both marks.

Q19.

Unit 6

(a) Although the correct answer was given by many candidates, a significant minority made arithmetical errors or rounded their answers incorrectly.

(b) The emulsion test was most frequently cited but the method was often not described correctly.

Many of these responses used water or ethanol as the sole reagent or cited an incorrect test. A small minority of candidates gave details of incubating with lipase and testing for pH change, these answers received the appropriate credit.

(c) Microvilli were correctly identified and their function described by most candidates in part (i).

Part (ii) caused problems to the weaker candidates and the vast range of alternative answers generated by these candidates indicated that they had not understood the diagram. Part (iii) produced good responses from the candidates who correctly identified the rough endoplasmic reticulum, although a small proportion thought the structure was the Golgi body. Part (iv) was generally poorly answered. The most common incorrect response was facilitated diffusion.

Often these responses were given in answers which clearly indicated the size of the chylomicrons and it was interesting to observe the lack of coherent thinking displayed by many candidates.

Unit 7

(a) Calculations of the recommended daily lipid intake were often incorrect, a common error being to disregard the given energy content of one gram of lipid. Some spoiled their answers by inappropriate rounding or by compounding rounding approximations in a two-stage calculation.

(b) Many candidates did not know the details of the emulsion test for lipids. Benedict.s, the biuret test and the iodine test were all suggested.

(c) In (i), most knew that the microvilli shown in the diagram would increase the surface area for absorption of the products of digestion. However, in (ii), the identification of **R** and **S** was rarely correct. **R**, the tissue fluid, was sometimes thought to be 'cytoplasm', a 'blood vessel', or merely a 'space'. **S**, the lymph vessel or lacteal, was thought to be a 'blood vessel', a 'lysosome', even the 'small intestine'. In part (iii), many recognised organelle **U** as the rough endoplasmic reticulum and knew that the protein part of the chylomicron would be made here, better candidates emphasising the part played by its ribosomes. Some correctly suggested a role in transport, perhaps mentioning vesicle formation. Others incorrectly thought triglycerides were synthesised here, despite the indication in the diagram that this was fulfilled by the smooth ER. It was evident in (iv) that many candidates had no appreciation of the size of the chylomicrons – despite having been given the information in the stem to section (d) that they were composed of many triglyceride molecules and were surrounded by proteins. Hence, 'diffusion', 'facilitated diffusion' and 'active transport' were not sensible answers. Better candidates knew that such large structures could only leave the cell by exocytosis.

Q20.

(a) Imprecise expression frequently limited the marks awarded for part (i). Care clearly needed to be taken to avoid suggesting too few components, with answers such as that a polymer consisted of 'two or more' monomers. Those who did not make use of the term 'monomer' needed to indicate, in some way, the similarity of the constituents. They did not always do this. The most frequent reason for failing to gain credit for part (ii) was where candidates gave substances, such as haemoglobin and amylopectin, which were excluded by the wording of the question. Nevertheless, many candidates gave correct answers.

(b) In part (i), most candidates recognised the importance of buffers in maintaining pH, although some associated them with temperature. Better candidates could generally develop the idea and usually gained a second mark through reference to denaturation. Unfortunately, some saw parts (ii) and (iii) as a trick and pointed out that since starch was not a protein, it would give a negative result. Others made the same error by simply failing to focus on the right component of the mixture. Perhaps more disturbing is the continued failure of so many candidates at this level to learn the relevant information relating to basic biochemical tests. There was again much confusion over test and result, apparent both here and in the answers to Question **4** (b).

Q21.

It was pleasing to find a higher proportion of candidates performing well on this question than had been anticipated, and a considerable number gained at least 6 or 7 marks. In particular, an encouraging number managed to get to grips with part (c), although often the weakest candidates made no attempt.

(a) Most candidates answered both parts well.

(b) (i) The majority gained a mark, but a significant number merely stated that

caffeine improved performance without describing how. Some recited all the results from the table, including the glycerol and fatty acid concentrations, and were disqualified from the mark.

(ii) A good proportion recognised that the glycerol and fatty acids would have been derived from the breakdown of fats, for which they gained credit. Very few appreciated that the fats would be likely to have come from fat stores in the body rather than from, for example, the caffeine. A number proposed explanations in terms of more fats or fatty acids being 'needed' in order to be able to exercise for longer.

(c) (i) Many realised that the equation showed that the volume of oxygen absorbed was the same as the volume of carbon dioxide given out. Not all went on to explain how this ratio gave an RQ value of 1.0. It was encouraging, however, to see that many candidates explained their answer in terms of moles. Inevitably, a proportion of candidates ignored the equation altogether and suggested, for example, that a value of 1.0 was chosen because glucose is what is normally used in respiration.

(ii) Many of the better candidates provided good explanations, citing the evidence that the RQ being closer to 0.7 when caffeine was taken, showed that fatty acids were being respired. Fewer actually pointed out that glycogen would be broken down to glucose, and that an RQ closer to 1.0 would suggest that the glycogen stores would be used more rapidly. Credit was awarded for those who pointed out that the longer time to exhaustion would in itself suggest that glycogen stores were being used more slowly. Weaker candidates often ignored reference to the data and tried to offer explanations based on time spent on anaerobic respiration, or the overall rate of respiration being slower after drinking coffee. Many confused glycerol and glycogen, or assumed they were the same substance.

Q22.

(a) The vast majority of candidates gained the mark, with only a few confusing hydrolysis with condensation.

(b) Most candidates scored full marks, the most common error occurring in (ii) where the substrate of amylase was identified as protein.

(c) The difference between the types of fatty acids was well understood in terms of double bonds but very few candidates then went on to mention the location of the bonds or describe saturation with reference to hydrogen. Weaker candidates identified the bonds involved as hydrogen and therefore failed to obtain any marks.

Q23.

(a) Most candidates made an attempt to add three fatty acids to the glycerol but fewer could then draw the correct bonds.

(b) The concept of a monomer was generally poorly understood, with glycerol and fatty acids often referred to as the only two monomers making up the triglyceride. Many candidates referred to the presence of different R groups being the reason for the molecule not being considered a polymer.

(c) Very few candidates appreciated the white fat cell's involvement in fat storage. Although most noted the mitochondria in the brown fat cell and associated this with respiration, the process was not linked to energy or heat release but often to active

transport. Some candidates were confused over basic concepts involving energy, referring to ‘creating’ or ‘making’ energy.