**M1.**(a)     (i)      a catalyst

**1**

(ii)     protein

**1**

(iii)    salivary glands

**1**

(b)



extra lines from any enzyme cancels that mark

**3**

**[6]**

**M2.**         (a)      (i)


*all three correct =* ***3*** *marks*

*two correct =* ***2*** *marks*

*one correct =* ***1*** *mark*

*extra line from a large food molecule cancels the mark*

**3**

(ii)     sugars

**1**

fatty acids and glycerol

**1**

amino acids

*must be in this order*

**1**

(b)     liver

**1**

**[7]**

**M3.**          (a)     microorganisms

**1**

(b)     (i)      proteases clear indications of correct answer

**1**

(ii)     amino acids (both words) clear indications of correct answer

**1**

(c)     (i)      14

**1**

(ii)               *mark independently*

         enzyme Z

*clear indication of correct answer*

**1**

         takes least time (to pre-digest protein) / works fastest

*allow only 7 minutes / less time / faster*

*do* ***not*** *allow works best*

**1**

(iii)     temperature

**1**

         pH

**1**

**[8]**

**M4.**         (a)      (i)     A

**1**

(ii)     hydrochloric (acid) / HCl

**1**

(iii)    alkali / suitable named example

*accept sodium hydrogen*

*carbonate / sodium bicarbonate / milk of magnesia / other brand names
allow bile (salts)
ignore antacid*

**1**

(b)     •    amylase breaks down starch

**1**

•    (broken down) into sugars / glucose

**1**

•    digestion of starch in the mouth

**1**

•    (also) starch broken down in small intestine

**1**

•    amylase produced in salivary glands / small intestine / pancreas

**1**

(c)     small intestine

*allow ileum / duodenum*

*do* ***not*** *accept large intestine*

**1**

**[9]**

**M5.**          (a)     opaque / less transparent / blue

*allow mixture becomes dark / black*

*ignore thicker*

**1**

(b)     (i)      7 (minutes) **or** in range 6.7 to 7

*award* ***2*** *marks for correct answer*

         if answer is incorrect evidence of selection of
40(% light intensity) either in working **or** in graph
2 for **1** mark

**2**

(ii)     any **two** from:

•        slower / takes longer at lower temperatures

•        (40oC is) optimum / best temperature

*allow near to 37oC / body*

*temperature where enzymes work best*

•        enzyme denatured / destroyed / damaged at higher temperatures

*allow description of denaturation*

**2**

(c)     (i)      isomerase

*allow phonetic spelling*

**1**

(ii)     fructose is sweeter than glucose
needed in smallerquantities **or** less is needed

**2**

**[8]**

**M6.**          (a)     any **one** from:

*ignore reference to recording results every 5 minutes* ***or*** *concentrations of lipid / lipase*

•        (same) volume / amount / 1 cm3 lipase

*allow amount of solution*

•        (same) volume / amount / 5 cm3 lipid

*allow keep same volumes in the test tubes*

•        mixed after 3 minutes / same time before mixing

*do* ***not*** *accept temperature*

**1**

(b)     so that the lipase and the lipid reached the right temperature

**1**

(c)     any **two** from

*ignore explanations*

•        decrease in time **or** faster (breakdown)

•        then increase in time **or** then slower (breakdown)

•        fastest / least time / optimum at 35°C

**2**

(d)     any **two** from:

*ignore ߢtest at more temperaturesߣ unqualified*

•        test more regularly eg test every minute

*any interval < 5min*

•        test at smaller temperature intervals

*any value <15°C*

*allow test more temperatures in the range*

•        test between 50 (°C) and 95 (°C)

*any value in range, eg test at 70*

•        repeat at same temperatures
**or** repeat the investigation
**or** compare results with others

*allow do* ***it*** *again*

**2**

(e)     (i)      (lipase / it) denatured / destroyed / changed shape

*allow damaged / deformed*

*do* ***not*** *accept killed*

*ignore broken (down)*

**1**

(ii)     fatty acids and glycerol

**1**

**[8]**

**M7.**          (a)     protease

*allow trypsin / peptidase*

*do* ***not*** *allow pepsin*

**1**

carbohydrase / amylase

*do* ***not*** *allow sucrase / maltase / lactase*

**1**

(b)     no lipase produced / found

**1**

in stomach / mouth / before small intestine
**OR**accept lipase only produced / found (1)
in small intestine / pancreas (1)

*if no other mark is awarded lipid is not broken down in the stomach* ***or*** *lipid is digested in small intestine gains* ***1*** *mark*

**1**

(c)     enzymes only work in solution / when dissolved
**or**because enzyme / lipase / it is dry

*allow enzymes only work in presence of water* ***or*** *enzymes do not work when dry*

*ignore other physical conditions*

**1**

**[5]**

**M8.**(a)     (i)      8.6

*accept value in range 8.5 to 8.7*

**1**

(ii)     hydrochloric acid / HCl

*accept HCL*

*accept hydrogen chloride*

*ignore hcl / etc.*

**1**

(iii)    X

**1**

(b)     Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](../resources/AG_BL/menus/Markingguidance.pdf).

**0 marks**No relevant content.

**Level 1 (1-2 marks)**There is a simple description of part of a process or a reference to at least one of: mechanical digestion, lipase, product of enzyme action, bile, site of production or site of digestion

**Level 2 (3-4 marks)**There is a description of at least one process linking ideas

**Level 3 (5-6 marks)**There is a clear description of the process including reference to the majority of: mechanical digestion, lipase, bile, where they are produced, products, function of bile and site of digestion / absorption

**Examples of biological points made in the response:**

•        mechanical breakdown in mouth / stomach

•        fats →fatty acids and / or glycerol

•        by lipase

•        (produced by) pancreas

•        and small intestine

•        fat digestion occurs in small intestine

•        bile

•        produced by liver

•        neutralises acid from stomach

•        produces alkaline conditions in intestine

•        refs. to increased surface area related to emulsification or chewing

•        products are small molecules / water-soluble

•        products absorbed by small intestine

**6**

**[9]**

**M9.**          (a)    any **one** from:

*ignore control variables that are not given in the method, such as ‘equally crushed’* ***or*** *same time*

*do* ***not*** *accept volume of apple juice*

*•        20 g (of apple)* ***or*** *(same) mass / amount / weight of apple*

*ignore volume / size*

*•        crushed (apple)*

*•        10 drops (of solution)* ***or*** *(same) number / amount / volume of drops*

*do* ***not*** *accept 10 drops of amylase alone*

*•        apple* ***or*** *type of fruit*

*ignore type of apple*

***1***

*(b)     (may) have different volume / amount / sizes*

*ignore reference to human error*

*ignore don’t know / can’t measure size of drop*

***1***

*(c)     amylase has no / little effect on cell / walls / apple*

*accept ideas that refer to shape of enzyme being ‘incorrect’*

***or*** *amylase does not breakdown / digest cell / walls / apple*

*accept amylase only breaks down / digests starch*

***1***

*pectinase breaks down cell / walls / apple*

*allow digest for breakdown*

*allow shape of pectinase fits cell / walls / apple*

***1***

*boiling breaks down cell / walls / apple*

***1***

*(d)     11.6*

***1***

*enzyme / pectinase destroyed / denatured / damaged / broken down*

*do* ***not*** *allow kill*

***1***

*only effect of boiling (relevant)*

***1***

***[8]***

***M10.****(a)     (i)      amino acid(s)*

*accept peptide(s)*

*do* ***not*** *allow polypeptide(s)*

***1***

*(ii)     protease*

***1***

*(b)     (i)      2*

***1***

*(ii)     repeat*

*do not allow other enzyme / substrate*

***1***

*using smaller pH intervals between pH1 and pH3*

*allow smaller intervals on both sides of / around pH2*

*allow smaller intervals on both sides of / around answer to (b)(i)*

***1***

*(iii)    enzyme / pepsin denatured / shape changed*

*do* ***not*** *allow enzyme killed*

*allow enzyme ‘destroyed’*

***1***

*enzyme / pepsin no longer fits (substrate)*

*allow enzyme / pepsin does not work*

***1***

*(c)     hydrochloric (acid)*

*allow phonetic spelling*

*accept HCl*

*allow HCL*

*ignore hcl*

*do* ***not*** *allow incorrect formula –e.g. H2Cl / HCl2*

***1***

***[8]***

*﻿*

***M11.****(a)     lipase*

***1***

*(b)     fatty acid*

*ignore glycerol*

***1***

*(c)     (i)      0.25 or *

*if correct answer ignore working or lack of working*

* for* ***1*** *mark*

***2***

*(ii)     fats emulsified* ***or*** *described re. Small droplets* ***or*** *large S.A.
(for enzyme action)* ***or*** *fats ‘mix’ better with water*

*do* ***not*** *allow breakdown / breakup unqualified*

***1***

***[5]***

***M12.****(a)     (i)      B*

***1***

*(ii)     any* ***one*** *from:*

*•        largest area of / most digestion (of lipid)*

*allow agar / jelly / mixture broken down / digested*

*do* ***not*** *allow digestion of bacteria / lipase*

*ignore digestion* ***by*** *bacteria*

*•        largest clear area*

***1***

*(b)     any* ***two*** *from:*

*•        effect of pH / pH described*

*•        effect of temperature*

*•        effect on different types of lipid / fat*

*•        cost* ***or*** *allergic reactions* ***or*** *effect on skin / fabrics /* ***or****environment* ***or*** *interaction with other chemicals in
powder* ***or*** *shelf life*

***2***

*(c)     enzymes / named enzyme denatured / destroyed*

*allow active site(of enzyme) altered*

***1***

***[5]***

***M13.****(a)     stomach is acidic / has low pH*

*allow any pH below 7*

*ignore stomach is not alkaline*

***1***

*lactase works best / well in alkali / high pH / neutral / non-acidic conditions*

*allow any pH of 7 and above
accept works slowly in acid conditions*

*allow figures from table with a* ***comparison***

*ignore reference to temperature*

***1***

*(b)     any* ***three*** *from*

*•        (below 45(°C)) increase in temperature increases rate / speed of reaction*

*•        reference to molecules moving faster / colliding faster / harder / more collisions*

*•        optimum / best at 45(°C)*

*allow value(s) in range 41 - 49*

*•        high temps / above 45(°C) (rate slows due to) denaturation of enzyme /lactase*

*allow synonyms of denaturation but* ***not*** *killed*

*denaturation at high* ***and*** *low temperature does* ***not*** *gain this mark*

*ignore body temperature*

*ignore references to time / pH*

***3***

*(c)     any* ***two*** *from*

*•        acid neutralised* ***or*** *conditions made neutral / alkali*

*accept bile is alkaline*

*•        (allow) emulsification / greater surface area of fat / lipid*

*allow description of emulsification eg fat is broken down / broken up into droplets*

*•        enzymes (in small intestine) work (more effectively / better)*

*allow better for enzymes*

***2***

***[7]***

***M14.****(a)* ***A*** *− saliva(ry) gland*

**1**

**B** − liver

**1**

**C** − duodenum

*ignore small intestine*

**1**

**D** − pancreas

*accept phonetic spellings*

**1**

(b)     (i)      any **three** from:

•        chewing / muscle contraction / mechanical digestion

*allow churning*

•        protease enzymes

*allow pepsin / trypsin*

•        in stomach / small intestine / duodenum / from pancreas

•        (break down protein) into amino acids

*allow (poly)peptides*

**3**

(ii)     neutralises acid pH / makes conditions alkaline

**1**

so lipase can work

**1**

emulsifies fat

**1**

to give large(r) surface area for lipase / enzyme action

**1**

(c)     (i)      starch

*ignore carbohydrate*

**1**

(ii)     breakdown stops

*allow slows down*

**1**

because stomach produces / contains acid / has low pH

**1**

and amylase cannot work in acid / low pH

*accept amylase is denatured / changes shape*

**1**

**[15]**

**M15.**(a)     Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance and apply a ‘best-fit’ approach to the marking.

**0 marks**No relevant content.

**Level 1 (1−2 marks)**The method described is weak and could not be used to collect valid results, however does show some understanding of the sequence of an investigation.

**Level 2 (3−4 marks)**The method described could be followed and would enable some valid results to be collected, but lacks detail.

**Level 3 (5−6 marks)**The method described could be easily followed and would enable valid results to be collected.

**Examples of the points made in the response:**

•        bean seedlings of same age

•        cut material from same part of each organ (for repeats) e.g. top 1 cm of stem / a whole cotyledon / seed

•        equal mass of each organ

*accept weight for mass*

•        grind / homogenise

•        in equal amounts of water / buffer

•        equal volumes of hydrogen peroxide solution

•        equal concentrations of hydrogen peroxide solution

•        same temperature

•        temperature maintained in water bath

•        quantitative measure of gas production eg height of foam in mm / collect gas in graduated syringe in cm3

•        for same time period

•        repetitions (3+ times)

•        calculate mean for each.

**6**

(b)     (i)      correct answer: 40

***1*** *mark for 45 as the anomalous result has been included in the calculation*

*or*

***1*** *mark for *

*or *

**2**

(ii)     vertical axis correctly labelled:
‘Enzyme activity in arbitrary units’

*allow ecf from (b)(i)*

**1**

points plotted correctly ±1 mm

*deduct* ***1*** *mark for each incorrect plot*

**2**

suitable line of best fit

*not feathery, not point to point*

**1**

(iii)    6.0 / 6

*allow ± 0.1*

*if 6.0 not given, allow correct for candidate’s graph ± 0.1*

**1**

(iv)    in range 0 to 14 units

*allow correct for candidate’s graph*

**1**

(v)     enzyme denatured / enzyme (active site) shape changed

*allow substrate no longer fits (active site)*

*ignore reference to temperature*

*do not allow enzyme dies*

**1**

**[15]**