GCSE
BIOLOGY

Topic Paper: Enzymes (2.2 The human digestive system, 6.1.5 DNA structure)
Part 1 & 2 Mark Scheme

MARK SCHEME

77 Marks

M1. (a) lipase

1

(b) fatty acid

ignore glycerol

1

(c) (i) 0.25 or $\frac{1}{4}$

if correct answer ignore working or lack of working

$\frac{(8.7-7.7)}{4}$ *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]

M2. (a) any **two** from:

neutralises acid / makes conditions alkaline / raises pH

enzymes (in small intestine) work (more/most effectively) **or** stop/prevents enzymes being denatured

emulsifies fats/lipids **or** description of emulsification

*do **not** accept breakdown unqualified*

larger surface area

2

(b) (i) bile / bilirubin / pigment / broken down haemoglobin / substance / cholesterol linked to movement **or** effect

1

does **not** get to the intestine / food / faeces **or** cannot leave liver **or** effect not happening (in intestine)

1

(ii) bilirubin / pigment / broken down haemoglobin

not 'bile' alone

1

(deposited) in skin

only award if bilirubin / pigment / broken down haemoglobin given

allow carried in the blood

1

[6]

M3. (a) **B**

*no mark for "B" alone, the mark is for B **and** the explanation.*

large(r) surface / area **or** large(r) membrane

accept reference to microvilli

ignore villi / hairs / cilia

accept reasonable descriptions of the surface eg folded membrane / surface

*do **not** accept wall / cell wall*

1

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

(salivary) amylase

carbohydrase

1

(ii) <u>many</u> ribosomes

*do **not** mix routes. If both routes given award marks for the greater.*

1

ribosomes produce <u>protein</u>

accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

<u>many</u> mitochondria (1)

mitochondria provide energy to build / make <u>protein</u> (1)

accept ATP instead of energy

1

[4]

M4. (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]

M5. (a) the enzyme must be lipase

1

since fatty acid produced, which lowered the pH

1

(b) (i) 0.25 **or** $\frac{1}{4}$

correct answer with / without working

if answer incorrect / missing, then evidence of $\frac{8.7 - 7.7}{4}$ *gains **1** mark*

2

(ii) bile provides optimum / suitable / best pH for enzyme action
therefore the rate of the reaction increased

1

[5]

M6. (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(℃)) increase in temperature increases rate / *speed* of reaction

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

optimum / best at 45(℃)

allow value(s) in range 41 - 49

high temps / above 45(℃) (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]

M7. (a) pancreas

either order

1

small intestine

1

(b) any **two** from:

to give them time to come to temperature of the water-bath
accept so (they / both) are at the same temperature

at / near body temperature / best / optimum temperature

otherwise reaction would take place at a series of different temperatures
or sensible statement about control / fair test

2

(c) (i) 0.42
allow in range 0.42 to 0.425

1

(ii) 0.021
correct answer with or without working
*allow ecf from (c)(i) ie (c)(i) ÷20 correctly calculated for **2** marks*
*if answer incorrect 0.42 ÷20 **or** (c)(i) ÷20 gains **1** mark*

2

(iii) (all) starch digested / gone / used up / turned to sugar
allow the amount of sugar stays the same / maximum

1

(iv) any **two** from
allow reference to active site once only as alternative to first or second bullet point

enzyme destroyed / denatured / damaged / shape changed
*do **not** accept killed*

unable to fit (starch molecule)

starch can't be digested
enzymes don't work is insufficient

2

[10]

M8. (a) gene / allele

1

(b) (in / on) ribosome(s)

1

(c) any **three** from:

amino acids make up a protein

(protein is) particular combination / sequence (of amino acids)

bases form a code

the bases work in threes or description
accept bases work in triplet

(code / three bases) for one amino acid
*accept eg (bases) WXZ for amino acid J for **2** marks*

3

(d) (i) different / wrong amino acid (coded for) **or** different / wrong shape
ignore reference to amino acid 'made'
ignore change unqualified
ignore different protein

1

(ii) different / example of different eye colour
allow protein may / would not be made / function (normally)

1

[7]

M9. (a) shape changed / destroyed (above 45 ℃)
accept denatured
accept active site changed
*do **not** accept enzyme killed*

1

(shape) doesn't fit (other molecules / stain)

1

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

can wash the clothes at higher temperature

so wash / enzyme action will be quicker
*do **not** accept idea of bacteria working faster*

enzyme not destroyed at high temperature / 80 ℃
accept denaturation or description

2

(ii) high(er) temperature / 80 ℃ uses more energy / fuel

1

more pollution / named (eg carbon dioxide / global warming) (from electricity production)

or

increased release of hot water (into the environment)

1

[6]

M10. (a) any **two** from:

product not contaminated with enzyme or is pure

enzyme can be reused
allow enzyme not wasted / less enzyme is needed

continuous flow process possible

enzyme more stable / can be used at higher temperature
allow enzyme lasts longer
ignore refs. to cost / cheaper

2

(b) maximum fructose production / maximum enzyme activity
accept optimum / best

or

increase in flow rate does not increase production

1

higher rate leaves some glucose unchanged
allow glucose not wasted / extra glucose wastes money

1

(c) less (fructose) needed (for same sweetness)
ignore fructose is sweeter unqualified

1

(less fructose) → less fattening / fewer 'calories'
ignore refs. to cost / cheaper

1

[6]

M11. (a) changes code /sequences of bases
or
sequence of amino acids is different

1

the enzyme has different / wrong shape / structure
allow the active site is changed

1

so substrate will not fit into enzyme / will not join to enzyme

1

(b) (i) 46

allow 23 pairs

1

(ii) also inherited (from mother) normal chromosome 15 / normal allele / normal gene / boy is heterozygous / **Hh**

allow the boy is a carrier

1

(allele for) this disorder is recessive
or
the normal allele would give a working enzyme

ignore converse

1

(iii) genetic diagram including:

Parental gametes:

H and **h** from both parents

accept alternative symbols, if defined

1

derivation of offspring genotypes:

HH Hh Hh hh

allow alternative if correct for student's parental genotypes / gametes

1

identification of **hh** (having the disorder) if 1 in 4

1

[9]

M12. (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 40(℃)) increase in temperature increases rate / speed of reaction

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

enzyme optimum / works best at 40℃
allow value(s) in range 36 – 44
ignore body temperature unless qualified

high temperatures (above 40℃) / 45℃ / 50℃ enzyme denatured
*allow synonyms for denaturation, but do **not** allow 'killed'*
*denaturation at high <u>and</u> low temperature does **not** gain this mark*
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 lipid / fat)
allow description of emulsification eg fat broken down / broken up <u>into droplets</u>
*do **not** accept idea of chemical breakdown*

lipase / enzymes (in small intestine) work more effectively / better
allow better for enzymes
ignore reference to other named enzymes

2

[7]