General Certificate of Education (A-level)
June 2012

Human Biology   **HBI3X**

(Specification 2405)

Unit 3X: Investigative and Practical Skills

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

HBI3X: Task 1

Question	Marking Guidance	Mark	Comments
1	<table><tr><td>Volume of 5% trypsin solution **/ cm³**</td><td>**Volume of** (distilled) **water** **/ cm³**</td><td>Volume of 1% trypsin solution **/ cm³**</td></tr><tr><td>**0.2**</td><td>**0.8**</td><td>1.0</td></tr></table> One mark for completed labels and units; One mark for correct volumes;	2	Required information in bold Accept appropriate alternative to cm³ No other volumes acceptable
2	1. Described way of recognising end point; 2. Made a reference/standard / compared all to first tube / same procedure in all trials; 3. Allow to run past end point for confirmation;	2 max	1. E.g. 'x' can be seen through solution / solution colourless like the water in the water bath 2. Do not reward a repeat of the question i.e. 'same each time'
3	Produce a reliable mean / reduce effect of/identify anomalies / reduce chance of random error;	1	
4	1. Control pH/use buffer; 2. Equilibration of enzyme/description of equilibration; 3. Use of electronic water bath/optimum temperature/37°C; 4. Use of colorimeter; 5. Stir mixed contents of tubes;	2 max	2. E.g. bringing tube B to temp of tube A 3. Accept alternatives equivalent to 'electronic'
5	Quantitative because time taken (to go clear) is measured/categoric/numeric data;	1	Accept converse e.g. if qualitative, data would not be categoric etc.

6	1. End point is judgemental/subjective/based on opinion; 2. Takes time to start/stop/read timer; 3. Human reaction time greater than additional precision of timer;	2 max	Context of error lies with human reactions so additional precision of no benefit 3. Accept reference to 'accuracy' of timer
	Total	**10**	

HBI3X: Task 2

Question	Marking Guidance	Mark	Comments
7	1. Data presented clearly with full descriptions of both the independent (Concentration of trypsin) and dependent variable (Time taken….); 2. Independent variable (Concentration of trypsin) in first column; 3. Units clearly stated for IV = % and DV = seconds and <u>only</u> in the headings; 4. Trend shows that 1% was the quickest and 0.1% the slowest;	4	Accept other appropriate descriptions of IV Information in title might help descriptions 3. Shown in either one set of data or mean data
8	Accurate calculations for all concentrations using formula provided;	1	Calculations use mean data. Reject if calculation of mean ignores some results obtained. Ignore calculations using 1/t
9	1. Graph has independent variable (Concentration of trypsin) on x-axis and dependent variable (Relative rate of reaction) on y-axis; 2. Appropriate scales selected for the x and y axes; 3. Both axes correctly labelled with appropriate units; 4. All points plotted accurately; 5. Data presented as a line graph on which points are joined with curve of best fit or with ruled lines, as appropriate;	5	Graph title can provide further information for labels If relative rate not plotted, do not credit* 2. Scales should allow for both accurate plotting and reading of the graph. Both size of graph and proportion of graph paper used should be taken into account. 3. x-axis = Trypsin concentration / %, y-axis = Relative rate of reaction / 1000/t If relative rate not plotted, do not credit *(reject only once)* 4. x-axis = Trypsin concentration / %, y-axis = Relative rate of reaction / 1000/t If relative rate not plotted, do not credit *(reject only once)* 5. Do not award mark if candidate has extrapolated data beyond plotted points.
	Total	**10**	

HBI3X: Written Test Section A

Question	Marking Guidance	Mark	Comments
10	Timed/waited until both tubes/one tube/specified tube had reached 35(^{o}C)/required temperature/ temperature of water bath (and applied to other tube(s));	1	
11 (a)	1. (Distilled) water/boiled enzyme/boiled/ trypsin **and** milk; 2. Reference to appropriate volume(s) (1 cm^3 water etc / 5 cm^3 milk);	2	1. Need a reference to both for this point. Accept denatured enzyme. 2. Either or both. Accept 'same volume of milk as before' as equivalent to giving volume.
11 (b)	0 / there is no relative rate of reaction;	1	
12 (a)	Concentration of trypsin and time taken are inversely proportional / as concentration increases time taken decreases;	1	Look for general idea without need for complete description of variables
12 (b)	**A** to **C** 1. (Because more enzyme) means more active sites / enzyme concentration is limiting factor; 2. (So) more collisions / more ES complexes / breakdown of milk protein/product formed per unit time; **E** to **G** 3. Substrate concentration/amount of milk <u>protein</u> is limiting factor / enzyme concentration is not limiting factor; 4. Rate of reaction remains constant/at its fastest/appropriate description;	3 max	2. Need idea of 'in same time interval' for this point 3. Reject 'milk' unqualified 4. Must refer to rate. Reject idea that reaction stops

12 (c)	1. Points should be joined / <u>curve</u> should be drawn / it should be a line graph; 2. (It is a) negative correlation/ description;	2	1. Allow description i.e. point to point or <u>curve</u> of best fit 2. E.g. DV/time taken falls/does not rise with increase in IV/trypsin concentration Reject 'it is not a positive correlation'
13 (a)	(Peptide bond) split/broken down by addition of water;	1	Need idea that water is added Reject breaking of named bonds other than peptide
13(b)	1. Trypsin/enzyme is a protein; 2. Trypsin/enzyme not affected by reaction/still present; 3. Will (also) react with biuret reagent;	2 max	
Total		**13**	

HBI3X: Written Test Section B

Question	Marking Guidance	Mark	Comments
14	1. <u>Active site</u> affected (in some way); 2. Changes shape of enzyme; 3. Protein/substrate can no longer fit / trypsin cannot form ES complex;	2 max	1. E.g. binds to/blocks/changes shape of active site (allows for competitive or non-competitive effect but terms not expected) 2. Accept other ways of expressing 'shape' e.g. tertiary structure 3. Allow other ways of expressing 'fit'
15	People without lung disease;	1	Absence of disease must relate to lungs
16 (a)	Highest and lowest values;	1	
16 (b)	Middle number/value (when all have numbers have been ranked);	1	
16 (c)	1. Spread of data; 2. About the mean;	2	1. Accept variation in data
17	1. There is a correlation/relationship/ association /equivalent (between AAT level and lung disease); 2. (Because) <u>mean</u> is higher; 3. (Because) bottom value of range is higher / top value of range is higher; 4. Than normal /compared with control/healthy group/people; 5. For <u>both</u> (lung) diseases;	3 max	1. Accept 'link' as minimum for idea Allow converse (for points 2 & 3) but must be clear whether the values discussed relate to control/healthy group or people with lung disease Allow use of values to show points 2 & 3

18	(Maybe valid because) 1. <u>Mean</u> and <u>median</u> (concentrations) are higher (than for healthy people); 2. For all three types of lung disease; (But) 3. Overlap of range/standard deviation for healthy and lung disease groups; 4. Based on small (overall) sample size; 5. Group sizes are not the same; 6. Make up of 'patient' groups not known; 7. May not be true for other lung diseases;	3 max	1. Need ref to both but allow use of figures to show this idea. Ignore ref to SD here 2. Idea that some affected have same/similar AAT concentration as a healthy person / ORA 6. E.g. potential differences in age/gender/length of suffering/other valid
19	1. Use a <u>pencil</u> line for the origin; 2. Concentrated spot (of mixture) (on origin line); 3. Use of micropipette/equivalent and dry between spotting; 4. Paper in solvent with origin line/spot above level of solvent; 5. Remove from solvent before solvent runs off end of paper; 6. Mark distance reached by solvent; 7. Use a locating agent/named example (to see amino acids); 8. Formula to calculate Rf values; 9. Compare Rf value to standards/identify from table of values;	4 max	2. Correct place should be stated or implied 7. Accept use of stain to show position
Total		**17**	