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Biology (8040/9040)

Biology (Human) (8042/9042)

Supplement to UA016171

January 2005

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Mark Schemes and
Examiners' Reports

Edexcel (International) GCE
Biology (8040/9040)
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Contents

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GENERAL INTRODUCTION

Mark schemes are prepared by the Principal Examiners and revised, together with the relevant questions, by a panel of senior examiners and subject teachers. The schemes are further amended at the Standardisation meetings attended by all examiners. The Standardisation meeting ensures as far as possible that the mark scheme covers the candidates' actual responses to questions and that every examiner understands and applies it in the same way.

The schemes in this document are the final mark schemes used by the examiners in this examination and include the amendments made at the meeting. They do not include any details of the discussions that took place in the meeting, nor do they include all of the possible alternative answers or equivalent statements that were considered to be worthy of credit.

It is emphasised that these mark schemes are working documents that apply to these papers in this examination. Every effort is made to ensure a consistent approach to marking from one examination to another but each marking point has to be judged in the context of the candidates' responses and in relation to the other questions in the paper. It should not be assumed that future mark schemes will adopt exactly the same marking points as this one.

Edexcel cannot under any circumstances discuss or comment informally on the marking of individual scripts. Any enquiries about the marks awarded to individual candidates can be dealt with only through the official Enquiry about Results procedure.

Unit 3 W1 (6103/02)

Question 1 **Maximum mark**

(a)

Concentration of pre-treatment chemical / µg cm^{-3}	Mass of discs / g			Percentage increase in mass	Percentage increase in mass *(if final mass used in error)*
	Original mass	Final mass	Difference in mass		
0.00	2.10	2.20	0.10	4.76 (4.8)	4.55
0.25	2.06	2.46	0.40	19.42 (19.4)	16.26
0.50	2.12	2.65	0.53	25.00 (25.0)	20.00
1.00	2.08	2.87	0.79	37.98 (38.0)	27.53
2.00	2.05	2.80	0.75	36.59 (36.6)	26.79
4.00	2.08	2.70	0.62	29.81 (29.8)	22.96

[Shaded column optional]

Neat table correctly formatted ;

Correct rows and columns (concentration, original mass, final mass and percentage change) with labels and units ;

Percentage increases correctly calculated ; ;
[one error = 1 mark, two errors = 0 marks]
[inconsistent decimal place = 1 error]
[mistake in rounding up = 1 error]
[use of final mass to calculate % increase in mass = 1 error]

4 marks

(b) **A**xes – correct orientation and labels ;

Scale – use of more than half the paper and correct scale ;

Plots – all points plotted correctly (use of figures from table) ;

Lines – well drawn through all points ;

4 marks

Question 1 continued **Maximum mark**

(c) Percentage increase in mass (for all concentrations of chemical) greater than in water ;

Steepest increase from 0 to 0.25 µg cm^{-3} / less steep increase from 0.25 to 1.00 µg cm^{-3} ;

Small decreases in percentage increase in mass at concentrations greater than 1.00 µg cm^{-3} / greatest percentage change is at 1.00 µg cm^{-3} / eq ;

Chemical increases water uptake at all concentrations ;

Effect of chemical {does not increase / decreases} above 1.00 µg cm^{-3} ;

Optimum effect of chemical is between 1-2 µg cm^{-3} ;

4 marks

(d) Discs not taken from same part of {tuber / plant} / taken from different {tubers / plants} ;

{not possible / difficult} to dry discs equally ;

Traces of chemical left {on / in} discs may affect subsequent results / eq ;

Chemical treatment might affect solute potential of discs /eq ;

One other named variable not controlled e.g. temperature, pH, surface area ;

2 marks

Total 14 marks

Question 2 **Maximum mark**

(a)

1. Reference to standardising potato / same potato {species / variety} ;
2. Reference to testing potato tissue immediately (after harvesting / eq) ;
3. Potato samples kept in controlled conditions - Any two from: light (or dark) / temperature / humidity / eq ;
4. Tested at suitable intervals for a minimum of 1 week ;
5. Same {volume / mass} of tissue used for each test ;
6. Cut from same part of tuber / eq ;
7. Suitable method of enzyme extraction e.g. blending and filtering ;
8. Starch removed from extract (using centrifuge / eq) ; [accept filtering]
9. Same volume of enzyme used for each test ;
10. Same volume <u>and</u> concentration of glucose used for each test ;
11. Use of iodine as starch indicator ;
12. Same volume of {iodine / Benedict's} used in each test ;
13. Colour change described e.g. (reddish brown) turns to black ;
14. End point standardised / use of standard / first appearance of black colour / test each minute / eq ;
    [accept testing for disappearance of glucose in similar fashion]
15. Test repeated for each time (minimum three times) ;

9 marks

(b) Suitable table with correct rows and columns with units to match suggested method ;

Mean time for change ;

Line graph / bar chart where simply tested before and after storage ;

Correct orientation of axes with labels and units ;

3 marks

Question 2 continued **Maximum mark**

(c) **Limitations**

Natural variations in enzyme content of potato tubers ;

End point difficult to measure accurately ;

Difficult to extract all enzyme from tissue ;

Difficult to remove all starch from extract ;

Other changes in potato may affect enzyme activity ;

Further work

Test glucose levels in potato tubers ;

Test different potato {species / varieties} ;

Test effect of different storage conditions ;

6 marks

Total 18 marks

Unit 5B (6105)

Question 1 **Maximum mark**

(a)
1. Pesticide killed most of the {pests / mites} ;
2. Only a few pests survived because they were resistant ;
3. Survivors reproduced ;
4. No predators in glasshouse so numbers increase quickly again ;
5. Pesticide {didn't persist / was broken down quickly / eq} ;
6. Reference to resurgence ;

3 marks

(b)
1. Combining the use of {pesticides / chemical control} and {biological methods / eq} ;
2. To encourage natural predators ;
3. Example of a method to encourage predators ;
4. Reference to {intercropping / companion plants / beetle banks /eq} ;

2 marks

(c)
1. Biological avoids having to apply chemical to food crop / eq ;
2. Biological does not (normally) have to be reapplied through season / self perpetuating / pests do not become resistant / no problem with resurgence ;
3. Biological does not require equipment to treat crops / reference to need to have spraying equipment ;
4. Repeated applications of chemical spray is expensive, biological has a one-off cost of buying the predator ;
5. Crops can be classed as organic when controlled biologically ;
6. Biological {targets specific pests / doesn't harm non-target species / eq} ;
7. No bioaccumulation ;

2 marks

Total 7 marks

Question 2 **Maximum mark**

(a) (Multiple alleles) more than two alleles for {same / single} {gene / locus} ;

(Polygenic inheritance) more than one gene for one characteristic ;

{Multiple alleles give discontinuous / polygenic associated with continuous} variation ;

2 marks

(b) (i) Possible genotypes:

I^AI^O AND I^AI^A

I^BI^O

I^AI^B

[All three correct = 2 marks, two correct = 1 mark]

2 marks

(ii) 1. Indicate that blood group O has to be genotype I^OI^O ;

2. Gametes shown for mother as I^A and I^B and for father as I^O (and I^O) ;

3. Potential genotypes of offspring shown as I^AI^O and I^BI^O ;

4. Statement to say that children can only be group A or group B ;

5. Reference to I^A and I^B dominant to I^O ;

[*Allow consequential error if answer in (b)(i) - W is I^AI^A or I^BI^B*]

3 marks

(c) {Genetic / DNA} fingerprinting ;

{ABO does not give definite answer for fatherhood / ABO can only eliminate fathers} / DNA fingerprinting gives positive evidence / DNA unique / eq ;

2 marks

Total 9 marks

Question 3 **Maximum mark**

(a) X {Ribulose bisphosphate / RuBP} ;

Y {Glycerate phosphate / GP / G3P / phosphoglycerate / phosphoglyceric acid / PGA / glycerate 3 phosphate} ;

2 marks

(b) Stroma ;

1 mark

(c) (i)

1. Both increase (as carbon dioxide concentration increases) ;
2. Up to 1000 ppm C4 update faster than C3 ;
3. Both reach same maximum rate (3.8 µmol m^{-2} s^{-1}) / eq ;
4. C4 maximum reached at lower CO_2 concentration / eq ;
5. C4 levels off at <600 ppm and C3 levels off at <1000 ppm / other example of comparative figures ;

3 marks

(ii)

1. At normal CO_2 concentrations, C4 plants {more efficient / eq} at CO_2 {uptake / fixation} / C4 plants have higher rate of CO_2 uptake ;
2. Rate of photosynthesis higher in higher light intensities ;
3. (Leads to) more oxygen produced / higher oxygen concentration ;
4. Reference to high oxygen concentration has no effect upon enzyme in C4 plants ;
5. (Therefore) {no inhibition / slowing down / eq} of photosynthesis as oxygen concentration increases ;
6. {Faster growth / higher yield} (than C3 plants) ;
7. Some C4 plants may open stomata at night ;
8. So no risk of dehydration ;

2 marks

Total 8 marks

Question 4 **Maximum mark**

(a) (i) 6 beats in 15 seconds ;
[A*llow slight variations as they may read off 6 beats in 14.5 seconds to give 25 beats (rounded up), or 4 beats in 10 seconds that gives 24 beats per minute. However do not allow 6 beats in 14 sec, which is wrong*]

= 24 beats per minute ; [only allow whole numbers]

2 marks

(ii) Acetylcholine decreases and adrenaline increases heart rate ;

Acetylcholine (decreases to) 8- 9 beats per minute ;

Adrenaline (increases to) 40 - 46 beats per minute ;

In both the changes are immediate / eq ;

In both effects wear off after approximately 20 - 25 seconds / beat returns to normal by 35- 40 seconds / eq ;

3 marks

(b) Increase blood glucose levels ;

By increasing the conversion of glycogen to glucose ;

Reference to {glycogenolysis / gluconeogenesis} ;

In the liver ;

2 marks

Question 4 continued **Maximum mark**

(c)

1. {Gaps between neurones / neuromuscular junction / eq} OR gaps too large for impulses to {cross / jump / eq} ;
2. Need a {chemical / transmitter} to cross synaptic cleft ;
3. Transmitter released by presynaptic membrane ;
4. Binds to receptors on postsynaptic membrane ;
5. Causes ion channels to open ;
6. Sets up {postsynaptic / action} potential (in correct context) ;
7. Some types of transmitters are {inhibitory / block synapses / eq} ;

(Other possible references to transmitters)

8. Constant stimulation causes fatigue as transmitter is exhausted ;
9. Use of medical drugs to interfere with chemical transmitters at synapses / credit suitable example, e.g. tranquillisers ;
10. Reference to {temporal / spatial} summation ;

5 marks

Total 12 marks

Question 5 **Maximum mark**

(a) Mutualism / mutualistic / symbiosis / symbiotic ;

Suitable example naming two organisms ;

2 marks

(b) (i) 1. As SO_2 decreases {number of species / diversity} of lichens increases (with increasing distance from centre) ;

2. (Number of species of) lichens {very low / does not increase} and SO_2 {remains high / does not decrease} up to 6 km ;

3. (Number of species of) lichens increases {steeply / eq} and SO_2 decreases {steeply / eq} between 6 and {10 / 11} km from centre ;

4. (Number of species of) lichens starts to {level off / eq} after 12 km ;

5. Comparative manipulated figures ;

3 marks

(ii) SO_2 produced by {domestic fires / industries / eq} ; [not cars / traffic]

More combustion of fossil fuels nearer city centres ;

2 marks

(c) 1. Name of appropriate organism within a named habitat ;

2. Reference to suitable technique for named habitat e.g. {use of quadrats / measured sampling areas} ;

3. Reference to type of sampling e.g. {random / systemic / stratified} ;

4. Detail of technique ;

5. Reference to large number of samples taken (if specific number given, at least 10) ;

6. Reference to suitable units for data obtained ;

4 marks

Total 11 marks

Question 6 **Maximum mark**

(a) (i) Circle includes phosphate / deoxyribose and a base ;
[ignore inclusion of incorrect phosphate]

1 mark

(ii) Loss of hydrogen bonding (between complementary base pairs) ;

Bonding between adjacent bases / covalent bond between bases ;

2 marks

(iii) {Base pairing / complementary pairing} not possible / eq (at point of damage) ;

(Because) hydrogen bonds cannot form ;

Incorrect bases may be {inserted / substituted} ;

(So) sequence of bases changed ;

DNA replication may fail / eq (for example second strand of DNA fails to form) ;

3 marks

(b) (i) 1. Both groups fall as UV-C dosage increases ;

2. Group A survival greater ;

3. Group B survival higher than group A at 100 a.u. ;

4. Group B survival lower at 200 a.u. ;

5. Group B all killed by dosages at {300 / >200} a.u., but group A not killed off completely until dosage reaches {700 / >600} a.u. ;

3 marks

(ii) Group A ;

Percentage survival rate is higher at higher dosages ;

So must be able to repair damage ;

2 marks

Total 11 marks

Question 7 **Maximum mark**

(a) (i) Variety A ;

Size of fruit (the same as C but) bigger than B ;

Rate of growth faster than B and C / eq ;

Breaking force higher than C ;

Alternative answer:

Variety C ;

Size of fruit (the same as A but) bigger than B ;

Even number of chromosomes / fertile plants ;

2 marks

(ii) Has an odd number of chromosomes / triploid ;

Chromosomes could not pair up ;

In meiosis ;

Gametes would have different number of chromosomes / different haploid number ;

2 marks

(b) Offspring produced by mitosis ;

Genetically identical ;

2 marks

Question 7 continued **Maximum mark**

(c)

1. Carry out field trials to find suitable resistant wild bananas ;
2. Remove gene for resistance from DNA of wild banana / eq ;
3. Using restriction enzyme ;
4. Open plasmid from {Agrobacterium (tumefaciens) / bacteria} using same restriction enzyme ;
5. Reference to sticky ends / eq ;
6. Insert gene into plasmid using DNA ligase ;
7. Plasmid put back into {Agrobacterium / bacteria} / reference to using DNA gun to get plasmid into plant cell / eq ;
8. Banana cells infected with genetically {modified / transformed} {Agrobacterium / bacteria} ;
9. {Bacterial DNA / new gene} becomes incorporated into banana DNA ;
10. Banana cells grow into new banana plants with new gene / eq ;

ALTERNATIVE ANSWER:

1. Carry out field trials to find suitable resistant wild bananas ;
2. Identify the protein that confers resistance from wild banana / eq ;
3. Obtain mRNA ;
4. Use reverse transcriptase to synthesise {single strand DNA / cDNA} from mRNA ;
5. DNA polymerase to produce double stranded DNA / eq ;
6. Use same restriction enzyme on new DNA and plasmid ;
7. Plasmid inserted into {Agrobacterium / bacterium} ;
8. Banana cells grow into new banana plants with new gene / eq ;
9. Bacterial {DNA / new gene} incorporated into banana DNA ;
10. Banana cells grow into new banana plants with new gene / eq ;

6 marks

Total 12 marks

Unit 6 W2 (6106/02)

Question 1 **Maximum mark**

(a)

Length of time trees covered by nets / days	Mass of apples produced from one tree / kg		Mean mass of apples / kg
	Field 1	Field 2	
70	4.65	4.85	4.74 (4.7)
60	4.75	4.81	4.78 (4.8)
50	4.78	4.20	4.49 (4.5)
40	5.46	5.20	5.33 (5.3)
30	5.86	6.06	5.96 (6.0)
20	6.04	6.82	6.43 (6.4)
10	6.32	6.34	6.33 (6.3)
0	6.64	6.56	6.60 (6.6)

Neat table correctly formatted ;

Correct rows and columns with units including raw data ;

All means correct ; ;
(one error = 1 mark, two errors = 0 marks)

4 marks

(b) Correctly orientated axes with appropriate scales and labels ;

Data plotted correctly ;

Scattergram / line of best fit ;

3 marks

(c) There is no correlation between the length of exposure of trees to birds and the {yield / eq} of apples ;

1 mark

Question 1 continued **Maximum mark**

(d) There is a significant correlation between the length of exposure of tree to birds and the {yield / eq} of apples / eq ;

Calculated coefficient is greater than the critical value / than 0.74 ;

At the {5% / 95%} level ; [accept in correct context]

Little effect on yield when netted for 50-70 days / greatest increase in yield between 20-50 days ;

3 marks

Total 11 marks

Question 2 **Maximum mark**

(a)
1. Seeds collected directly from flower / newly formed seeds collected ;
2. Seeds stored in dark ;
3. Stated number of seeds in each test (minimum 10) ;
4. {Suitable growing medium / filter paper} in each petri dish / eq ;
   [do not allow covered in soil]
5. Seeds equal distance apart ;
6. Method of exposure to light standardised e.g. same {wavelength / light source / distance from light source} ;
   [accept methods with and without treatment or different periods of treatment]
7. Control with no light treatment ;
8. Left to germinate in the dark ;
9. Method of temperature control described ;
10. Any one other condition for germination controlled ;
11. Number germinating checked at regular intervals ;
12. Attempt to define exact point of germination for counting ;
13. Repeated at least twice more ;

8 marks

Style

Account is concise and well-organised, there is good use of technical vocabulary and almost no spelling errors – 2 marks

There is some lack of organisation, limited vocabulary and a number of spelling errors - 1 mark

The account lacks organisation, there is little or no technical vocabulary and many spelling errors - 0 marks

2 marks

Question 2 continued **Maximum mark**

(b) Table of raw and manipulated data with suitably labelled rows and columns ;

Calculation of means / % germination ; [accept from table]

Suitable graphical format matched to data / bar chart for with and without light / line graph for different periods of treatment ;

Graphical presentation has correctly labelled axes and allows for comparison ;

Named suitable statistical test matched to data table / correlation test for different periods of treatment / {Mann Whitney U / t test / z test} for with and without light ; [accept from plan]

Use of the {5% / 95%} level ; [accept in correct context]

6 marks

(c) **Limitations**

Difficult to control exposure to light following seed production on flower ;

Difficult to control exact age of seed when collected ;

Difficult to judge exact time of germination ;

Some light needed to examine seeds for germination ;

Further work

Investigate effects of different {wavelengths / intensity} of light ;

Investigate effect of different species of seed ;

Investigate effect of light on seeds of different ages ;

5 marks

Total 21 marks

Unit 6 Synoptic paper (6106/03)

Question 1 **Maximum mark**

(a) Second / {primary / 1°} consumers / herbivores / 2 ;

1 mark

(b) (i) Overall increase ;

Credit a manipulated quantitative comment ;

2 marks

(ii) {Reference to loss of open areas / shaded plants die out / eq} / less light penetration ;

Growth of shrubby vegetation ;

Further growth of trees / increase in biomass ;

Change in {species diversity / biodiversity} / reference to climax community ;

Reference to succession ;

3 marks

(iii) Winter survival ;

Plants growing more ;

(So) more food for butterflies ;

Increased survival further north ;

As fewer eggs (or caterpillars) die (as temperature drops less) ;

2 marks

Total 8 marks

Question 2 **Maximum mark**

(a) 1, 4 bonds give (straight) chains of glucose (residues) ;

1, 6 bonds give rise to formation of branches / eq ;

2 marks

(b)
1. {Forms / can be packed} into compact structures / eq ;
2. So large quantities can be stored in cells ;
3. Too large to pass out of cells ;
4. Branched structure means many molecules can be {added / removed} ;
5. So speeding up {synthesis / breakdown} when required ;
6. Glycogen {less reactive / more stable} than glucose ;
7. As –OH group involved in bonding ;
8. Glucose (small and) soluble / glycogen (large and) insoluble ;
9. Correct reference to osmotic effect of {glucose / glycogen} ;

4 marks

(c)
1. {Low / fall in} blood glucose levels / hypoglycaemia ;
2. After {fasting / exercise} ;
3. Fall detected by {pancreas / α cells / islets (of Langerhans)} ;
4. Results in secretion of glucagon ;
5. Activates {enzymes / glycogen phosphorylase} ;

3 marks

Question 2 continued **Maximum mark**

(d)

1. Change to a {base / nucleotide / codon / base sequence) ;
2. Reference to {substitution / deletion / insertion} / eq ;
3. Reference to change in {amino acid / primary structure} ;
4. Reference to change in {shape / tertiary structure} of {enzyme / polypeptide / protein} ;
5. Reference to formation of enzyme-substrate complex ;
6. Reference to change in enzyme action ;

4 marks

(e)

Glycogen {accumulates / not completely broken down / not converted to glucose} ;

Possibility of (very) low blood glucose levels / lack of respiratory substrate ;

After {fasting / exercise} ;

2 marks

Total 15 marks

ESSAY MARK SCHEME

Outline Scheme for Marking Essay Questions 3, 4B and 5H

Total maximum mark available: 15
13 available for Scientific content
2 available for Balance
2 available for Coherence

Scientific content

Good scientific content (11 - 13)

13 Excellent
11 Good

Essays in this category demonstrate a sound understanding of the topic, contain a significant amount of material relevant to two or more units of the specification, and suitable examples where appropriate. Information from different parts of the specification is clearly and coherently linked in the candidate's discussions.

Moderate scientific content (5 - 9)

9 Above average
7 Average
5 Below average

Essays in this category contain factually correct and relevant material. There is some evidence that the candidate has linked information from different areas of the specification. Some areas should show a progression from AS level, particularly if a mark of 7, or higher, is awarded.

Poor scientific content (0-3)

3 Some correct facts
1 Very few correct facts
0 No correct information

Essays in this category contain some relevant facts, but the material that has been included has little depth and barely reaches the standard expected at AS level. Few appropriate examples are included.

S = 13 marks

Balance

2 Most of the main topic areas outlined are covered.
Some discussion of each of the areas chosen, illustrated with suitable examples where appropriate.
Material included is all relevant to the topic and the candidate has linked information from more than one area of the specification.
Few, if any, errors.

1 Some of the main topic areas outlined are covered.
Some discussion of each of the areas chosen.
Some irrelevant material included.
There are some examples which link together different areas of the specification.
Some errors

0 Very limited account, possibly only one aspect chosen
Material mostly irrelevant
No examples of the candidate linking information from different topics
Large number of errors

B = 2 marks

Coherence

2 Material logically presented, with little or no repetition
Essay has coherence, ideas are developed well; continuous prose used throughout
Essay has an introduction and a conclusion, summing up the main points
Technical terms have been used correctly
Spelling, punctuation and grammar are sound

1 Material is presented in an orderly way and some ideas developed
Continuous prose used throughout
The introduction and conclusion may be present, but brief
Technical terms are used and generally in the correct context
Spelling, punctuation and grammar are generally sound

0 Essay style not used
Material in note form or numbered points
Very poor standard of spelling, punctuation and grammar

C = 2 marks

Total max 15 marks

Question 3 **Maximum mark**

Introduction could include outline properties of lipids as fats, oils and waxes –

Structure of a triglyceride –

Saturated and unsaturated fatty acids –

Phospholipids –

Waxes –

Steroids –

Roles of lipids as:

- Energy stores –
- Protection –
- Waterproofing –
- Insulation (including role of the myelin sheath) –
- Buoyancy –
- Steroid hormones –

Scientific content 13 marks
Balance 2 marks
Coherence 2 marks

Total 15 marks

[Note: the *structure* of lipids is U1, but *roles* of lipids occur in units 2B, 2H and 4]

Question 4B **Maximum mark**

Introduction could include reference to autotrophic nutrition and an outline of photosynthesis –

Fixation of carbon dioxide –

Production of PGA –

Use of NADPH + H^+ and ATP (from light-dependent reaction) –

Synthesis of carbohydrate from PGA –

Reference to mineral nutrition and synthesis of, for example, amino acids –

Reference to protein synthesis -

Translocation of organic solutes –

Structure of phloem tissue –

Structure and arrangement of sieve tube elements –

Companion cells –

Transfer cells –

Mass flow –

Scientific content 13 marks
Balance 2 marks
Coherence 2 marks

Total 15 marks

Question 5H **Maximum mark**

Introduction could include the concept of homeostasis, concept and roles of feedback mechanisms –

Specific examples of negative feedback –

Control of water and solute content of the body –

Role of ADH –

Regulation of blood glucose –

Reproductive hormones –

Regulation of body temperature –

Normal body temperature and diurnal variation –

Structural, physiological, behavioural mechanisms of temperature regulation –

Structure and roles of the skin –

Roles of thermoreceptors and hypothalamus –

Scientific content 13 marks
Balance 2 marks
Coherence 2 marks

Total 15 marks

6103/02 Unit 3 Written Alternative (W1) Examiner Report

Maximum mark 32

Mean mark 13.2

Standard deviation 4.8

General Comments

Whilst there was a wide range of marks, some candidates were clearly unfamiliar with the requirements of a good, well-controlled investigation. There was a tendency for many candidates to rely on previous mark schemes, especially in question 2, rather than to think carefully about the specific hypothesis to be tested. Invariably, the greater the reliance on rote learning, the lower the marks which could be awarded. Credit could not be given where points were inappropriate in the context of this particular question.

It would be helpful for many candidates to have wider experience of planning a range of investigations using standard techniques in more original ways.

Question 1

A large number of candidates calculated percentages correctly but a significant number of candidates were unable to maintain a consistent approach to significant figures in their answers.

Many candidates could easily have gained maximum marks for their graphs but were let down either by careless plotting, which made inaccurate use of the smallest squares, or by failing to ensure that the straight lines they drew passed accurately through the plotted points.

It is expected that, above all, candidates will apply objective analysis to the <u>actual data</u> in this section. Many gained credit for recognising the position of the greatest percentage increase or the small decrease that followed. Few picked out the greatest rate of increase initially.

A majority of candidates then proceeded to give accounts of osmosis with wide assumptions which could not be deduced from the data. A more objective consideration of the observed effect of the chemical itself was expected.

Many candidates gained both marks for recognising a lack of control of variables and problems with blotting.

Question 2

Many plans illustrated the points made in the General Comments very well. It was common for candidates to place great emphasis on glucose testing with little thought of the relevance of their methods to the actual enzyme described or the practicality of their application of standard techniques.

Even where emphasis was placed on testing for the appearance of starch very few clearly extracted the enzyme to test or considered removing starch from their preparations.

A wide range of quantitative measurements was accepted. The use of a colorimeter was described accurately by many candidates but less credit could be given where this was applied to blended potato or even whole discs.

Many candidates gained some credit for describing basic techniques but then did not progress towards maximum marks because of a lack of thoughtful details in their methods.

This was generally a high scoring section but even here there were attempts to apply a pre-conceived approach. For example there were several attempts to tabulate means which were clearly inappropriate to the data or tables that did not always match the methods described.

Objective evaluation is always a difficult skill for many candidates. Once again a substantial number of candidates were drawn to admissions of weak practical ability or corrections of major errors of planning. Many suggested carrying out tests on all standard variations of enzyme experiments rather than focusing on investigations which would provide further evidence in support of the original hypothesis.

Summary

To improve their marks many candidates could:

- Pay greater attention to accuracy in tabulating data and plotting graphs
- Confine conclusions to those that can clearly be inferred from the data presented.
- Apply their knowledge more carefully to the hypothesis in the question rather than using pre-conceived ideas or standard answers.
- Consider why, no matter how carefully the investigation may be carried out, there may still be variations in repeat collections of data.
- Confine suggestions for further work to the original hypothesis rather than launching totally new investigations.

6105 Unit 5B Examiner Report

Maximum mark 60

Mean mark 34.5

Standard deviation 10.5

General comments

There was a wide range of marks seen on this paper. It was pleasing to note that there was a marked improvement in the standard of writing and grammar compared with Summer 2004.

Question 1

This question was well answered. In part (a), a number of candidates appreciated that some of the mites may have been resistant. Part (b) was less well answered and the majority of candidates could only explain that it involved the use of pesticides and biological control. Only a few give suitable examples. Part (c) was well answered.

Question 2

Overall, this question was answered to a high standard and many candidates gained full or close to full marks. The only part of the question that caused problems for some candidates was part (a).

Question 3

The majority of candidates gained at least 2 marks for parts (a) and (b). However the graph was poorly described. Many candidates did not appreciate that the graph was showing an increase in the rate of carbon dioxide uptake. A surprising number of candidates gave 400 ppm as the concentration at which the rate of carbon dioxide uptake for C4 plants levelled off, rather than 600 ppm. Part (c)(ii) was poorly answered.

Question 4

The responses to this question were quite varied. Part (a)(ii) was very straightforward but it caused problems for candidates, with some candidates resorting to incredibly complex calculations. In part (a)(ii), most candidates appreciated that acetylcholine decreased the rate and adrenalin increased it. Few worked out the new heart rate. Part (b) was answered well by some. However many believed that adrenalin reduced blood glucose levels and others confused adrenalin with insulin. A number suggested incorrectly that adrenalin caused the breakdown of glycogen to glucose directly. Part (c) was generally well answered, although most candidates simply gave a detailed description of the processes that occurred in the synapse rather than considering the role of a neurotransmitter.

Question 5

The majority of candidates gained full marks for part (a). A few confused Rhizobium with Rhizopus and others did not get the second mark as they did not specify the type of plant that was associated with Rhizobium. Part (b)(i) required candidates to compare the number of species of lichen with the sulphur dioxide concentration. Many candidates simply wrote several sentences describing the changes in the lichen numbers and then wrote a sentence about the sulphur dioxide and did not make direct comparisons. In part (c), most candidates did not specify a named organism and a named habitat. The descriptions were varied but many candidates mentioned the use of a quadrat and random sampling. A surprising number of candidates described how they would determine the population of a species using the Lincoln Index. Obviously some of the weaker candidates were not familiar with the difference between distribution and abundance.

Question 6

This question had some variable responses. Most candidates were able to ring a nucleotide on the diagram. In part (a)(ii), most mentioned the loss of the hydrogen bond between the base pairs and the formation of new covalent bonds. The responses to part (a)(iii) were generally not mark yielding and it appeared that candidates had not thought through their answers. Some described the formation of mRNA and protein synthesis rather than the process of DNA replication. In part (b)(i), most candidates appreciated that group A could survive higher doses of UV-C. Weaker candidates confused the increasing doses with increasing time.

Question 7

Parts (a) and (b) were reasonably well answered with most candidates picking up some, if not all the marks. Part (c) proved challenging for the weaker candidates. The more able candidates mentioned key enzymes such as restriction enzyme and DNA ligase, the role of the plasmid and the process of using a bacterium to get the new DNA into a banana plant. However, weaker candidates tended to overlook the role of the bacterium in the sequence. They obtained a plasmid from a bacterium, added a new gene and then inserted the plasmid directly into a banana cell rather than placing it back in a bacterial cell first.

6106/02 Unit 6 Written Alternative (W2) Examiner Report

Maximum mark 32

Mean mark ....

Standard deviation ....

General Comments

Many candidates scored well on basic tasks. They showed commendable accuracy in tabulation and graph plotting. However, a majority were less adept at applying higher level skills to explaining statistical data and planning investigations at the level expected of A2 students.
A major factor was the tendency to apply points from previous mark schemes rather than display independent thought and a rigorous approach to controlling variables.

Question 1

In part (a) most candidates tabulated the data accurately and scored high marks.

Axes and plotting were often well executed in part (b), but there was much wider variation in selecting a scattergraph or correlation line.

In part (c), as in part (d), candidates were expected to use the term correlation which was clearly indicated in the rubric.

In part (d) most candidates recognised that the calculated value exceeded the critical value, but clear explanations of confidence limits were rare. A simple repetition of p=0.05 given in the rubric was insufficient to provide convincing evidence that candidates understood this concept.

Question 2

Many plans in part (a) were not well done. The straightforward nature of the hypothesis led many candidates to suggest naïve and poorly structured investigations. Control of variables was often vague and accurate suggestions of how germination might be recorded were rare. A significant minority of candidates tried to apply previous mark schemes rather than planning for the actual hypothesis to be tested.

Loose terms such as 'amounts' and 'about' remain common but are never given credit at this level as they imply an inappropriate level of rigour.
Whilst many candidates scored well in part (b), the standard was slightly lower than in previous papers. This was often due both to poorly constructed tables which did not always take account of raw data recording and to a lack of suitable suggestions for statistical analysis.

Suggestions for both limitations and further work in part (c), were often very weak. Limitations rarely addressed the important area of actual techniques employed. It is assumed that these techniques are used competently and it is the inherent variability that these may create which needs to be understood and discussed. Correcting obvious omissions or errors in planning cannot gain credit in this section.

Examiners have often commented that further work must provide additional evidence for the hypothesis tested and not suggestions for completely new investigations. Yet the majority of candidates relied entirely on a list of basic suggestions they have learned from previous examples rather than applying their own evaluating skills. These weaknesses often led to low marks in this section.

Summary
To improve their marks many candidates could:

- Use the information in the question to select the appropriate graphical format.
- Use more accurate terminology to describe confidence limits and null hypotheses.
- Focus more carefully on planning a suitable investigation for the hypothesis suggested, using scientific judgement rather than seeking to apply a set of memorised points.
- Eliminate all suggestions of poor technique or equipment failure from discussions of limitations.
- Confine suggestions for further work to those which would provide additional evidence or support for the hypothesis under investigation.

6106/03 Unit 6 Synoptic Paper Examiner Report

Maximum mark 38

Mean mark ....

Standard deviation ....

General comments

There was a wide range of responses to this Paper, from some rather poor attempts to those from candidates with a good ability to apply their knowledge and understanding, and to synthesise facts, principles and concepts from different areas of the specification. In general, Question 1 parts (a) and (b)(ii), and Question 2 parts (b) and (d) were answered well; answers to other questions were more variable.

The quality of the essays was as variable as usual. Relatively few gave balanced accounts, and included information from at least two units of the specification. For high marks, it is expected that essays include a significant amount of material relevant to two or more units, illustrated with suitable examples. One general failing of candidates attempting this Paper was their ability to recall accurate information from AS units. This was particularly apparent in Question 3, where correct structures of glycerol and fatty acids were seen very rarely.

Question 1

Almost all candidates answered part (a) correctly, by stating either ‘primary consumers’ or ‘herbivores’.

Answers to part (b)(i) were more variable. Many candidates gave a step-by-step description of the data, rather than identifying the general trend. Although some candidates correctly included a manipulated quantitative comment, many did not.

There were some good descriptions of succession in abandoned woodland in part (b)(ii), as many candidates appreciated that the trees that had previously been coppiced would continue to grow, with consequent effects on the woodland community. Some candidates stated that the changes in the woodland lead to a decrease in the numbers of speckled wood butterflies and, consequently, contradicted their answers to part (b)(i).

Relatively few candidates answered part (b)(iii) correctly; many candidates suggested that because the butterflies preferred cold conditions, they would migrate to the north where the conditions were more suitable for them. There were also some inappropriate references to geographical isolation and speciation. However, it was pleasing to note that some candidates were able to describe the possible changes in vegetation, in response to climate change, as a reason for the change in abundance of the butterflies.

Question 2

In part (a) there were some good explanations of the α-1,4 and α-1,6 bonds in relation to the structure of glycogen, although a number of answers did not clearly distinguish between each type of bond.

Part (b) was generally answered successfully, with some good comparisons between glucose and glycogen. Many candidates referred to the compact structure of glycogen, its insolubility and consequent lack of osmotic effects. Marks points 4, 5 and 7 were seen less frequently.

In part (c), there were some good, reasoned descriptions of the circumstances under which the conversion of glycogen to glucose occurs. However, there were also some rather muddled accounts of the regulation of blood glucose in general, including references to the role of insulin.

There were some good, detailed explanations in part (d), in which candidates clearly appreciated the possible effects of a point mutation on enzyme structure. However, there were also some inaccurate answers with confusion between amino acids and bases, polypeptides and polynucleotides.

Answers to part (e) were more variable. Whilst many candidates suggested correctly that glycogen would not be completely broken down to glucose, which could result in a low blood glucose concentration, some answers digressed into irrelevant descriptions of diabetes.

Question 3

This essay was slightly more popular than 4B. The majority of candidates included triglycerides and phospholipids in their answers, but fewer candidates also referred to other lipids, such as waxes and steroids. It was rare to see references to the general nature of lipids, in terms of their solubility, and many essays did not include an accurate indication of the structure of a triglyceride. Some of the essays were rather general accounts, referring consistently to lipids, but without stating which type. Many candidates were aware of the roles of triglycerides in thermal insulation, buoyancy and as energy stores, but it was rare to see any attempt to relate the structure and properties of triglycerides to their functions. One frequent error was in referring to the *hydrolysis* of triglycerides yielding metabolic water, or energy.

The majority of attempts at this essay focused on Unit 1 only and did not, therefore, include much truly synoptic content.

Question 4B

There were some detailed, accurate and balanced accounts of both the synthesis and transport of organic solutes in flowering plants. Some essays, however, were unbalanced descriptions of photosynthesis, often with considerable detail of the light-dependent reactions, with only an outline of transport, almost as an afterthought. Consequently, the emphasis of many of these essays was on Unit 5B, with few details of phloem and translocation from Unit 2B. Very few essays included a reference to organic solutes other than sucrose.

Question 5H

There were very few attempts at this essay and none included more than a superficial account of homeostasis and the regulation of body temperature. There was little or no attempt to integrate knowledge and understanding from Units 2H and 4 and the general standard of these essays was, consequently, lower than that of Questions 3 and 4B.

UNIT GRADE BOUNDARIES AND UNIFORM MARKS

The raw mark obtained in each module is converted into a standardised mark on a uniform mark scale, and the uniform marks are then aggregated into a total for the subject. Details of the method of aggregation are given in Appendix A.

For AS examinations, the three unit tests each have a weighting of 33.3% with a maximum of 100 uniform marks.

For the A level, the six unit tests each have a weighting of 16.7% with a maximum of 100 uniform marks.

The table below shows the boundaries at which raw marks were converted into uniform marks in this examination. The A and E grade boundaries are determined by inspection of the quality of the candidates' work. The other grade boundaries are determined by dividing the range of marks between A and E. Marks within each grade are scaled appropriately within the equivalent range of uniform marks.

In Unit 3, the A and E boundaries are determined separately on the two components T1 and Paper 03 (or W1 and Paper 03 for International). These marks are then added together to find the A and E boundaries for Unit 3 as a whole, and the other grade boundaries for the Unit are then found as described above. Boundaries for the B, C and D grades for each component can be calculated in the same way, but please note that these are **not** simply added together to obtain the B, C and D boundaries for the unit as a whole.

Unit grade boundaries

Unit		Maximum mark	Grade				
			A	B	C	D	E
		Uniform marks 100	80	70	60	50	40
		Raw marks					
6103 Unit 3		70	43	38	33	29	25
	Paper 02 W1	*32*	*19*	*16*	*14*	*12*	*10*
	Paper 03	*38*	*24*	*21*	*19*	*17*	*15*
6105 Unit 5B		70	47	42	37	33	29
6106 Unit 6		70	51	45	39	34	29
	Paper 01 T2	*32*	*24*	*21*	*18*	*15*	*12*
	Paper 03	*38*	*27*	*24*	*21*	*19*	*17*
6106 Unit 6		70	48	42	37	32	27
	Paper 02 W2	*32*	*21*	*18*	*15*	*12*	*10*
	Paper 03	*38*	*27*	*24*	*21*	*19*	*17*

PROVISIONAL STATISTICS

The provisional percentages of candidates obtaining at least the indicated grade are given below.

Unit	Number sat	Cumulative percentage of candidates				
		A	B	C	D	E
6103 Unit 3 (W1+03)	999	13.7	27.0	43.3	59.7	72.1
6105 Unit 5B	329	14.6	28.9	44.1	59.3	73.6
6106 Unit 6 (T2+03)	20	0.0	45.0	70.0	85.0	95.0
6106 Unit 6 (W2+03)	249	4.4	17.3	33.3	52.2	67.9

APPENDIX A
The Uniform Mark System for AS and A level Unit Schemes

The result for each unit will be issued as a standardised mark on a uniform mark scale. AS subjects have a total of 300 uniform marks and A level subjects have a total of 600 uniform marks.

Tables 1 and 2 show the numbers of uniform marks required to gain each subject grade in AS and A level examinations. They also indicate the number of uniform marks in units with various weightings that will aggregate into the appropriate subject grade. These provide a guide to the level of performance in each unit.

The uniform marks shown for each unit do not necessarily represent the actual mark range used for marking the module. Grade boundaries for modules are set at Awarding meetings on the basis of candidate performance on the actual mark range used. These boundaries are then converted to the uniform marks shown in the tables, with intermediate values calculated accordingly.

Table 1 – Advanced Subsidiary Subjects

Subject		Unit Weighting					
Grade	**UM**	**20%**	**30%**	**$33\frac{1}{3}$%**	**40%**	**50%**	**60%**
Max mark	**300**	60	90	**100**	120	150	180
A	**240**	48	72	**80**	96	120	144
B	**210**	42	63	**70**	84	105	126
C	**180**	36	54	**60**	72	90	108
D	**150**	30	45	**50**	60	75	90
E	**120**	24	36	**40**	48	60	72

For example, a candidate for AS Biology or Biology (Human) must take three modules, all weighted at 33.3% of the subject.

	Uniform mark obtained	**Approximate level of performance**
Unit 1	65	C
Unit 2	73	B
Unit 3	80	A
Subject Total	**218**	**Subject Grade = B**

Table 2 – Advanced Level Subjects

Subject		Unit Weighting				
Grade	**UM**	**15%**	**$16\frac{2}{3}$%**	**20%**	**25%**	**30%**
Max mark	**600**	90	**100**	120	150	180
A	**480**	72	**80**	96	120	144
B	**420**	63	**70**	84	105	126
C	**360**	54	**60**	72	90	108
D	**300**	45	**50**	60	75	90
E	**240**	36	**40**	48	60	72

For example, a candidate for A level Biology or Biology (Human) must take six units, all weighted at 16.7%. The candidate in this example has four units in the bank.

	Uniform Mark Obtained	**Approximate level of performance**
Unit1	59	D
Unit 2	53	D
Unit 3	69	C
Unit 4	82	A
Unit 5	*	
Unit 6	*	
	Partial Total in Bank = 263	

The candidate already has 263 uniform marks in the bank. If a Grade C is required in the subject, the candidate must obtain at least 97 marks from the remaining two units (e.g. 45 +52) in order to gain the minimum uniform mark of 360 for a Grade C (263 + 97 = 360).

A subject grade of B would require at least 157 extra uniform marks (e.g. 80+77) and would require a performance somewhat better than the average achieved so far.

There is no rule requiring candidates to take units amounting to 30% of the examination at the time of cashing in, nor do candidates have to take all papers with synoptic assessment at the same time at their first cash in.

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