



MARKSCHEME

May 2002

BIOLOGY

Standard Level

Paper 2

Subject Details: **Biology SL Paper 2 Markscheme**

Mark Allocation

Candidates are required to answer **ALL** questions in Section A [total 20 marks] **and ONE** question in Section B [20 marks]. Maximum total = [40 marks].

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- ◆ Each marking point has a separate line and the end is signified by means of a semicolon (;).
- ◆ An alternative answer or wording is indicated in the markscheme by a ‘/’; either wording can be accepted.
- ◆ Words in (...) in the markscheme are not necessary to gain the mark.
- ◆ The order of points does not have to be as written (unless stated otherwise).
- ◆ If the candidate’s answer has the same ‘meaning’ or can be clearly interpreted as being the same as that in the mark scheme then award the mark.
- ◆ Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have not achieved or what they have got wrong.
- ◆ Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- ◆ Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalised. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with ‘**ECF**’, error carried forward.
- ◆ Units should always be given where appropriate. Omission of units should only be penalised once. Indicate this by ‘**U-1**’ at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- ◆ Do not penalise candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

Section B

Extended response questions - quality of construction

- ♦ Extended response questions for SL P2 carry a mark total of 20. Of these marks, 18 are awarded for content and 2 for the quality of construction of the answer.
- ♦ Two aspects are considered:
 - expression of relevant ideas with clarity
 - structure of the answers.
- ♦ **ONE** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **TWO** quality marks are awarded when a candidate satisfies **BOTH** criteria.

Clarity of expression:

The candidate has made a serious and full attempt to answer all parts of the question and the answers are expressed clearly enough to be understood with little or no re-reading.

Structure of answer:

The candidate has linked relevant ideas to form a logical sequence in at least two parts [(a), (b), etc.] of the question.

- ♦ It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.
- ♦ Candidates that score very highly on the content marks need not necessarily automatically gain the two points for the quality of construction (and vice versa).
- ♦ The important point is to be consistent in the awarding of the quality points. For **sample scripts for moderation** the reason why quality marks have been awarded should be stated.
- ♦ Indicate the award of quality marks by writing **Q2**, **Q1** or **Q0** in **red** at the end of the answer.

SECTION A

1. (a) *(Both answers are required for [1])*
cooled: sour;
warmed: sweet; **[1]**
- (b) warming causes a greater sensation of sweetness than cooling;
on warming the sensation of sweetness increases (but) on cooling the sensation decreases;
on cooling sweetness becomes undetectable (but) on warming it becomes more detectable;
sensation of sweetness on warming is always “weak” but cooling it is always “just detectable”;
neither cooling nor warming causes moderate taste intensity; **[2 max]**
(Accept other suitable paired answers based on the data in the graph.)
- (c) *(Two correct answers are required for [1])*
age / gender / ethnic origin / health / sensitivity to taste / smoker (or non-smoker) /
genetic (taster/non-taster) / drugs (use) / pregnancy; **[1]**
(not size / weight)
- (d) cooling;
because two tastes (sour and salty) detectable (weakly) compared with only one (sweet) when warmed;
responses to cooling show the greatest changes; **[2]**
- (e) *similarities [2 max]*
both (A and B) result in sweetness being detected;
both (A and B) result in sourness being detected;
both give a greater sensation of sweetness than sourness;
- differences [2 max]*
A (chemoreceptors) give a greater sensation of sweetness than B;
B (chemoreceptors) give a greater sensation of sourness than A;
the difference between sweet and sour taste intensity for A is greater than the
difference between sweet and sour for B; **[4 max]**

2. (a) name of molecule;
function of molecule; [2 max]

Fe examples: haemoglobin;
transports oxygen (in the blood);
myoglobin;
store of oxygen in muscle;
cytochromes / ferredoxin;
electron carrier;
(do not accept avoids anaemia)

- (b) name of molecule;
function of molecule; [2 max]

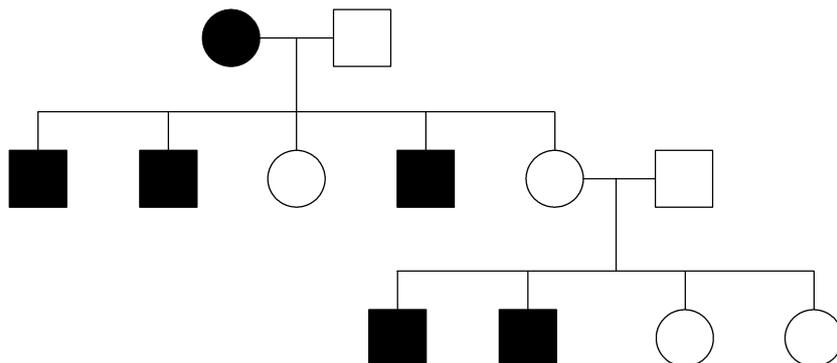
P examples: ATP / ADP;
energy storage and release;
DNA / RNA / nucleotides;
genetic (hereditary) material;
phospholipid
structural component of membrane

3. (a) gene / allele / trait on a sex (-determining, X or Y) chromosome [1]

- (b) *examples include:*
Fabry's disease / Hunter's syndrome / Lesch-Nyhan syndrome / haemophilia / forms of colour blindness / Menkes' steely-hair syndrome / ALD (adrenoleukodystrophy) / Renpenning's syndrome / Duchenne muscular dystrophy / G-6-P dehydrogenase / testicular determining factor (TDF on Y-chromosome) / calico-tortoiseshell cat fur colour / white eye Drosophila; [1 max]

- (c) affected woman and unaffected man in first generation drawn correctly;
all sons in the 2nd generation affected;
all daughters 2nd generation unaffected;
at least one son (but no daughter in 3rd generation unless father was affected) of a carrier daughter (in 2nd generation) must be affected;
drawing of pedigree chart (2 generations) with correct symbols and connecting lines; [4 max]

example:



SECTION B

4. (a) **[1 max]** per scientist

- Hooke: developed the term “cell” (after investigating cork under microscope);
- Van Leeuwenhoek: observed unicellular organisms / nucleus / discovers bacteria;
(Do not accept contributions to microscope development.)
- Schleiden: concluded all plants are made of cells / (discovered importance of nucleus to cell division);
- Schwann: concluded that all animals are made of cells;
- Schwann & Schleiden: proposed the cell theory and concluded that all plants and animals are made of cells (that within an organism these cells are identical);
- Virchow: showed that all cells come from existing cells; **[5 max]**

(b) *(Annotated diagram illustrating the process may be used to gain some or all the marks.)*

- the mechanism whereby cells take in solids and / or solutions;
involves the formation of vesicles;
infolding of cell membrane;
called phagocytosis when solids / organisms are engulfed;
phagocytosis is called feeding in some unicellular organisms;
called pinocytosis when solutions are taken in (vesicles are much smaller);
may be receptor-mediated (*e.g.* HIV);
requires energy / active process; **[5 max]**

(c) labelled diagram of generalised prokaryotic (P) and generalised eukaryotic (E) animal cell **[2 max]**
(Marks must be awarded if the following comparisons are made as either annotations to the diagram or in narrative/table form.)

- P is usually smaller in size, E is larger;
both have cytoplasm / protoplasm;
P has no nucleus / nucleoid region, E has (membrane-bound) nucleus;
P has one chromosome / circular, E has two or more chromosomes;
P has DNA only, E has DNA with protein (histones);
P has no membrane-bound organelles, E has some membrane-bound organelles;
E has mitochondria, P does not;
E has other example of organelle, P does not;
both can have a flagellum / flagella;
if flagella then E has 9+2 fibrils, P does not;
P can have pili / slime layer / capsule, E does not;
P can have plasmids, E does not;
both have ribosomes;
P has small ribosomes, E has larger ones;
both have cell membrane;
P has cell wall, E has no cell wall;
E has centriole, P has no centriole; **[8 max]**

(Plus up to [2] for quality)

5. (a) (*Award [1] for each of the following structures clearly drawn **and** labelled correctly.*)
lymph vessel;
arteriole;
venule;
(central) lacteal;
capillary network;
epithelial layer / lining / epithelium;
microvilli;
goblet cells; **[5 max]**
- (b) name of health problem (*e.g.* coronary heart disease, sickle-cell anaemia, varicose veins, phlebitis, elephantiasis, arrhythmia, haemophilia, high blood pressure);
(*exemplified by coronary heart disease*)
detail of who is likely to suffer from the problem (obese, heavy smokers, low / non exercisers, *etc.*);
detail of symptoms of problem (pain in chest / arm, *etc.*);
another detail of the symptoms (lack of breath, *etc.*);
detail of the cause of the problem (blockage in coronary arteries);
detail of any risk factors (genetic factor, smoker, obesity, no exercise, fatty diet, *etc.*);
detail of treatment of the problem (surgery, use of vein in leg in place of artery, drugs, *etc.*);
other relevant detail (*e.g.* costs high, prevention, success rate depends on how severe and when detected, dependent on suitable tissue-typed donor); **[5 max]**
- (c) (**[3 max]** for information on arteries)
thick wall / elastic fibres to help withstand the high(er) pressure;
outer fibrous coat prevents artery from rupturing under the high pressures;
lumen small compared to wall thickness to maintain high pressure;
except lumen large near the heart to conduct a large volume of blood;
valves in aorta and pulmonary artery to prevent back flow into ventricles in diastole;
layers of (smooth) muscle to allow arteries to contract / elastic recoil;
allows the pressure to be altered (vasoconstriction and vasodilation);

(**[3 max]** for information on veins)
lumen always large in relation to diameter;
thin wall / more collagen and fewer elastic fibres (than arteries) since pressure low(er);
very little muscle since not needed for constriction;
valves to prevent back flow between pulses;

(**[3 max]** for information on capillaries)
no muscle / elastic tissue since pressure very low;
endothelial layer one cell thick to allow permeability / diffusion of chemicals / tissue fluid;
small diameter leads to exchange;
some fenestration / pores to allow rapid diffusion;
no valves since pressure very low; **[8 max]**

(Plus up to **[2]** for quality)

6. (a) standard deviation (s.d.) is a measure of the spread about the mean value;
68 % of values fall within 1 s.d. of the mean;
small s.d. means data is clustered around the mean;
the larger the s.d. the greater the spread of the data;
the larger the s.d. the less useful the mean is for comparing data;
quoting the formula for s.d.;
as the means and s.d. become closer, the less likely the data from the two sites are different;
the s.d. can be used to help decide whether the difference between the two means is likely to be significant; *[4 max]*
- (b) a shape (rectangular or circular frame) of known area / definition of quadrat;
placed / thrown randomly in each area;
random number tables can be used to avoid human bias;
count the number of individuals of the species in that quadrat;
small quadrats placed many times / large quadrats fewer times;
enough samples must be taken to make it representative;
size of quadrats determined by size of species / area used / the number / size of quadrats can be determined by tables;
population density is number of plants divided by area;
measurement of total area requires a proportion calculation; *[6 max]*

- (c) name of relevant activity;
(To obtain full marks, a candidate must include at least one idea from each of the following categories.)

cause of the problem;
another detail of the cause of the problem;

effect caused by the problem / activity;
another detail of the effect caused by the problem / activity;
other discussion concerning another feature (cost, geographical features);

contained / reduced: detail how cause / problem can be contained / reduced;
another detail how cause / problem can be contained / reduced;
effectiveness of one solution;

conclusion;

[8 max]

example:

air pollution;
burning fossil fuels / industrial smoke;
internal combustion engine / diesel engines / petrol engines;
smoke / soot particles damage / aggravate lungs / breathing disorders;
sulfur dioxide may irritate respiratory tract / kill plants;
sulfur dioxide contributes to acid rain;
nitrogen oxide leads to photochemical smog;
pollution more pronounced in industrial / urban areas;
aggravated by closed valleys / geographical location (temperature inversion);
a solution is low-sulfur fuels;
also desulfurisation units on chimneys / power stations;
can also use hydrogen / methane / ethanol / electricity powered vehicles;
but these are currently (generally) expensive / short range / lower power;
clean air acts effectively reduce pollution;
further research on cleaner fuels / solar power will help;
cheaper and more widely available public transport will also help;
alternative means of generating energy will be effective;
poorer countries are still unable to buy the technology / solutions;

(Plus up to [2] for quality)
