



Cambridge IGCSE®

BIOLOGY

0610/04

Paper 4 Theory (Extended)

For examination from 2020

MARK SCHEME

Maximum Mark: 80

Specimen

This document consists of **8** printed pages.

mark scheme abbreviations

| | |
|--------------------|---|
| ; | separates marking points |
| / | alternative responses for the same marking point |
| not | do not allow |
| allow | accept the response |
| ecf | error carried forward |
| avp | any valid point |
| ora | or reverse argument |
| owtte | or words to that effect |
| underline | actual word given must be used by candidate (grammatical variants excepted) |
| () | the word / phrase in brackets is not required but sets the context |
| max | indicates the maximum number of marks |
| Any [number] from: | accept the [number] of valid responses |
| note: | additional marking guidance |

- 1 (a) animals written in the correct boxes in the food web
 vultures;
 cheetahs;
 mice / mouse; [3]
- (b) (primary) producer;
primary consumer; [2]
- (c) (i) Sun; [1]
 (ii) (lost) to the atmosphere / (lost as) infra-red (radiation) / heat / owtte; [1]
- (d) Any three from:
 idea that small percentage of energy from Sun is 'fixed' by photosynthesis /
 most energy from Sun not available / reference to wrong wavelength;
 energy is lost between and within trophic levels;
 ref. to 10% energy transfer / ora (per trophic level);
 note: if magnitude given, e.g. '90% lost between trophic levels', award 2 marks
 ref. to material that is inedible or indigestible;
 ref. to (small) total percentage reaching fourth trophic level (cumulative idea);
 not enough energy in fourth trophic level to support another level;
 avp; [max 3]
- (e) Any three from:
 feed is expensive;
 more energy efficient to feed humans on crops or producers or animals that are used to make
 the (fish) food;
 waste feed causes eutrophication of water supplies;
 diseases or parasites spread easily (in captivity);
 diseases spread to other organisms in the wild;
 chemicals used to control disease are also pollutants (e.g. antibiotics);
 avp; e.g. animal welfare concerns [max 3]

2 (a) Any three from:

muscular contraction / movement / pump blood;

allow: maintain posture

maintenance of body temperature;

active transport described / example such as nerve impulses;

metabolic reactions / named example (e.g. excretion / biosynthesis / digestion);

mitosis / nuclear division / cell division;

growth / replacement / repair;

making gametes / owtte;

avp;

[max 3]

(b) (i) respiration;

[1]

(ii) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

[1]

(c) Any four from:

takes time for;

oxygen debt (to be repaid);

more oxygen needed;

lactic acid / lactate;

builds up in muscles / needs to be cleared away;

lactic acid is broken down / respired;

[max 4]

(d) Any five from:

as body temperature increases;

vasodilation;

(relaxation / owtte) of arterioles;

allow: arteries

increase in supply of blood to skin capillaries;

(causes) loss of heat;

by, conduction / convection / radiation;

increase in blood flow to sweat glands;

increased production of sweat;

loss of heat by evaporation;

[max 5]

- 3 (a) ability to detect and respond to changes in the environment; [1]
- (b) correct label and name of:
sensory neurone;
relay / connector / intermediate neurone;
motor / effector neurone; [3]
- (c) automatic / no thought required / not a conscious action;
allow: no (higher centres in) brain involved
ignore: reference to speed of response
stimulus always leads to the same response;
allow: fixed response [2]
- (d) (i) a junction between two neurones; [1]
(ii) Any three from:
(an impulse triggers) the release of neurotransmitters (into the gap);
diffuse across the gap;
binds to receptors;
which allows the passage of the impulse; [max 3]
- (e) Any two from:
heart beats faster / increased pulse;
increased rate of breathing;
stimulates breakdown of glycogen in the liver;
increases blood glucose concentration;
dilate pupils;
heightened sensitivity / increased mental awareness / owtte;
allow: sharper senses / more alert / owtte [max 2]
- (f) Any one from:
nervous control is faster / ora;
hormonal control is longer-lasting / ora;
note: comparison must be made [max 1]

- 4 (a) **R and Y;**
RY;
 orange;

[3]

(b)

| | genotypes of offspring |
|---------|------------------------|
| cross 2 | RR, YY, RY |
| cross 3 | RR, RY |
| cross 4 | YY, RY |

allow: ecf from **4(a)**

[3]

(c) Any three from:

phenotype of **RY** (offspring of **cross 1**) is different from either parent or the homozygous genotypes / owtte;

the phenotype was intermediate / mixture of two colours;

offspring of **cross 2** gives three phenotypes not two;

offspring of **crosses 3** and **4** both give two phenotypes;

if dominance **cross 3** or **4** would give one phenotype only;

allow: incomplete dominance

allow: both alleles are expressed

[max 3]

(d) Any two from:

transfer of pollen from anthers or stamen to stigma;

self = within same flower (or flower on same plant);

cross = between flowers on different plants (of same species);

[max 2]

(e) Any four from:

limited variation;

offspring become homozygous (over time) / owtte;

allow: reference to inbreeding / limited gene pool

variation is due to mutation;

low chance that mutations will be expressed / owtte;

offspring will be well adapted to conditions near parent;

if environment does not change;

limited opportunity for evolution if environment changes / will not be able to adapt to change in the environment;

allow: reference to disease in context (as a change)

avp; e.g. some variation due to reassortment of chromosomes and crossing over during meiosis / reduced variation leads to intraspecific competition locally;

[max 4]

5 (a) *water jacket*

Any four from:

maintain optimum / constant temperature;
 allow: prevent overheating
 to prevent enzymes denaturing;
 (because as) fungus respire;
 releases heat so temperature in the fermenter increases;
 which would kill fungus;
 (therefore) no product / no penicillin / owtte;

addition of acids and alkalis

Any two from:

maintains pH / keeps pH constant;
 enzymes need optimum pH;
 to give maximum enzyme activity / rate of reaction at its fastest;
 to give maximum yield / owtte;
 allow: stop enzymes denaturing

[max 6]

(b) (i) 40–50; [1]

(ii) mitosis; [1]

(iii) Any three from:

nutrients are used up;
 limiting (factors);
 explanation of limiting factor;
 allow: factor in shortest supply / owtte
 waste products accumulate;
 wastes are toxic;
 penicillin could inhibit growth;
 population reaches carrying capacity;
 avp;

[max 3]

(c) (i) fungus grows when no penicillin produced;
 during first 20 hours; [2]

(ii) Any one from:

no more growth of fungus / fungus is dead;
 no further production of penicillin / no advantage in continuing;

[max 1]

(d) Any three from:

purifying or separating penicillin;
 from waste or toxins / owtte;
 concentration;
 making into pills / owtte;
 avp; e.g. colour / taste

[max 3]

(e) Any two from:

viruses have no metabolism;
 allow: viruses do not have ribosomes
 idea that viruses have no target for antibiotics / owtte;
 antibiotics stop cell wall growth;
 viruses have no cell wall;
 antibiotics stop enzymes working;

[max 2]

- 6 (a) **A** epithelium / epithelial lining;
B lacteal;
C capillary / blood vessel;

[3]

(b) Any three from:

microvilli

increases / large surface area;
 for absorption;
 allow: diffusion / active transport (into villus)

mitochondria

(for) respiration;
 provide energy / ATP;
 for active uptake / transport;

[max 3]