



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

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*Scrúduithe Ardteistiméireachta, 2003*

*Bitheolaíocht*

*Ardleibhéal*

*Marking Scheme*

*Leaving Certificate Examination, 2003*

*Biology*

*Higher Level*



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# **Marking Scheme**

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*Biology*

*Higher Level*

Part I (120 marks)

1. any five 2(7) + 3(2)
- (a) liver
  - (b) lignin
  - (c) cochlea *or* ear
  - (d) stem
  - (e) testosterone *or* oestrogen
  - (f) meristem
2. 2(5) + 5(2)
- (a) (measure or demonstrate) evaporation / (potometer) control /  
/ in transpiration experiment
  - (b) to collect animals *or* named animals (from leaf litter or soil)
  - (c) test for pH *or* explain / in compensation point (experiment) /  
(to detect change in) CO<sub>2</sub> conc
  - (d) to separate substances *or* example
  - (e) to absorb oxygen /in relevant experiment
  - (f) to eliminate effects of gravity / in (geo)tropism (experiment)
  - (g) to absorb carbon dioxide/part of biuret *or* protein test /in relevant experiment
3. 4 (2) + 4(3)
- (a)
 

P = root cap	2
Q = meristem / (zone of) cell division	2
R = (zone of) elongation / vacuolation	2
S = (zone of) differentiation / specialisation / maturation [allow 'root hair' zone]	2
  - (b) protection 3
  - (c) mitosis / cell division / growth 3
  - (d) elongated / larger / vacuolated / non dividing / older  
[or correct reference to 'Q'] 3
  - (e) P *or* named / S *or* named 3
4. 8 + 7 + 5(1)
- (a) cornified / horny / epidermis
  - (b) Pigment *or* named pigment [allow malpighian layer ]  
barrier / continuous layer / biocide *or* example / sweat / sebum
  - (c) Water / urea / salt / sweat [any two points 3+3]
  - (d) Sensory / waterproofing / protection / secondary sexual characteristic *or* explained / filters  
air (in nose) / lubrication
  - (e) D

5. 8 + 7 + 4(1) + 1 (label)
- (a) water
  - (b) 0.25 – 0.35
  - (c) isotonic *or* explained
  - (d) plasmolysed
  - (e) **diagram** - [must show shrunken cytoplasm inside cell wall]  
**labels – any one**  
[*cell wall, cell membrane, cytoplasm, vacuole*] 1
  - (f) (immersion in distilled) water *or* hypotonic solution  
*or* explained

6. 8 + 7 + 5(1)
- (a) top of abdomen / bottom of thorax *or* chest / correct relation to named organ
  - (b) skeletal / striated *or* striped / involuntary (control) / voluntary (control)
  - (c) rises
  - (d) intercostal
  - (e) tidal
- Exhaled air is:**
- (f) warmer / less dust / reference to micro organisms / [**any two points**]  
[allow (difference in) pressure or temperature or ‘water’]

7. 5(3 + 1)
- (a) **hydrophyte** plant (adapted to wet conditions)  
**hydrosere** succession *or* explained / an aquatic ecosystem *or* example
  - (b) **node** – (point on stem) where leaves *or* buds are attached  
[allow reference to a mammalian ‘node’ e.g. in heart ]  
**internode** – (space) between nodes *or* leaves *or* buds
  - (c) **endoplasm** - (Inner *or* liquid) cytoplasm / part of cell / reference to *Amoeba*  
**endoderm** - (Inner) germ layer *or* explained / (layer of) cells
  - (d) **integument** - (coat of) ovule *or* explained / cuticle *or* exoskeleton / insect  
**testa** – seed (coat) *or* explained  
[integument develops into testa = 2 points]
  - (e) **parenchyma** - thin-walled (cells) / living / correct function  
**sclerenchyma** – thick-walls / lignified / dead / correct function

Part II (280 marks)

8.(a) (i) **diagram** 7, 4, 0  
 [full spindle, chromosomes on equator, 4 bivalents opposite 4 bivalents, = 7m  
 any one missing = 4m]

**labels** any three 3 (2)  
 [spindle fibre, centriole, centromere, chromosome or chromatid,  
 bivalent, tetrad, equator, pole]

(ii) (homologous) chromosomes are in pairs *or* explained  
*or* correct comment on mitosis  
*words or diagram* 3

(iii) gametes / named gamete / sex cells / germ cells 3

(iv) produces spore *or* named spore / (entry to) gametophyte 3

22

(b) (i) more than two forms of a gene 3  
 [accept 'more than two alleles' if accompanied by an example *or*  
 with a valid expansion]

(ii) Ao Bo 2(3)

(iii) (group) AB (group) A (group) B 3(3)

18

(c) (i) adenine, thymine, cytosine, guanine 4(3)  
 [allow A, T, C, G]

deoxyribose 3

phosphate 3

(ii) preparation details e.g. use of HCl *or* warm / squash *or* slice /  
 place on (glass) slide / add stain *or* named stain / cover slip /  
 microscope / colour matching stain  
any four 4(3)

30

9 (a) **ONLY THREE TERMS**

**glycolysis** – conversion of glucose *or* other correctly named substance/  
/ to pyruvic acid / anaerobic / small energy release

**aerobic respiration** – release of energy / oxygen (required) / from food *or* named  
food /  
[marks can be obtained from correct equation]

**facultative anaerobe** – (organism) lives or respire / (both) with and without oxygen

**phosphorylation** – formation of ATP / from ADP / by addition of phosphate/ from  
breakdown of ATP / forming high energy bond / other correct  
example  
[marks can be obtained from equation]

**photolysis** – breakdown of water *or* other substance / named product /  
/ using light (energy)

**any 3**                      **3(3 + 2)**  
**15**

(b) mitochondrion / cristae / comment on bacteria    **3**

hydrogen (atoms) / with high energy / from Krebs cycle *or* from glycolysis / accepted by  
carrier *or* named carrier / passed to other carriers *or* named / energy released / ADP combines  
with P *or* ATP formed / low energy hydrogen / combines with oxygen / to form water /  
enzyme controlled

*words or diagram*    **any seven**                      **7(3)**  
**24**

(c) *Experiment*

Yeast / sugar solution / oxygen-free conditions / how maintained / keep warm *or* temp stated /  
how kept warm / name product / details of test for product / result of test / mention of control /  
details of control / result of control

*description or labels*    **any eight**                      **8(3)**  
**diagram**                      **7, 4, 0**

[two containers, solutions, oil or seal, linking tube (above yeast soln and below lime water) = 7m  
any one missing = 4m]

**31**

10 (a)

<i>Structure</i>	<i>Animal</i>	<i>Function</i>
<b>Clitellum:</b>	Earthworm	Produces cocoon or egg case [Allow reference to reproduction or mucus production]
<b>Spiracle:</b>	Named insect	Gas exchange <i>or</i> explained
<b>Ventral sucker:</b>	Liver fluke	Attachment (to host)
<b>Seminal vesicle:</b>	Earthworm <i>or</i> Named mammal	Stores sperm / nourishes sperm / fluid (for sperm) Fluid (for sperm) / nourishes sperm

4(3 + 3)

24

- (b) (i) **mesoderm:**(third or middle) germ layer / (development of) muscular system / for movement / (potential) for new systems *or* for new organs / example of new system *or* organ / increased specialisation / more efficient / greater complexity / transport problem

any one

9

- (ii) **coelom:** (body) cavity / (provides) space for / example of organ / independent gut movement / protection of organs / hydrostatic skeleton in annelida *or* explained / greater complexity *or* explained

any one

9

18

- (c) feeding (stage) / different feeding regime / may occupy different habitat / allows for dispersal / provides energy for next stage / reduces competition / [allow mutiplication]

any one

3

<i>Larval stage named</i>	<i>Location</i>
Miracidium:	outside host <i>or</i> inside secondary host <i>or</i> named
Sporocyst:	inside secondary host <i>or</i> named
(1 <sup>0</sup> ) Redia	inside secondary host <i>or</i> named
(2 <sup>0</sup> ) Redia	inside secondary host <i>or</i> named
Cercarium:	inside secondary host <i>or</i> inside primary host <i>or</i> outside host <i>or</i> named
Encysted cercarium	outside host <i>or</i> inside primary host <i>or</i> named

Any five names 5(2)

Matching correct locations 5(2)

Correct sequence 5

[any 4 in correct sequence for sequence mark]

28

11. (a) (i)	<i>diagrams</i>	7, 4, 0
	[contrasting walls and lumens clearly seen = 7m only one contrast seen or diagrams not titled = 4m]	
	<b>any three labels</b>	<b>3(3)</b>
	<i>[muscle, elastic fibres or elastin, endothelium, lumen, valve, fibrous coat or collagen, thick or thin wall]</i>	
	(ii) <u>Reasons for any TWO Differences</u>	
	<b>reason for thick muscle wall in artery</b> - carries blood under pressure / wall expands and contracts / pushes blood (onwards)	
	<b>reason for valves in veins</b> - blood under low pressure / (veins) cannot force blood forward / prevent backflow	
	<b>reason for wide lumen or thin wall</b> – action of (skeletal) muscle	3 + 3
		22
(b)	<b><u>any three of the following</u></b>	
	(i) <i>Hepatic portal vein</i> (carries blood) from intestine <i>or</i> named part / to liver / carries digested foods / /one example of food / capillaries at both ends / direct transport	
	(ii) <i>Lymph nodes</i> found along lymph vessels / concentrated in places / named location / part of defence <i>or</i> immune system / 1 <sup>st</sup> example of defence mechanism / 2 <sup>nd</sup> example of defence mechanism	
	(iii) <i>Leucocytes</i> formed in lymph / formed in bone marrow / function in defence / 1 <sup>st</sup> example of defence mechanism / 2 <sup>nd</sup> example of defence mechanism / mention of more than one type / valid reference to numbers / fate e.g. pus	
	(iv) <i>Thrombin</i> enzyme <i>or</i> protein / in (blood) clotting / formed from prothrombin / by thrombokinase <i>or</i> thromboplastin / converts fibrinogen / to fibrin	
	<b><u>any three</u></b>	<b>3(3 +3+3)</b>
		27
(c) (i)	blood under pressure / (due to) arterial pressure <i>or</i> from heart / different bore size / (pressure maintained due to moving from) arteriole to arteriole / (causing) leakage (from glomerulus) / passes into Bowmans capsule	
	<b><u>any three</u></b>	<b>3(3)</b>
	(ii) water reabsorbed / urea secreted (into the tubule)	3
	(iii) (glucose) molecules small / all pass through (filter)	3
	(iv) reabsorbed (in proximal tubule) <i>or</i> explained	3
	(v) (protein) molecules too large / filter pores too small / (protein) not filtered	3
		21



12. (a) (i) **diagram** 7, 4, 0  
 [rhizoid, stolon, sporangiophore, sporangium = 7m  
 any one missing = 4m]  
**labels** any 4 4(3)  
 [rhizoid, stolon, hypha, mycelium, sporangiophore,  
 sporangium, columella, spores]
- (ii) *Type of nutrition:*  
 saprophytic / saprobic / heterotrophic 3
- Significance in nature:*  
 Decomposition / decay / rot / recycling (minerals)  
 3
- (iii) *Differences:*
- |   | <i>Rhizopus</i> | <i>Phytophthora</i>            |
|---|-----------------|--------------------------------|
| Haustoria (at tips of hyphae)               | absent          | present                        |
| Sporangia <i>or</i> reproductive structures | round           | lemon shaped <i>or</i> conidia |
| Rhizoids                                    | present         | absent                         |
| Sporangiophore                              | single          | branched                       |
| Stolons                                     | present         | absent                         |
| Zoospores                                   | absent          | present                        |
- Any two differences 2(3)  
 [comment on either species is sufficient] 31
- (b) *Graph*
- (i) **X:** (bacteria) adapting to the environment *or* explained 3
- (ii) **Y:** (rapid) division *or* reproduction *or* mitosis /  
 availability of resource *or* suitable conditions *or* any  
 one named resource e.g. food, space, oxygen, air *or*  
 condition e.g. suitable temp., pH 3
- (iii) *Why decline:*  
 shortage of food / shortage of space / shortage of  
 oxygen *or* air / build up of wastes *or* toxins *or* antibiotics  
any three 3(3) 18
- (c) (i) sterilising *or* explained /  
 to prevent contamination of plate / to prevent  
 contamination of sample 2(3)
- (ii) use as control *or* explained 3
- (iii) moisture collects on lid / prevent condensation on agar /  
 doesn't interfere with growth of bacteria / 2(3)
- (iv) to sterilise *or* explained / safety *or* prevent infection /  
 from high numbers of bacteria 2(3) 21

13 (a)

- (i) **habitat** – a place where an organism *or* a community lives 3
- ecosystem** – (interaction of) living organisms and the (non-living) environment *or* habitat 3
- biosphere** – parts of the earth where life exists 3
- (ii) **food chain** – sequence of organisms in a feeding relationship *or* explained /one organism at each trophic level 3
- food web** - interconnecting food chains *or* explained/ a number of organisms at each trophic level 3
- valid **example** of food chain with four levels 4\*, 0  
 [allow one collective term]
- matching habitat (all stages in given food chain must match it) 3
- energy is lost at each step *or* example stated 3

25

- (b) (i) **climax community** – a community that has reached stability / / final stage in succession 3
- example** – woodland *or* any other example 3
- (ii) **abiotic** – non-living + **biotic** – living 3
- abiotic example** – edaphic *or* example / climatic *or* example / topographic *or* example / chemical *or* example any two 2(3)
- biotic example** – competition *or* example / predation/ / parasitism / reproduction rate / interdependency *or* example/ / one human activity any two 2(3)

21

- (c) (i) **in 1934:** red squirrels 320 3  
 grey squirrels 100 3
- (ii) **in 1948:** red squirrels 80 3  
 grey squirrels 800 3  
 [attempt = 3]
- (iii) **change:** 240 less red squirrels 3  
 700 more grey squirrels 3  
 [correct subtraction of wrong figures from (i) or (ii) gets marks]

- (iv) **explanation related to change given in (iii)**  
 wider range of food eaten / greater reproductive rate / / competition or named example / immunity to disease / weather tolerance / response to predators / response to parasites / hunted / better adapted / migration / [allow size difference]

[comment on either species is sufficient] any two 2(3)

24

14. (a) (pollen grain) germinates / forms tube / grows through style / cells nourish tube / comment on tube nucleus / generative nucleus divides / produces two male gamete *or* nuclei / enters via micropyle / tip bursts / tube nucleus disintegrates / male gamete (nuclei) enter embryo sac / double fertilisation / one (male nucleus) fuses with egg / forms zygote / diploid / second (male nucleus) fuses with polar nuclei *or* with 1<sup>0</sup> endosperm nucleus / forms endosperm nucleus / triploid

*words or diagram labels*  
[max 4 points from labels]

**any eight**

**8(3)**

24

**(b) alternation of generations**

**moss** – (moss plant) is haploid / gametophyte / produces gametes / by mitosis / male gamete swims / to archegonium / fertilization / zygote formed / diploid / (develops into) sporophyte / dependent / produces spores / haploid *or* by meiosis / spores scattered in dry conditions / germinate / protonema / gametophyte is dominant *or* explained

**OR**

**fern** – (fern plant) is diploid / sporophyte / produces spores / haploid *or* by meiosis / spores scattered in dry conditions / germinate / produce haploid / gametophyte / prothallus / produces gametes / by mitosis / male gamete swims (in water) / fertilization / zygote formed / diploid / develops into new plant / sporophyte is dominant *or* explained

*words or labels*

**any seven**

**7(3)**

***labelled diagrams***

**7, 4, 0**

[gametophyte and sporophyte must be shown in one or more diags = 7m  
one missing = 4m]

28

**(c) ANY THREE**

<b><i>Structure</i></b>	<b><i>Plant</i></b>	<b><i>Function</i></b>
<b>Pyrenoid:</b>	<i>Spirogyra</i> or other named alga	Storage
<b>Lenticel:</b>	Named tree <i>or</i> shrub <i>or</i> 'potato'	Gas exchange <i>or</i> example
<b>Conceptacle:</b>	<i>Fucus</i> / other named brown alga	Contains sex organs or gametes [allow gamete <i>or</i> mucilage formation]
<b>Sieve tube:</b>	Named vascular plant	Translocation <i>or</i> explained

**3 (3 + 3)**

18

**Q 15. ANY TWO PARTS 2 (35)**

**Q15 (a)**

**(i) reflex action –**

automatic response / not under conscious control /  
/ involuntary response / **3**

**Diagram 7, 4, 0**

[correct detail sensory neuron and motor neuron = 7m  
one error = 4m]

**Labels 5(2)**

[receptor or stimulus, sensory neuron, spinal cord or CNS, motor neuron, brush end or  
effector or muscle, relay neuron, grey matter, white matter, ganglion, arrow showing direction]

**(ii)**

**1. threshold**

minimum level or explained / of stimulus or example

**2(3)**

**2. at synapse**

(acetylcholine) released from vesicles / in first neuron / within axon tip or synaptic knobs /  
crosses gap / sets up impulse / in next neuron / broken down by an enzyme.

**3(3)**

**35**

**15 (b)**

**(i) test for reducing sugar**

Benedict's or Fehlings /  
/ heat / orange or red (precipitate) **3(3)**

**(ii) polysaccharide**

**name:** starch **3**  
**test:** add iodine (solution) / turns blue-black **2(3)**

**(iii) Either**

**Vitamin A** - antimony chloride (in chloroform) / blue colour

**OR**

**Vitamin C** - DCPIP / goes colourless or back to  
original sample colour

**Any two 2(3)**

**(iv) Protein** – liquid sample or named e.g. milk / add biuret reagent or  
sodium hydroxide (solution) plus copper sulphate (solution) /  
mix or shake / blue / to purple or violet colour

**3(3) + 2**

**35**

**15 (c) Explain the biological basis of ....****35**

- (i) **Pruning** - reduces number of buds /increases size of fruit / strengthens tree to carry fruit / removes apical dominance *or* explained / / disease control /
- (ii) **Cuttings** - plant can be propagated quickly / identical plants produced / preserves genotype
- (iii) **Iron** - avoidance of anaemia / iron needed for haemoglobin *or* for red cells
- (iv) **Spraying** - prevent transmission of disease / stop damage to crop
- (v) **Burning aerial parts** - to prevent *or* reduce infection (of tubers) / kills fungus / cause tubers to mature uniformly/
- (vi) **Closed season** - to allow for reproduction *or* growth / increase numbers
- (vii) **Salting meat** - causes plasmolysis of bacterial cells *or* explained

**7(5)****15(d)****(i)**

<i>Mineral</i>	<i>Use</i>
<b>Nitrogen:</b>	Amino acids / protein / nitrogenous bases/ nucleotides/ nucleic acid
<b>Magnesium:</b>	Chlorophyll
<b>Calcium:</b>	Middle lamella / calcium pectate/ nitrogen absorption

**3(3)****(ii) experiment**

similar seedlings (plants) / use of distilled water to make up solutions / control containing all essential elements / experiments with one of the essential elements missing / all left in same conditions / aerate *or* aerating tube / light-proof covering (of solutions) / state experimental and control results

*Described or labels*                      **any five**                      **5(3)**

**Diagram**                                      **7, 4, 0**

[Container, plant, aerating tube, cover = 7m. one missing = 4m]

**(iii) Any TWO deficiencies**

<i>Mineral</i>	<i>Deficiency symptom</i>
<b>Nitrogen:</b>	Stunted growth <i>or</i> described / chlorosis <i>or</i> described
<b>Magnesium:</b>	Stunted growth <i>or</i> described / chlorosis <i>or</i> described
<b>Calcium:</b>	Stunted growth <i>or</i> described / chlorosis <i>or</i> described / growing tips die / distorted leaves

**2(2)****35**