# LEAVING CERTIFICATE BIOLOGY
# HIGHER LEVEL EXAM PAPER SOLUTIONS

## Sample Paper 4

**Section A**

**Question 1**

a) D: Zone of Differentiation/C: Zone of Elongation/A: Root Cap/B: Meristem 4(1)
b) New Tissues: Zone of Differentiation/Mitosis: Meristem/Growth Regulators: Zone of Elongation/Absorbtion of water: Zone of Differentiation 4(1)
c) (i) A: Vascular bundle/B: Air Spaces/C: Guard Cells/D: Stoma 4(1). (ii) B+D2(I). (iii) Xylem/carries water and minerals up the stem 2(1). (iii) Correct labels X+Y 2+2

**Question 2**

a) Dd
b) Both dark haired
c) 50%
d) d,D in both
e) D or d 5(4)

**Question 3**

a) Proteins produced by lymphocytes in the lymphatic system /to fight pathogens 2(2)
b) Weakened form of pathogen which is inoculated into the body to induce production of antibodies (2)
c) 30; 130 2(2)
d) B-Lymphocytes (2)
e) Produces more antibodies/effect lasts longer/quicker response to second infection 2(1)
f) Digestive juices/skin/monocytes/macrophages 2(2)
g) May have side affects mmr vaccine, can cause brain damage (2)

**Question 4**

a) (i) Competition –organisms compete for a common resource/cattle and sheep compete for grass 2(2)
(ii) Organism lives on or in another living organism causing death or disease/liver fluke lives in the bile duct of cattle or sheep 2(2)
b) (i) fox/sheep(2), (ii) rabbits – large ears for hearing/fox – good nocturnal vision 2(2), (iii) correct graph out of phase (4)
c) disease (black death)/famine/war 2(1)

**Question 5**

a) Saliva/cheek cells (2)
b) Skin/nail/hair (2)
c) (i) DNA fragments, (ii) Thicker due to concentration of fragments of the same type, (iii) 9 3(2)
d) (i) C (ii) his sample matches the cigarette butt sample 2(2)
e) Adenine/Thymine/Guanine/Cytosine 4(1). ThymineorCytosine/hydrogen bonding 2(1)

**Question 6**

a) Carbohydrate: whole grain bread/sugar; Fat: butter, ham, cheese ice cream, Protein: cheese, ham Water soluble vitamin: Vitamin C/Orange juice 4(1)
b) (i) fibre: whole grain bread, apple, peach, (ii) improves movement of food/cleans digestive system/prevents constipation 2(2)
c) (i) a single sugar unit (2), (ii) glucose (1), test Fehling's solution or benedict's reagent/heat $80^0$C/Colour change blue to red 3(2)
d) Mineral: Calcium/bone production (1+2)

## Section B

### Question 7

a) (i) Transpiration (3)
(ii) Easy to see – show exact transpiration stream pathway through the plant (3)

b) (i) Place stem in carrot (centre removed) or older stem (elder)
– or cut with micro tome – cross section
– very sharp scalpel or knife
(ii) Place very thin sections in water.
(iii) Remove with paintbrush onto slide.
(iv) Place some water on sample.
(v) Cover slip at $45^0$. Cover. 5(3)

c) Iodine
Significance: makes nucleus easy to see, also outlines plant cell wall (2)

### Question 8

a) Catalase or Amylase (3)
Substrate: Hydrogen peroxide (3), Starch (substrate)
Product: Oxygen and water (2+1), maltase (product)

b) Diagram: Water bath
Thermometer
Graduated cylinder
Foam/substrate/enzyme/washing up liquid/buffer 3(3)

Graph (3)

(i) Height (volume) of foam in time (3)
(ii) Buffer solution (3)
(iii) Temp – water bath (3)

### Question 9

a) Amylase (6)
Plant undergoes dormancy – no metabolic actions (6)

b) (i) To ensure enzymes came in contact with substrate. (6)
(ii) To get an average result.
(iii) To allow time and suitable conditions of temp for the enzyme to digest the starch.
Results: Where the seeds lay all the starch had been digested: no blue-black colour when iodine added.
Control: Control as above using boiled seeds 5(3)

**Section C**

**Question 10**

a) (i) 6 $CO_2$ + 6 $H_2O$ → $C_6H_{12}O_6$+6$O_2$ (3)

(ii) Light phase – light required (3)
Dark phase – no light required (3)

b) (i) Apparatus
Pond weed
Water bath
Lamp
Meter stick
Ruler 4 (3)

(ii) Rate = no of bubbles/min (3)

(iii) Use a water bath – constant temp 25–30$^oC$ on thermostatically controlled water bath/temperature affects rate of enzyme activity. 2(3)
(iv) as conc. of $CO_2$ increases so too does the rate until at a certain conc. the reaction becomes saturated and rate remains constant. (3)
(v) Increased light intensity increases rate. (3)

c) (i) Artificial light provides great light intensity/longer exposure of plants to light.(6)
(ii) Greater amounts of $CO_2$ keeps photosynthetic rate at maximum. (3)

Summer: Greater time of light exposure (6)
Greater temp. (6)

**Question 11**

a) (i) Male infertility = inability to produce sperm or low sperm count (3)
(ii) Smoking/alcohol abuse/drug abuse → stop the mentioned or hormone treatment or change in diet. 2(3)

b) (i) A = Testes, B = Sperm Duct, C = Prostate gland, D = Urethra, E = Penis. 5(2)
(ii) A = meiosis (3)
Diagram to include Tail, Collar, Nucleus, Aerosome
(iii) In diagram show sperm from testes → sperm duct → penis → vagina → cervix → uterus (womb) → fallopian tube (fertilization) (6)

c) (i) In vitro = fertilization outside the body/eggs removed from the ovary 2(3)
(ii) A fertilized egg is implanted/in the uterus/the eight cell structure is the morula. 3(3)
(iii) Progesterone: failure or drop off of progesterone/= miscarriage (6)

**Question 12**

a) (i) Habitat: a place where plants and animals live.
Abiotic/octors: non-living factors 3 (2)
Niche: is the functional role of an organism in a community.
(ii) Aquatic habitat: salinity; current speed, wave action, $O_2$. (2+1)

b) (i) Name of habitat. (3)
(ii) Qualitative: Identifies the types of species present in a habitat. (3)
Quantitative: Records numbers of each species present in a habitat. (3)
(iii) Piece of apparatus: name. (2) Use. 3(2)

Error: Human error: e.g. counting; using a transect not typical of habitat.
Changing conditions; accidental discovery; insufficient sample size. (4)
(ii) 2 plants 2(1), + 2 animal 2(1), adaptation (2)

c) (i) Spraying: results in fewer tomato flowers producing tomato fruits. (8)
(ii) Spiders may develop an immunity to the mites/mite population reduced (8) due to lack of food.
(iii) autotroph: tomato plant; herbivore: spider. 2(4)

**Question 13**

a) (i) A chemical messenger, released into the blood system from an endocrine gland to a target organ. (3)

(ii)

| | Nervous | Hormone | |
|---|---|---|---|
| Nature of response | Electrical | Chemical | |
| Rate of response | Fast | Slow | 3 x (2) |
| Duration | Rapid | Slow | |
| Ability to stop | All or nothing effect | Negative feedback inhibition | |
| Effect | Localised | General | |

b) Diagram to include (outside). Diagram 0, 3, 6
Labels: Cell body, dendron, dendrites, myelin sheath, schwann cells, node of ranvier. 6 (2)

| Differences | Sensory | Motor | |
|---|---|---|---|
| | Cell body outside CNS | Cell body in CNS | 3 x (3) |
| | No end brushes | End brushes | |
| | Dendron | No dendron | |

c) (i) Diagram (0, 3, 5). Correct labels 5(1)
(ii)Hormone name & function (2) + (2)
(iii) Cause e.g. Parkinsons. Treatment (2) + (2)
Failure to produce dopamine/no cure/drugs reduce symptoms.
(iv) Use of treatment: (4)
Insulin/Anabolic steroids.
Control of thyroid levels//hormone replacement therapy.

**Question 14**

a) (i) Cell continuity refers to the fact that all cells arise from pre existing cells. (3)
(ii) X = Mitosis (Asexual reproduction by cell division).
Y = Interphase 2x(1)
(iii)Mitosis produces 2 identical (diploid or haploid) daughter cells, genetically identical. 2x(1)
Meiosis produces 4 haploid daughter cells (half number), genetically different. 2x(1)
Mitosis in unicell organism like amoeba: increases number of individuals.

2x(1)

In multicell organisms, it produces new cells for growth and repair.

Meiosis: Allow for sexual reproduction, i.e. leads to production of gametes with haploid number of chromosomes: These combine to form a diploid zygote. 2x(2)
Allows for variation leads to different combination of genes.

(iv) Diagram (0, 1, 3)
Labels 4x(1)
Sister chromatids
Align along the equator 2x(2)
Joined at the centromer

(v) Cancers: are uncontrolled multiplication of abnormal cells. In this case the mitosis and the rate of reproduction of abnormal cells cannot be controlled. (2)

Causes: Carcinogens: – Cigarette smoke, asbestos, UV light, A/B gama rays, viruses (2)

b) RrBb x rrbb Parents (2) + (2)

(i) rb x

| RB | Rb | rB | rb |
|---|---|---|---|
| RrBb | Rrbb | rrBb | rrbb |
| Pink | Pink | white | white |
| Broad | Narrow | Broad | Narrow |

Gametes 5x(1)
Crosses genotypes: 4x(1)
Crosses phenotypes: 4x(1)

(ii) Mendel's Second Law: During gamete formation either of a pair of alleles may reassort randomly with either of another pair. (5)
In this case: the gene R is combined with B or b to form RB and Rb
And r is combined with B or b, rB and rb are formed.
This giving 4 possible phenotypes (genotypes of offspring). 4 x (2)
Ratio 1:1:1:1.

c) (i) Variations: Differences between members of species. (3)
Mutation: change in amount or structure of DNA. (3)

2 types: gene (point) mutation. 2x(2)
chromosome changes
change in chromosomal numbers.

Causes: Chemicals, formaldehyde, tobacco smoke, radiation (UV). 2x(1)

(ii) Evolution: is the genetic change in living organisms producing new forms of life over a long period. (4)
Darwin + Wallace (2)

(iii) Source of evidence: Fossils: – rocks aged, older rocks less fossil/new rock more fossils/which are more specialised than predecessors/shows common ancestry.
Comparative Anatomy
The wing of a bat, hoof of a horse, paddle of a whale: all have the same bones/which have become adapted/shows common ancestry. 3x(3)
Comparative Embryology

Organisms retrace their ancestry during their embroyology/by examinig the fish, frog, bird and human embryo we see the existence of gill slits/showing common ancestry. 3(3)

**Question 15**

a) (i) Root
w = xylem; x = phloem; (Y): ground tissue; z = root hair.

(ii) Osmosis: Nitrogen; sodium; calcium; phosphorous; potassium
2 Minerals:
Use: N: produce proteins, Na: control osmotic balance, Cu: growth, P = growth, K: controls osmotic balance
(iii) xylem: diagram (0, 1, 3). Cell wall; Spiral (lignin); Hollow lumen

All internal structures die leaving a hollow lumen in the xylem. No living cytoplasm of just hollow phloem: companion cells have a clear cytoplasm and posess a nucleus.

b) (i) Evaporation from a leaf of water through stomata. Cuticle water proof. Stomata on under-surface. (Reduce)
(ii) Root pressure, capillarity; adhesion, cohesion
Adhesion: Water adheres to the moist xylem.
Cohesion: Hairs keep water molecules together. Forming a continuous column. As water evaporates the column moves up.

c) (i) Root: carrot/turnip
Stem: celery/potato
Leaf: onion
Tissue: phloem
(i) Stored: starch. (ii) Transported: glucose

(ii) Excretion removal of metabolic waste.

Leaves: Loose water, $O_2$ + $CO_2$ through their lenticels and stomata. Water and $CO_2$ are products of respiration. $O_2$ is a product of photosynthesis and lost during the day, together with $H_2O$. $CO_2$ is a product of respiration.