LEAVING CERTIFICATE BIOLOGY – 2018 Higher Level

SECTION A (100 marks)

Answer any **five** questions from this section.

Each question carries 20 marks.

1. Answer any **five** of the following parts (a) to (f):

(a) Give the **two** main reasons why living organisms require food.

(b) What is a polysaccharide?

(c) Name the main structural polysaccharide in plants.

(d) Describe the composition of a triglyceride molecule.

(e) Give a structural role of lipids in the human body.

(f) Name a test or give the chemicals used to demonstrate the presence of protein in a food sample.

Answer & Marking **5(4)**

(a) *Why living organisms require food:*
Energy (source) **or** (cellular) respiration **or** (raw materials) for growth **or** (raw materials) for repair **or** anabolism

(b) *Polysaccharide:*
(A carbohydrate or molecule composed of) many sugar (or named monosaccharide) units (or molecules)

(c) *Main structural polysaccharide in plants:*
Cellulose [**allow** pectin]

(d) *Triglyceride molecule composition:*
Glycerol **and** three fatty acids

(e) *Structural role of lipids:*
(Found in) membranes [**allow** insulation]

(f) *Name of test or chemicals used to demonstrate the presence of protein:*
Biuret **or** copper sulfate **and** sodium hydroxide

2. From your knowledge of ecology, explain the following terms:

(a) Biotic factor.

(b) Habitat.

(c) Community.

(d) Population.

(e) Niche.

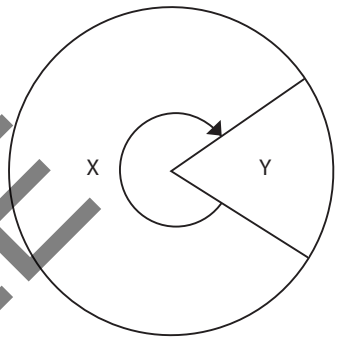
(f) Biosphere.

(g) Qualitative survey.

Answer & Marking **2(5) + 5(2)**

(a) *Biotic factor:* Living (factor)
(b) *Habitat:* Where an organism (or a plant or an animal) lives [**allow** plurals]
(c) *Community:* All the organisms in an area (or habitat or ecosystem)
(d) *Population:* All the organisms of a (particular) species (living in an area)
or all the organisms of the same species (living in an area)
(e) *Niche:* The role of an organism (or plant or animal or population) (in its ecosystem)
(f) *Biosphere:* The part of the earth (planet) where life can exist
or the part of the earth (planet) inhabited by (living) organisms
(g) *Qualitative survey:* (To establish) the presence (or absence) of species (or organisms)

3. The diagram represents the cell cycle.



(a) What stage of the cell cycle is represented by X?
(b) There are two types of cell division, mitosis and meiosis. Define mitosis.
(c) State two ways in which meiosis differs from mitosis.
(d) Explain the term *cancer*.

Answer & Marking **2(5)+5(2)**

(a) X = Interphase
(b) *Mitosis:*
(Cell or nuclear division) forming two identical (daughter) cells (or nuclei) **or** same chromosome number as parent
(c) *Two ways meiosis differs from mitosis:*
Four (new cells or nuclei) produced / variation (or not identical) / chromosome number halved ***Any two***
(d) *Cancer:*
(A group of disorders due to) uncontrolled (rate of) mitosis (or cell division)

4. (a) What is meant by the term *genetic engineering*?
(b) Genetic engineering involves the following steps but not necessarily in the order given. Rewrite these steps, placing them in the correct order.
Transformation; Cutting; Isolation; Expression.
(c) Briefly explain what is meant by isolation and expression in relation to genetic engineering.
(d) In genetic engineering, DNA molecules called cloning vectors are used during transformation. Name the rings of DNA contained in bacteria that may be used as cloning vectors.
(e) Give **one** application of genetic engineering in any **two** of:
an animal, a plant, a micro-organism.

Answer & Marking **2(5)+5(2)**

(a) *Genetic engineering:*
Manipulation of genes **or** alteration of genes **or** alteration of genotypes **or** alteration of DNA

(b) *Genetic engineering steps:*
1. Isolation
2. Cutting
3. Transformation
4. Expression

(c) *Isolation:* Identifying (or locating) gene **or** removal of a gene (or of a piece of DNA or of a plasmid)
Expression: (The gene causes the) production of protein (or product)

(d) *Rings of DNA in bacteria used as cloning vectors:*
Plasmids

(e) *Application of genetic engineering* ***Any two***
in animals:
Clotting factors **or** lactose-free milk **or** growth hormone **or** other valid answer
in plants:
Resistance to herbicides (or to pests) **or** slow ripening **or** longer shelf life **or** fruit colour **or** rice producing Vitamin A **or** improved yield **or** other valid answer
in micro-organisms:
Production of interferon (or of insulin or of hormones or of vaccines or of antibodies or of antibiotics) **or** oil breakdown **or** other valid answer

5. (a) What is an auxin?

(b) With regard to auxins, state:
(i) A precise location in plants where they are produced.
(ii) One example of an inhibitory function.

(c) (i) Exactly how does an unequal concentration of auxin in the elongation zone affect the growth of either a shoot or a root?
(ii) Suggest what could cause an unequal concentration of auxin in a shoot **or** in a root?

(d) State **two** uses in horticulture of auxins or related compounds.

Answer & Marking **2(5)+5(2)**

(a) *Auxin:*
A plant growth regulator (or promoter or inhibitor)

(b) (i) *Precise location of auxin production in plants:*
Shoot tips **or** root tips **or** meristematic (tissue) **or** seeds **or** buds **or** young leaves

(ii) *Inhibitory function of auxin:*
Apical dominance **or** slows (prevents) the growth in side branches **or** slows mitosis (or slows cell division)

(c) (i) *How unequal concentration of auxin affects growth of shoot or root:*
Shoot: higher auxin concentration results in higher rate of cell division (or more growth)

(or vice-versa)

OR

Root: higher auxin concentration results in lower rate of cell division (or less growth) (or vice-versa)

(ii) *Cause of unequal concentration of auxin in shoot or root:*

Shoot: Difference in light direction (or explained) **or** gravity

OR

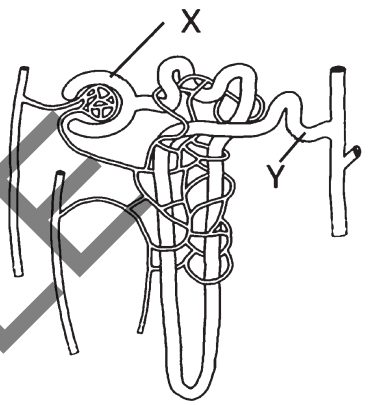
Root: Gravity **or** difference in water concentration

(d) *Uses of auxins in horticulture:*

(Promote) ripening in fruit / tissue culture / rooting powder / weed killers / seedless fruit

Any two

6. The diagram shows the structure of a nephron and part of its associated blood supply.



Target area

(a) Name the structures labelled X and Y.

(b) Draw a line from the 'Target area' box above, to a precise location on the diagram to indicate where the hormone ADH has its effect.

(c) Briefly describe the effect of ADH on its target area.

(d) What change in blood composition triggers the secretion of ADH?

(e) Name the endocrine gland in which ADH is produced.

(f) Suggest one possible treatment for kidney failure.

Answer & Marking **2(5)+5(2)**

(a) X = Bowman's capsule

Y = Distal (convoluted) tubule (or DCT)

(b) *Target area of ADH:*

Line drawn to distal convoluted tubule **or** to collecting duct

(c) *Effect of ADH on target area:*

It becomes more permeable to water **or** more water is reabsorbed

(d) *Change in blood composition that triggers secretion of ADH:*

Increasing (salt) concentration **or** decreasing water concentration

(e) *Where ADH produced:*

Hypothalamus [**allow** (posterior) pituitary]

(f) *Possible treatment for kidney failure:*

Dialysis **or** transplant

Section B (60 marks)

Answer any **two** questions.

Part (a) carries 6 marks and part (b) carries 24 marks in each question in this section.

7. (a) (i) Why is it important that scientists publish the results of their research?

(ii) How can scientists avoid bias in scientific experiments?

(b) (i) When carrying out certain experiments at the laboratory bench:

1. How would you ensure that reactants or organisms are maintained at a constant pH over a period of a few hours?
2. How would you ensure that reactants or organisms are maintained at a constant temperature over a period of a few hours?

(ii) When you used yeast to prepare alcohol:

1. What other product was produced during the fermentation?
2. What test did you use to confirm the presence of alcohol?

(iii) When using a microscope to examine biological specimens, describe how you:

1. Calculated the magnifying power of the microscope.
2. Altered the amount of light shining on your specimens.

(iv) In relation to investigations you carried out on food, state:

1. Why the brown paper used to test for the presence of fat should be allowed to dry out.
2. Which other food test required the application of heat.

Answer & Marking (30)

(a) **4 + 2**

(i) *Why it is important that scientists publish results of their research:*

Information made widely available **or** to spread knowledge **or** peer review

(ii) *How scientists avoid bias in experiments:*

Large sample size **or** replicates **or** double blind testing **or** random sampling **or** use of placebo

(b) **4(4) + 4(2)**

(i) *At the lab bench*

1. *How constant pH maintained:*
   (Use) a (pH) buffer
2. *How constant temperature maintained:*
   Water bath **or** incubator

(ii) *Alcohol production*

1. *Other product produced during fermentation:*
   Carbon dioxide (or CO_2)
2. *Test to confirm alcohol present:*
   Iodoform (test) **or** sodium hypochlorite + potassium iodide **or** other valid test

(iii) *Microscopy*

1. *How calculate magnifying power of microscope:*

Multiply (the power of the) eyepiece (lens) by (the power of the) objective (lens)

2. *How alter amount of light on specimens:*
   Adjust the diaphragm (or condenser) **or** adjust the lamp **or** adjust the mirror

(iv) *Food tests*

1. *Why should paper dry out in fat test:*
   To ensure (translucent) stain is not just water (or explained)
2. *Other food test that requires heat:*
   Reducing sugar **or** Benedict's **or** Fehling's (test)

8. (a) The process of photosynthesis in plants is divided into two stages, the light stage and the dark stage.

(i) Where in the cell does the dark stage take place?

(ii) Why is the dark stage called the dark stage?

(b) Answer the following questions in relation to an activity that you carried out to investigate the influence of light intensity or carbon dioxide concentration on the rate of photosynthesis.

(i) Name the plant you used for this investigation.

(ii) Give a reason for using this plant.

(iii) How did you measure the rate of photosynthesis?

(iv) Label the axes below, and sketch a graph to show how the rate of photosynthesis would change as your chosen factor varied over a wide range.

(v) Explain the shape of your graph.

Answer & Marking (30)

(a) **4 + 2**

(i) *Where in cell dark stage takes place:*
Chloroplast

(ii) *Why dark stage is called dark stage:*
Light is not required **or** light independent **or** can occur in the dark

(b) **4(4) + 4(2)**

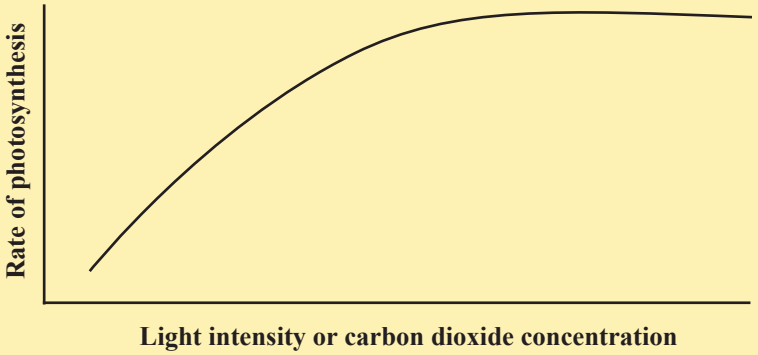
(i) *Plant:*
Elodea (or pondweed) **or** named aquatic plant

(ii) *Why this plant:*
(Aquatic plant) produces bubbles **or** gas easily seen

(iii) *How rate of photosynthesis measured:*
(Counted) the number of bubbles per unit time **or** (measured) the volume of gas per unit time (or per stated time)

(iv) *Graph axes:*
X-axis = Light (intensity) or carbon dioxide (concentration) **and** Y-axis = rate **or** number of bubbles (or volume) per unit time (or per stated time)

Plot:
Graph increasing
Graph levels off



(v) *Reason for shape of graph:*
As light (intensity) increases **or** as carbon dioxide (concentration) increases, rate (or photosynthesis) increases
Rate levels off as saturation point reached (or due to limiting factor) (or explained)

9. (a) (i) Name the fungus, other than yeast, that you have studied as part of your course.
(ii) Give **one** way the fungus you have named in part (i) differs from yeast.
(b) Answer the following questions in relation to your investigation into the growth of leaf yeast using agar plates.
(i) Mention two aseptic techniques you carried out to ensure a pathogen-free environment.
(ii) What type of agar is recommended for optimal growth of yeast and other fungi?
(iii) Describe how the plates were stored, from introduction of the yeast source until yeast growth was visible on the agar.
(iv) How did you identify the leaf yeast growing on the agar?
(v) Suggest a reason why few or no leaf yeasts may have grown on the agar.

Answer & Marking (30)

(a) **4 + 2**
(i) *Other fungus:* Rhizopus
(ii) *How different from yeast:*
Multicellular or has hyphae (or mycelium or rhizoids) or produces (zygo)spores

(b) **4(4) + 4(2)**
(i) *Aseptic techniques*
Minimal opening of containers / wash bench with disinfectant / flaming (or sterilising) instruments / wash hands or (wear gloves) / soak equipment in disinfectant *Any two*
(ii) *Type of agar for fungi:* Malt (agar) [**allow** nutrient (agar)]
(iii) *How plates stored until yeasts visible:*
Right side up / (right-side up) for (first) 24 – 48 hours / upside down / in incubator (or at 15 - 30 ◦C) / for 2-7 days *Any three*
(iv) *How identify leaf yeast on agar:* Pink (colonies)
(v) *Why few or no leaf yeasts on the agar:*
(Air) pollution or time of year or recent rainfall or unsuitable temperature or wind or damage during handling or no yeast on leaf

Section C (240 marks)

Answer any **four** questions.

Each question carries 60 marks.

10. (a) (i) Draw a pyramid of numbers to represent the information in the food chain below.

Rose bush → Caterpillars → Blackbirds → Hawk

(ii) What term is used to describe the organisms at the top of food chains?

(iii) Explain why pyramids of numbers are usually restricted to three or four levels. **(9)**

(b) Write notes on the following.

(i) Factors which influence the size of the human population.

(ii) Organism adaptations.

(iii) Conservation. **(27)**

(c) (i) Describe the steps you would take to estimate the size of the population of a particular animal species in the ecosystem you have studied.

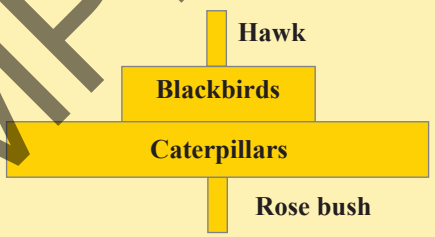
(ii) Name a plant from the ecosystem you have studied and indicate two abiotic conditions which favour its presence.

(iii) How did you measure any one of the abiotic conditions mentioned in (ii)? **(24)**

Answer & Marking (60)

(a) **4 + 3 + 2**

(i) *Pyramid of numbers:*



(ii) *Organisms at top of food chains:*

Top (or tertiary) consumer (or carnivore or predator)

(iii) *Why pyramids of numbers usually restricted to three or four levels:*

Due to large energy loss (at each level) **or** to small energy transfer (at each level)

(b) **2(5) + 3(4) + 2 + 3(1)**

(i) *Factors which influence the size of the human population:*

Named factor **and** matching note

War: high death rate **or** decrease (in population)

Famine: high death rate **or** decrease (in population)

Disease: high death rate **or** decrease (in population)

Contraception: low birth rate **or** decrease (in population) ***Any three***

(ii) *Organism adaptations:*

A structural feature (or change) / a behavioural feature (or change) / example / matching benefit / natural selection or explained ***Any three***

(iii) *Conservation:*

Management of the environment / to maintain biodiversity / to prevent extinction / named practice / benefit of named practice ***Any three***

(c) **2(5) + 2(4) + 3 + 3(1)**

(i) *Estimation of size of an animal population:*
For moving animals:
Capture / how captured / mark / release in same place / recapture / count / formula or calculation described
OR
For sessile or slow-moving animals:
Quadrat / random / how random / count / repeat (several times) / record numbers (or area) / calculate population ***Any five***

(ii) *Abiotic conditions favouring a particular plant's presence:*
(Plant name) with two matching abiotic conditions e.g. light (intensity) / (soil) pH / temperature / water (or rain) / other valid condition ***Any two***

(iii) *How measured one abiotic factor:*
Matching method to measure any one condition named in (ii)

11. (a) (i) Blood acts as a transport medium in the human body. Name two substances, other than food molecules and water, that are transported in the blood.

(ii) Give the location in the body where each of the substances you named in (i) enters the blood. **(9)**

(b) (i) Draw a diagram to show the structure of the human heart and associated blood vessels, labelling each of the following:
Vena cava; tricuspid valve; aorta; left ventricle; semi-lunar valve; pulmonary artery.

(ii) 1. State the precise location **and** describe the role of the sinoatrial (SA) node.
2. State the precise location and describe the role of the atrioventricular (AV) node.

(iii) What exactly is being measured when a person's blood pressure is taken? **(27)**

(c) Answer the following questions from your knowledge of the human nervous system.

(i) Outline the role of each of the following in the transmission of a nerve impulse:
1. Dendrites 2. Axon 3. Cell body.

(ii) Describe how a nerve impulse is transmitted across a synaptic cleft, from one neuron to the next.

(iii) Explain the importance of the myelin sheath in the transmission of a nerve impulse.

(24)

Answer & Marking **(60)**

(a) **4 + 2(2) + 1**

(i) *Substances, other than food molecules and water, transported in the blood:*
Urea / hormones (or a named hormone) / antibodies / oxygen / carbon dioxide / (plasma) proteins /enzymes / clotting factors (or a named clotting factor)
Any two

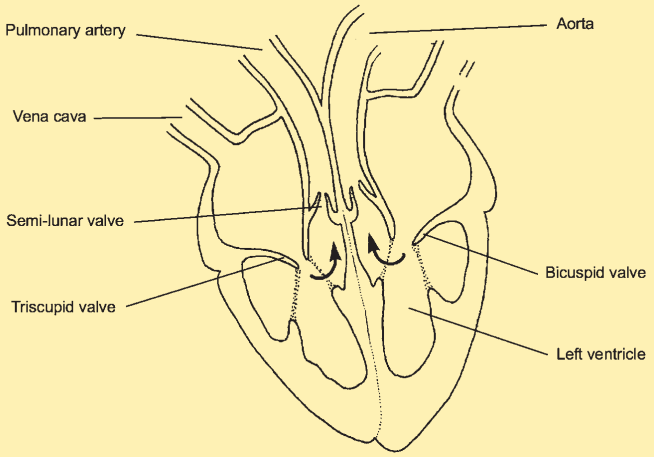
(ii) *Locations where substances enter the blood:*
Urea enters at liver / hormones enter at endocrine gland / antibodies enter from (B) lymphocytes / oxygen enters at lungs (or alveoli) / carbon dioxide enters at cells / enzymes (or clotting factors or proteins) enter from liver ***Any two***

(b) (i) **Drawing 6, 4, 0**

Labels 2(3) + 2 + 3(1)

Drawing: Four chambers including their valves + four correctly placed main blood vessels + left ventricle wall thicker than right ventricle wall

Labels: Vena cava / tricuspid valve / aorta / left ventricle / semi-lunar valve / pulmonary artery



(b) (ii) & (iii) **2(3) + 2 + 2(1)**

1. *Precise location of the SA node:* Right atrium

   Role of SA node:

   Generates (or sends) (electrical) impulses **or** causes contraction in the atria (or causes atrial systole) **or** controls the heart rate

2. *Precise location of the AV node:*

   In septum between right atrium and right ventricle **or** in septum near tricuspid valve

   Role of AV node:

   Generates (or sends) (electrical) impulses **or** causes contraction in the ventricles (or causes ventricular systole) **or** controls the heart rate

   Accept 'controls heart rate' once only i.e. for role of either SA node or AV node

(iii) *What is measured when a person's blood pressure is taken:*

Force of the blood against the wall of the artery **or** force required to stop flow of blood in the artery **or** systolic and diastolic pressures

(c) **2(5) + 2(4) + 3 + 3(1)**

(i) *Role of dendrites:*

Receive impulses **or** carry impulses towards cell body

Role of the axon:

Carries impulses away from cell body **or** carries impulses to effector (or named example)

Role of cell body:

Receives impulses **or** produces neurotransmitters **or** controls passage of impulses **or** passes impulse to axon

(ii) *How nerve impulse transmitted across synaptic cleft:*

Impulse arrives (at synaptic knob) / neurotransmitter (or named) / released into synapse / diffuses across gap / binds to receptors / impulse starts in next neuron (post synaptic) / enzymes break down neurotransmitter **or** neurotransmitter recycled (or reabsorbed) ***Any four***

(iii) *Importance of myelin sheath in transmission of nerve impulse:*

Speeds up (transmission of nerve impulse)

12. (a) (i) Suggest an advantage to the cell of using ATP as an energy source, instead of breaking down a sugar molecule every time energy is needed.

(ii) Name the nitrogenous base **and** the sugar present in ATP. **(9)**

(b) Answer the following questions from your knowledge of respiration.

(i) Give a balanced chemical equation to summarise the process of aerobic respiration.

(ii) 1. Name the storage polysaccharide in humans from which glucose is produced.

2. Give **one** major storage location of this polysaccharide in the body.

(iii) What happens to pyruvate molecules that prepares them for the Krebs cycle?

(iv) Name **three** products of the Krebs cycle.

(v) Briefly describe the fate of any **one** of the products mentioned in part (iv) above.

(vi) What is the final electron acceptor in aerobic respiration? **(27)**

(c) Answer the following questions from your knowledge of enzymes.

(i) Explain enzyme specificity with reference to the active site.

(ii) What happens to the activity of enzymes when they are placed in a medium outside of their optimum pH? Explain your answer.

(iii) Name two substances used in the school laboratory to immobilise enzymes or yeast cells.

(iv) Give **two** advantages of using immobilised enzymes. **(24)**

Answer & Marking (60)

(a) **4 + 3 + 2**

(i) *Advantage to cell of using ATP as energy source:*
ATP releases energy in suitable (or fixed or manageable) quantities **or** (energy) is available for immediate use **or** (energy) easily released **or** easily recycled

(ii) *Nitrogenous base in ATP:* Adenine
Sugar in ATP: Ribose

(b) Equation 6, 4, 0; parts (ii) to (vi), inclusive **5 + 3(4) + 4(1)**

(i) *Balanced equation to summarise aerobic respiration:* $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$

(ii) 1. *Human storage polysaccharide:* Glycogen
2. *A major storage location of this polysaccharide:* Liver **or** muscle

(iii) *What happens to pyruvate molecules before Krebs cycle:*
Lose a carbon (atom) **or** lose CO_2 **or** change from 3C to 2C **or** change to acetyl (Co-A)

(iv) *Krebs cycle products:* ATP / CO_2 / NADH **or** hydrogen ions **or** electrons

(v) *Fate of any one product:*
ATP: (Breaks down and) releases energy **or** used in active transport **or** used in anabolic reaction (or example)
CO_2: Released into atmosphere **or** used in photosynthesis
NADH: (Breaks down and) releases electrons **or** links to the electron transport system
H (ions): Forms water ***Any one***

(vi) *Final electron acceptor in aerobic respiration:*
Oxygen

(c) **2(5) + 2(4) + 3 + 3(1)**

(i) *Enzyme specificity with reference to the active site:*
Only one substrate
Fits (or matches) the (shape of) active site

(ii) *What happens to enzyme activity when outside optimum pH:*
What happens: (Activity is) reduced
Why: Shape of active site (or enzyme) changed **or** (enzyme) denatured

(iii) *Substances to immobilise enzymes:*
(Sodium) alginate
Calcium chloride

(iv) *Advantages of immobilised enzymes:*
Reusable (or longer-lasting) / recovered easily / pure product / (allows for) continuous flow process ***Any two***

13. (a) Most organisms contain both nucleic acids, RNA and DNA.

(i) Name the biologically active entities, each of which contains only one type of nucleic acid.

(ii) Name two locations in eukaryotic cells where RNA but no DNA is found. **(9)**

(b) Gregor Mendel studied the inheritance of various traits in pea plants.
The results of some of his investigations are presented in the table.

Parental Cross	F1 Phenotype
Round x Wrinkled Seeds	All Round
Yellow x Green Seeds	All Yellow
Purple x White Flowers	All Purple
Tall x Dwarf Plants	All Tall

(i) As a result of his work, he put forward two laws, the Law of Segregation and the Law of Independent Assortment. State each of these laws.

(ii) A dwarf pea plant with green seeds was crossed with a plant heterozygous for both height and seed colour. Indicate by means of a genetic cross, the possible genotypes and phenotypes of the progeny of this cross, if there is no linkage of genes.

(iii) Explain how the results of the cross in (ii) above would differ if the genes for height and seed colour were linked. **(27)**

(c) (i) What is meant by the term evolution?

(ii) Outline the theory of evolution by natural selection.

(iii) Describe evidence in support of evolution from any one named source. **(24)**

Answer & Marking **(60)**

(a) **4 + 3 + 2**

(i) *Biologically active entities:* Viruses

(ii) *Where RNA but no DNA found in eukaryotic cells:*
Cytosol **or** cytoplasm
Ribosome

(b) **2(5) + 3(4) + 2 + 3(1)**

(i) *Law of Segregation:*

Traits (or characteristics) are controlled by pairs of factors (or by pairs of genes) (or by a pair of alleles) which separate at gamete formation

Law of Independent Assortment:

Members of a pair of factors (or genes or alleles) separate independently of members of another pair **or** Each member of a pair of factors (or genes or alleles) can combine (randomly) with either member of another pair

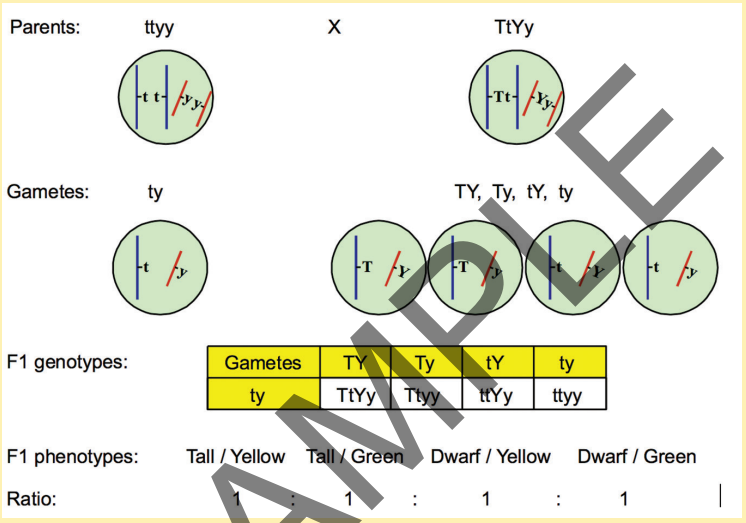
(ii) Parents: ttyy × TtYy

Gametes: ty, TY, Ty, tY, ty

F_1 Genotype: TtYy Ttyy ttYy ttyy

F_1 Phenotype: Tall/Yellow Tall/Green Dwarf/Yellow Dwarf/Green

Correct genotype **and** matching phenotype



Each excess incorrect F_1 cancels a correct answer

(iii) *How results would differ if genes linked:*

They would be mostly (or all) parental phenotypes **or** mostly (or all) tall, yellow and dwarf, green **or** no (or few) recombinants **or** no (or few) tall, green and dwarf, yellow **or** would not get same (1:1:1:1) ratio **or** less variation

(c) **2(5) + 2(4) + 3 + 3(1)**

(i) *Evolution:*

Inheritable (or genetic) change within a population (or species)

In response to change in the environment **or** over time

(ii) *Theory of evolution by natural selection:*

Variation /competition / survival of better adapted / better adapted leave more offspring / traits passed on / new species ***Any three***

(iii) *Evidence for evolution:*

Source:

Fossils **or** embryology **or** anatomy **or** biochemistry

Fossils: Structure changing / over time **or** related to environment

Embryology: Different organisms have similar embryo stages / similar development pathways

Anatomy: Named structure / expansion point to emphasise common ancestor
Biochemistry: Molecular structures common in related species / similar metabolism in different species
Both answers for any one named source

14. Answer any **two** of (a), (b), (c). **(30, 30)**

(a) (i) Define *dispersal* in relation to seeds.
Suggest **two** reasons why dispersal is important to plants.

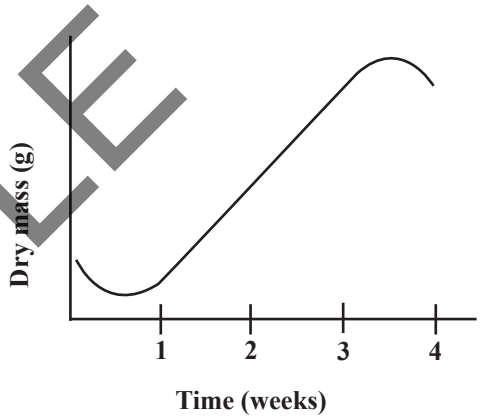
(ii) Give **one** way in which a knowledge of seed dormancy is useful to humans.

(iii) Other than water, name two essential environmental requirements for successful germination of seeds.

(iv) What is the role of digestion **and** the role of respiration in seed germination?

(v) The graph below shows variations in the dry mass of peas over a period of time after germination. Give a reason for:
1. The initial decrease in mass
2. The subsequent increase in mass.

(vi) Name a substance which, because of its changing quantities in the seed, could be responsible for the changes shown in the graph.



(b) (i) Draw a labelled diagram of a transverse section through a leaf.

(ii) Place the letter X on your diagram, to show the part of the leaf in which most photosynthesis occurs **and** explain why it occurs mostly there.

(iii) State **two** other ways in which the leaf is well adapted for photosynthesis.

(iv) Name **three** substances which are involved in leaf metabolism and which pass through the stomata.

(v) The concentration of which gas influences the diameter of the stomata?

(c) (i) The pancreas is both an exocrine and endocrine organ. Define the term *endocrine*.

(ii) Using your knowledge of the endocrine role of the pancreas, state:
1. A substance produced.
2. The name of the endocrine tissue in the pancreas that produces it.
3. A site of action of the substance mentioned in 1.
4. The role of the substance mentioned in 1.

(iii) Describe how a feedback mechanism works in the human endocrine system.

(iv) Give **two** examples of the use of hormone supplements.