Biology End of year Exam
Week commencing 8th May 2018

1hr 45min written paper
B1-B4 and B7

You will need:
Blue/black pen (+spare)
Pencil
Ruler (mm)
Calculator

The paper will be out of **90marks** in total. You should aim to spend about **one minute per mark.**

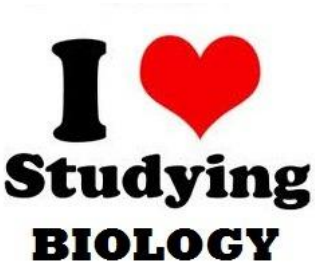
Read each question carefully, paying particular attention to the **command word** (describe, explain, calculate, evaluate etc) and to the **number of marks available** for the question.

Answers should be **written clearly**, **without waffle**, including any necessary **key words**. **Bullet points** are advisable for organising longer answers.

Remember to make use of the **kerboodle online text book** (ask your teacher regarding problems with access!) and your **class notes**.

The following checklists are based on the **OCR** exam specification.

Remember to **ask for help** if and when you encounter difficulties, either from your teacher or by attending biology clinic on Tuesday.



Good luck,
from
The Biology Dept.

OCR
RECOGNISING ACHIEVEMENT

Unit 1: Cell level systems

1.1– Cell structures and microscopy

I can…	
Describe the structure of a light microscope (name the different parts) AND explain the function of each part.	
Define the term 'magnification' AND explain the determining factor of magnification in a light microscope.	
Calculate the total magnification of a light microscope by multiplying the magnification of the eyepiece lens and the objective lens.	
Describe how to prepare a slide of a biological specimen INCLUDING the use of an appropriate chemical stain.	
Describe how to produce a focused image of a slide using a light microscope.	
Produce a quality biological drawing of a microscope image AND appreciate the quality of drawings produced by others.	
Define the term 'resolution' AND explain the determining factor of resolution.	
Compare the light microscope and the transmission electron microscope, TEM (advantages and disadvantages of each microscope type).	
Identify the organelles in a eukaryotic cell (membrane, cytoplasm, nucleus, mitochondria, ribosomes + cellulose wall, vacuole and chloroplasts in plant cells)	
Explain the function of each eukaryotic organelle.	
Identify the structural adaptations of specialised cells that enable them to carry out specific roles effectively.	
Identify the main features of a prokaryotic cell (wall, membrane, cytoplasm, loop of DNA, ribosomes + sometimes plasmids, flagella, capsule)	
Explain the function of each prokaryotic feature.	
Compare the structures of eukaryotes and prokaryotes (similarities and differences).	
Recognise the cell structures visible with a light and an electron microscope.	
Describe the relationship between mm, µm and nm.	
Convert values into different units (smaller unit = larger value!)	
Calculate the magnification of an image when provided with the actual size of the object (M = I / A)	
Calculate the actual size of an object when provided with an image and the magnification (A = I / M)	
Convert ordinary numbers in to standard form (A x 10^{B}) AND vice versa.	

1.2- What happens in cells (and what do cells need)

I can…	
Describe a biological molecule as a molecule that an organism is made up of. All cells are built using the same basic molecules.	
State that water (H_2O) is the most abundant molecule in living cells.	
Name the four main biological molecules as proteins, carbohydrates, lipids (fats) and nucleic acids.	
Identify proteins, carbohydrates and nucleic acids as being polymers AND ***name*** the monomers that each of these polymers is made up of.	
Identify the components of a lipid. (glycerol and fatty acids)	
Describe the main functions of each bio-molecule.	
Name DNA as an example of a nucleic acid.	
Describe the structure of DNA (two polymer strands made up on nucleotide monomers, 'double helix'. Four different bases A,C,G,T. Complementary base pairing between A-T, C-G holding two strands together.)	
Describe how DNA can be replicated to build exact copies needed for when new cells are made (cell division). Semi-conservative replication, original strands act as templates.	
State the function of DNA as a code to build proteins. The sequence of bases is the code that determines the order of amino acids in the final protein.	
Name RNA as another example of a nucleic acid.	
Describe the structure of RNA (single strand of nucleotide monomers. Four different bases A,C,G,U.)	
Identify the differences between the structures of DNA and RNA.	
Describe the basic principle of protein synthesis (including unzipping of the DNA molecule containing the gene, making a mRNA copy of the gene in the nucleus (transcription), the RNA gene copy leaving the nucleus, and a ribosome in the cytoplasm reading the base sequence of the gene copy (3 bases at a time) and joining together amino acids in order (translation)	

Use a genetic code table to determine the amino acid order coded for by a gene.	
Explain how a change in sequence of bases of DNA (a mutation) can affect the function of the protein produced.	
Identify enzymes as protein molecules that lower the activation energy of a chemical reaction. (biological catalysts).	
Use the terms *enzyme, active site, specific, substrate, products, collision,* and *denature* correctly. (Lock and key theory)	
Describe AND ***explain*** the effects of temperature, pH and substrate concentration on enzyme activity. (sketch graphs)	
Describe a method that could be used to investigate enzyme activity for a reaction that produces a gas **(PAG4)**	
Analyse numerical data, including mean calculations and rate calculations, AND present data graphically.	
Describe digestion as a process of breaking down large (insoluble) molecules into small (soluble) molecules.	
Identify the mechanical aspects (mastication by teeth, squeezing and churning by muscles) and the chemical aspects (enzymes) of digestion.	
Name the specific enzyme used and products made during the digestion of proteins, carbohydrates and lipids (fats).	
Identify where protease, amylase and lipase enzymes are made, AND where they act.	
Describe AND ***explain*** the roles of hydrochloric acid (HCl) and bile during digestion.	
Describe the term balanced diet.	
Identify the required nutrient types in a balanced diet AND give examples of food high in each nutrient.	
Describe the role of each nutrient type in the body.	
State that foods can be investigated using specific chemical tests to see which nutrient types they contain.	
Describe the chemical tests for starch (iodine-blue/black), sugar (benedicts-red/orange), protein (biuret-purple) and lipid (ethanol and water- emulsion) **(PAG 2)**	

1.3- Respiration

I can…	
Describe respiration as a chemical reaction that occurs inside ALL living cells that releases energy from food (glucose)	
Explain that enzymes control ALL chemical reactions that take place inside cells.	
Identify ATP as a small molecule that is used by ALL cells as energy currency. (Respiration produces ATP)	
State processes that require energy in cells (eg. movement, protein synethesis etc)	
Describe respiration as an exothermic reaction (releases heat energy)	
Name the two types of respiration (aerobic and anaerobic)	
Describe aerobic respiration as a reaction that takes place when oxygen is plentiful	
State that aerobic respiration takes place in the mitochondria and produces lots of ATP	
Recall the summary word equation for aerobic respiration	
Write a balanced symbol equation for aerobic respiration	
Link the effects of exercise (including increased heart and ventilation rates) to aerobic respiration.	
Describe anaerobic respiration as a reaction that takes place in the absence of oxygen	
State that anaerobic respiration occurs in the cytoplasm and produces less ATP than aerobic respiration.	
Recall the summary word equation for anaerobic respiration in animals (lactic acid).	
Link a build up of lactic acid during vigorous exercise to muscle fatigue/ cramp.	
Explain the term ‘oxygen debt’.	
Compare anaerobic respiration in animals, plants, fungi and bacteria (lactic acid, CO_2 and alcohol)	

1.4- Photosynthesis

Use the term producer to describe green plants (producers are organisms that make their own food using a chemical reaction called photosynthesis)	
Recognise the importance of plants to all other forms of life (start of ALL food chains, plants produce biomass)	
Recall the summary word equation for photosynthesis	
Write a balanced symbol equation for photosynthesis	
Describe and explain early experiments investigating photosynthesis and plant growth (eg. Van Helmont and Priestley)	
Describe photosynthesis as an endothermic reaction (requires energy) that occurs in the chloroplasts (using a pigment called chlorophyll that absorbs light energy) to produce sugar/ glucose	
Describe the uses of the glucose made by photosynthesis (respiration for energy, storage as starch, conversion to proteins, fats and other carbs)	
State that photosynthesis has two main parts 1- water molecules split into H+ ions and O_2 gas ***using light energy*** 2- H+ ions are added to CO_2 to create glucose	
Explain that enzymes control ALL chemical reactions that take place inside cells.	
Describe the effects of different factors on the rate of photosynthesis: temperature, light intensity and CO_2 conc. (including use of sketch graphs)	
Explain the effects of different factors on the rate of photosynthesis: temperature, light intensity and CO_2 conc. using the idea of limiting factors.	
Describe how to measure the rate of photosynthesis by collecting volume of O_2 produced in a set time or, counting number of bubbles in a set time.	
Understand that the **inverse square law** can be used to measure light intensity (as you increase the distance of a lamp from a photosynthesising plant, the light intensity decreases by the square of that distance) Light intensity = $\frac{1}{\text{distance}^2}$	
Describe how to maximise the rate of photosynthesis (eg. green houses) by choosing the best values for several factors limiting the rate of photosynthesis.	

Unit 2: Scaling up

2.1– Supplying the cell

I can…	
Name substances that are required to move into and out of cells.	
Describe the cell surface membrane as a partially permeable structure.	
Describe the process of diffusion as the movement of a substance from an area of high concentration to an area of lower concentration (a passive process=no ATP/energy required).	
State which factors affect the rate of diffusion, and explain why.	
State some examples of diffusion in organisms.	
Describe the diffusion of water through a partially permeable membrane as OSMOSIS.	
Use the term water potential to describe the amount of 'free' water molecules in a solution.	
Describe a solution as solute dissolved in solvent.	
Explain how the water potential of a solution changes as more solute is added.	
Use the terms isotonic, hypotonic and hypertonic when comparing solutions.	
Describe the effects of osmosis on animal cells (lysis and crenate).	
Describe the effects of osmosis on plant cells (turgid and flaccid/plasmolysed).	
Explain the reason for these different effects .	
State the difference between a passive and an active process.	
Describe how molecules can move by active transport (against the concentration gradient, using ATP/energy and requiring specific helper proteins in the membrane).	
Explain where the ATP/energy for active transport comes from.	
Describe some examples of active transport in organisms including ion uptake by root hair cells and glucose absorption in the small intestine.	

Give reasons why new cells need to be made (growth, repair and reproduction).	
Describe the life cycle of a cell as the preparation for, and the process of cell division.	
Describe what happens during the preparation phase (interphase) including growth, production of proteins and organelles and DNA replication.	
Describe how DNA is replicated (semi-conservative replication).	
Use the term chromatids when describing how chromosomes look once DNA has replicated (each chromosome now has chromatids = 'x' shaped).	
Describe the stages of MITOSIS (division of the nucleus) including • Chromosomes condense and become visible (prophase) • Chromosomes line up along the middle (metaphase) • Chromatids pulled to opposite poles by spindle fibres (anaphase) • New nuclei form around the two sets of chromosomes (telophase).	
Describe the final phase of cell cycle as cytoplasm division = cytokinesis.	
Use the terms zygote (fertilised egg) and embryo (ball of identical cells).	
Describe how embryos are formed by mitosis.	
Explain how cells from an embryo are unspecialised (have not yet differentiated) and have the potential to give rise to any type of specialised cell. These cells are called embryonic stem cells.	
Stem cells • Are unspecialised • Divide indefinitely • Can produce several types of specialised cells.	
Describe 'differentiation' as the process of an unspecialised cell becoming specialised by turning on/turning off certain genes.	
State that stem cells can be found in adult tissue too, although these do not have the same potential as embryonic stem cells (can only become a few cell types, not all).	
Describe how stem cells may be used in medical research.	
Evaluate the use of stem cells (ethics).	
State that plants also have stem cells (in meristem regions such as shoot and root tips).	

2.2- Challenges of size

I can…	
State how multicellular organisms need highly adapted structures including gaseous exchange surfaces and transport systems to enable living processes to be performed effectively.	
Describe the term ‘surface area:volume’	
State that small objects have a big SA:vol, whilst big objects have a small SA:vol	
Link SA:vol to diffusion	
Describe the main structures of the human gas exchange system, in particular alveoli as the site of gas exchange	
Relate the circulatory system to the gas exchange system (oxygen diffuses into the blood at the alveoli and is then pumped around the body to all cells)	
Describe the circulatory system as a ‘double circulation’ system (heart to lungs, then heart to body)	
Describe the structure of a human heart (2halves, 4 chambers, cardiac muscle, main blood vessels in and out, valves)	
Describe the structure of blood vessels with reference to thickness of walls, diameter of lumen, presence of valves	
Explain how the structure of the heart and the blood vessels are adapted to their functions	
Name the main components of blood.	
Explain how red blood cells and plasma are adapted to their transport functions.	
Describe how the roots, stem and leaves of a plant form a system for transport of substances around the plant.	
Explain that root hair cells are adapted for the absorption of water and mineral ions by having a large surface area, and lots of mitochondria for active transport.	
State that xylem tissue transports water and mineral ions from the roots up to the stems and leaves. *(X W)*	
Describe how plants lose water vapour from their leaves via the stomata. This is called transpiration.	

Describe how the rate of transpiration is affected several factors including humidity, temperature, air movement, light intensity. I can explain these effects.	
Use the term transpiration stream to describe the movement of water from the roots through the xylem and out of the leaves	
Explain that wilting occurs if plants lose water faster than it is replaced by the roots.	
Describe how a simple potometer can be used to investigate factors that affect the rate of water uptake (effectively the rate of transpiration)	
State that phloem tissue transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage. (mmm…phloem sounds nice, sugar is nice)	
Describe the movement of sugars from the leafs to other tissues throughout the plant as Translocation.	

Unit 3: Coordination and control

3.1– The Nervous System

I can…	
Describe the function of the nervous system (how the body communicates with itself and also receives information from its surroundings.)	
State that sense organs contain receptor cells to detect specific stimuli (changes in the environment)	
Describe how upon detecting a stimulus receptor cells generate an electrical signal that can be transmitted along nerve cells (neurones)	
Identify the brain and spinal cord as the central nervous system CNS [also called coordinators]. CNS contains relay neurons.	
State that sensory neurones transmit impulses TO the CNS, motor neurones transmit impulses FROM the CNS.	
Describe the basic pathway of a nervous impulse [receptor -> coordinator -> effector}	
State that effectors cause a response. They are either muscles (causing movement) or glands (causing the secretion of chemicals/hormone)	
Explain the purpose of reflex actions (rapid response to evade danger.)	
Describe the pathway of a reflex arc. Only 3 neurones involved. Uses closest coordinator (not necessarily the brain) for fastest response. [receptor>sensory neurone>relay neurone>motor neurone>effector]	
State that a synapse is a gap between two neurones.	
Describe how the electrical impulse is transmitted across the synapse as a chemical message. Neurotransmitter diffuses across the synapse and is detected by the next neurone generating a new electrical impulse.	
Explain how the main structures of the eye are related to their functions (including cornea, iris, pupil, lens, retina, optic nerve, ciliary body, suspensory ligaments)	
Describe common defects of the eye and explain how some of these problems may be overcome (including colour blindness, short-sightedness and long-sightedness)	
Describe the structure and function of the brain (including cerebrum, cerebellum, medulla, hypothalamus, pituitary)	
Explain some of the difficulties of investigating brain function (including the difficulty in getting research subjects and the consideration of ethical issues)	
Explain some of the limitations in treating damage and disease in the brain and other parts of the nervous system (including the limited ability to repair nervous tissue, irreversible damage to the surrounding tissues and difficulties with accessing parts of the nervous system)	

3.2- Coordination and control – The endocrine system

(PART 1: animal hormones)

I can…	
Understand that not all co-ordination and control of the body is carried out by the nervous system. There is a system of control that uses chemicals in its mechanism called the endocrine system.	
State that hormones are chemical messengers.	
Describe how, in animals, hormones are released by endocrine GLANDS, transported around the body in the BLOOD plasma and affect TARGET cells that have specific RECEPTORS on their cell surface membrane.	
Explain the role of thyroxine in the body (including how the thyroid gland produces thyroxine that controls the speed at which oxygen and food products are burned up to produce ATP/energy [metabolism])	
Use thyroxine as an example of a negative feedback system	
Explain the role of adrenalin in the body (including adrenal glands release adrenaline many cells in the body contain receptors for adrenaline allowing the hormone to exert an effect on a wide variety of tissues, responsible for 'fight or flight' responses)	
Describe the role of hormones in controlling the human menstrual cycle, including • FSH (matures an egg + stimulates oestrogen secretion from ovaries) • Oestrogen (builds up the uterus lining, inhibits FSH secretion from pituitary+ stimulates LH release from pituitary) • LH (releases the egg from the ovary [ovulation]) • Progesterone (maintains the uterus lining during mid/end of cycle and into pregnancy)	
Analyse the relative hormones levels from raw data and graphically.	
Explain the artificial use of hormones in contraception	
Describe the various methods of contraception available (hormonal and non-hormonal) and evaluate their relative effectiveness and ethical use	
Explain the use of hormones in modern reproductive technologies to treat infertility (including FSH use to increase the number of mature eggs available)	

3.2- Coordination and control – The endocrine system

(PART 2 : plant hormones)

I can…	
Explain how plant hormones are important in the control and coordination of plant growth and development.	
Describe plant growth in response to environmental stimuli as tropisms • Phototropism= growth of shoot towards light • Gravitropism=growth of shoot away from gravity AND growth of roots towards gravity • Hydrotropism = growth of roots towards water	
Identify Auxin as the hormone that controls plant growth in the growing tips of shoots and roots. Auxin causes cell elongation. Unequal distribution of auxin results in unequal growth (bending of shoots/roots)	
Identify Gibberellin as another plant hormone controlling growth of the stem.	
Identify Ethene a plant hormone responsible for fruit ripening.	
Describe some of the different ways in which people use plant hormones to control plant growth (including selective herbicides, root cuttings, seedless fruit (parthenocarpic fruit development-seedless fruit), altering dormancy)	

3.3- Homeostasis: Maintaining internal environments

I can…	
Describe Homeostasis as the mechanisms involved in keeping internal conditions of the body constant. 'same state'	
Explain the importance of homeostatic mechanisms to allow metabolic reactions to proceed at appropriate rates. For our cells to function properly the environment that surrounds them needs to be controlled at an optimum level. • Temperature (37◦C) • Water concentration (Isotonic) • Sugar concentration (Isotonic) • Toxic substances need to be removed.	
Describe how body temperature is monitored by the thermoregulatory centre in the Hypothalamus of the brain. This centre has receptors sensitive to the temperature of the blood flowing through the brain. Also temperature receptors in the skin send impulses to the thermoregulatory centre, giving information about skin temperature.	
Describe how core body temperature is controlled by the thermoregulatory centre by sending impulses to effectors (muscles and glands) If the core body temperature is too high: • blood vessels supplying the skin capillaries dilate (get wider) so that more blood flows through the capillaries and more heat is lost by RADIATION from the skin surface VASODILATION. sweat glands release more sweat which cools the body as it EVAPORATES. If the core body temperature is too low: • blood vessels supplying the skin capillaries constrict (get narrower) to reduce the flow of blood through the capillaries VASOCONSTRICTION • muscles may 'shiver' – their CONTRACTION requires ATP/energy from respiration, which releases some heat energy to warm the body.	
Explain why GLUCOSE is needed by all cells of the body for respiration- Chemical energy stored in the glucose is released and used by the cell.	
Explain why the concentration of glucose in the blood needs to be controlled to ensure there is enough for efficient respiration, but not too much as to negatively affect cells (osmosis)	
Describe how glucose levels rise after eating and fall during exercise.	
Describe how blood glucose concentration of the body is monitored and controlled by the PANCREAS. The pancreas is a gland that produces and secretes two hormones INSULIN and GLUCAGON.	

Describe what happens when glucose levels are high;

- Insulin is secreted.
- Insulin targets cells in the LIVER and muscles causing glucose to be absorbed from the blood and converted to insoluble GLYCOGEN for storage.
- Blood glucose concentration is lowered.

Describe what happens when glucose levels are low;

- Glucagon is secreted.
- Glucagon targets cells in the LIVER and muscles causing glycogen to be converted back into GLUCOSE and released from cells.
- Blood glucose concentration is increased.

Describe Diabetes as a disease where a person is unable to control their blood glucose concentration effectively.

Compare the two main types of diabetes:

- Type 1 is where insulin is not made or not made correctly by the pancreas (people are usually born with Type 1, or develop it following a virus)
- Type 2 is where insulin is made but either not enough or the body becomes insensitive to it (this form is associated with obesity and the elderly)

Explain how Diabetes may be controlled by careful attention to diet and exercise. Type 1 diabetics may also be treated by injecting insulin.

Identify the main waste products that have to be removed from the body including:

- carbon dioxide, produced by all cells during respiration
- urea, produced in the liver by the breakdown of excess amino acids

Describe how Urea is carried from the liver in the bloodstream and removed by the kidneys in the urine, which is temporarily stored in the bladder.

State that humans have two bean-shaped organs (kidneys) located in the abdominal cavity. The main function of the kidneys is to remove toxic urea from the blood, and to regulate the balance of electrolytes (salts/ions) and water in the blood. The kidneys produce a substance called urine.

Describe the gross structure of the kidney (capsule, cortex, medulla) and the structure of the kidney tubule (nephron)

Describe how a healthy kidney produces urine by:

• First FILTERING ALL the sugar, salt, water and urea out of the blood under high pressure. (the pores in the filtering unit are small so blood cells and proteins are not filtered out).
• ALL of the sugar is then actively REABSORBED
• As much salt needed by the body is reabsorbed (diffusion)
• As much water as is needed is reabsorbed (osmosis)
• Excess ions and water, and ALL the urea are then released from the kidney as urine.

Describe the effect of ADH on the permeability of the kidney tubules, referring to the amount of water reabsorbed and negative feedback

Explain the response of the body to different temperature and osmotic challenges, including response to dehydration/high sweating, effects of over hydration/excessive water intake, effects of high salt intake.

Evaluate the effectiveness of sports drinks (glucose- for respiration/energy, water to replace loss via sweating, salt/ions to replace loss via sweating)

Unit 4: Ecosystems

I can…	
Describe an ecosystem in terms of the living components (community of different organisms) within the physical area (habitat).	
Describe a group of organisms belonging to the same species living within a habitat as a population.	
State the difference between biotic and abiotic factors	
Explain how abiotic and biotic factors can affect communities (including temperature, light intensity, moisture level, pH of soil, predators, food/prey)	
State the factors that plants and animals need to survive.	
Describe the differences between the trophic levels (feeding levels) of organisms within an ecosystem (producers and consumers) – food chains/webs	
Describe the importance of interdependence and competition in a community (predation, mutualism and parasitism)	
Explain how predator and prey populations fluctuate in a predation relationship	
Describe the difference between parasitism and mutualism	
Define biomass and describe how biomass data is collected	
Construct and ***describe*** pyramids of biomass	
Explain, with examples, how biomass is lost between the different trophic levels (loss of biomass related to egestion, excretion, respiration)	
Calculate the efficiency of biomass transfers between trophic levels	
Explain why the number of trophic levels in a food chain is limited	
State that many different materials cycle through the abiotic and biotic components of an ecosystem (eg Carbon, Nitrogen and water)	
Describe how water is cycled through an ecosystem and ***explain*** the importance of the water cycle to living organisms (maintaining habitats and flow of nutrients through ecosystem)	
Describe the importance of nitrogen to organisms (required for DNA and proteins)	
Describe how nitrogen is cycled through an ecosystem	
Describe the main stages of the carbon cycle(especially how carbon is added to and removed from the atmosphere.	
Explain why atmospheric carbon dioxide levels are increasing, including interpretation of data relating to changes in atmospheric carbon dioxide levels.	
Explain the role of microorganisms in the cycling of materials through an ecosystem (***state*** examples of decomposers and ***define*** decomposition)	
Explain the effect of factors such as temperature, water content, and oxygen availability on rate of decomposition (aerobic and anaerobic)	