**Combined Science (Biology) Higher Paper**

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**Topic 1 – Key Concepts in Biology. Some short answer questions from this topic may be on either Paper 1 or Paper 2**

**• Topic 1 Key concepts in biology – enzymes (1.7–1.12)**

1.7 Explain the mechanism of enzyme action including the active site and enzyme specificity

1.8 Explain how enzymes can be denatured due to changes in the shape of the active site

1.9 Explain the effects of temperature, substrate concentration and pH on enzyme activity

1.10 Core Practical: Investigate the effect of pH on enzyme activity 2c, 2f

1.11 Demonstrate an understanding of rate calculations for enzyme activity

1.12 Explain the importance of enzymes as biological catalysts in the synthesis of carbohydrates, proteins and lipids and their breakdown into sugars, amino acids and fatty acids and glycerol

**• Topic 2 Cells and control – cell cycle (2.1–2.6)**

2.1 Describe mitosis as part of the cell cycle, including the stages interphase, prophase, metaphase, anaphase and telophase and cytokinesis

2.2 Describe the importance of mitosis in growth, repair and asexual reproduction

2.3 Describe the division of a cell by mitosis as the production of two daughter cells, each with identical sets of chromosomes in the nucleus to the parent cell, and that this results in the formation of two genetically identical diploid body cells

2.4 Describe cancer as the result of changes in cells that lead to uncontrolled cell division

2.5 Describe growth in organisms, including:

a cell division and differentiation in animals

b cell division, elongation and differentiation in plants

2.6 Explain the importance of cell differentiation in the development of specialised cells

**• Topic 3 Genetics – reproduction and DNA (3.3–3.6)**

3.3 Explain the role of meiotic cell division, including the production of four daughter cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes. The stages of meiosis are not required

3.4 Describe DNA as a polymer made up of:

a two strands coiled to form a double helix

b strands linked by a series of complementary base pairs joined together by weak hydrogen bonds

c nucleotides that consist of a sugar and phosphate group with one of the four different bases attached to the sugar

3.5 Describe the genome as the entire DNA of an organism and a gene as a section of a DNA molecule that codes for a specific protein

3.6 Explain how DNA can be extracted from fruit

**• Topic 4 Natural selection and genetic modification – inheritance (4.2–4.5)**

4.2 Explain Darwin’s theory of evolution by natural selection

4.3 Explain how the emergence of resistant organisms supports

Darwin’s theory of evolution including antibiotic resistance in

bacteria

4.4 Describe the evidence for human evolution, based on fossils, including:

a Ardi from 4.4 million years ago

b Lucy from 3.2 million years ago

c Leakey’s discovery of fossils from 1.6 million years ago

4.5 Describe the evidence for human evolution based on stone tools, including:

a the development of stone tools over time

b how these can be dated from their environment

**• Topic 4 Natural selection and genetic modification – genetic modification (4.8– 4.11)**

4.8 Explain selective breeding and its impact on food plants and domesticated animals

4.10 Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics

4.11 Describe the main stages of genetic engineering including the use of:

a restriction enzymes

b ligase

c sticky ends

d vectors

**• Topic 5 Health, disease, and the development of medicines – disease (5.2–5.8)**

5.2 Describe the difference between communicable and non-communicable diseases

5.3 Explain why the presence of one disease can lead to a higher susceptibility to other diseases

2c, 2d, 2g

4a, 4c

5.4 Describe a pathogen as a disease-causing organism, including viruses, bacteria, fungi and protists

5.5 Describe some common infections, including:

a cholera (bacteria) causes diarrhoea

b tuberculosis (bacteria) causes lung damage

c Chalara ash dieback (fungi) causes leaf loss and bark lesions

d malaria (protists) causes damage to blood and liver

e HIV (virus) destroys white blood cells, leading to the onset of AIDS

5.6 Explain how pathogens are spread and how this spread can be reduced or prevented, including:

a cholera (bacteria) – water

b tuberculosis (bacteria) – airborne

c Chalara ash dieback (fungi) – airborne

d malaria (protists) – animal vectors

5.8 Explain how sexually transmitted infections (STIs) are spread and how this spread can be reduced or prevented, including:

a Chlamydia (bacteria) b HIV (virus)

**Core practical activities that will be assessed:**

**• Core Practical 1.6 Investigate biological specimens using microscopes, including magnification calculations and labelled scientific drawings from observations.**

**• Core Practical 1.10 Investigate the effect of pH on enzyme activity.**

**Content will be assessed from the following topics:**

**• Topic 7 Animal co-ordination, control, and homeostasis – human hormones (7.1–7.8)**

7.1 Describe where hormones are produced and how they are transported from endocrine glands to their target organs, including the pituitary gland, thyroid gland, pancreas, adrenal glands, ovaries and testes

7.2 Explain that adrenalin is produced by the adrenal glands to prepare the body for fight or flight, including:

a increased heart rate

b increased blood pressure

c increased blood flow to the muscles

d raised blood sugar levels by stimulating the liver to change glycogen into glucose

7.3 Explain how thyroxine controls metabolic rate as an example of negative feedback, including:

a low levels of thyroxine stimulates production of TRH in hypothalamus

b this causes release of TSH from the pituitary gland

c TSH acts on the thyroid to produce thyroxine

d when thyroxine levels are normal thyroxine inhibits the release of TRH and the production of TSH

7.4 Describe the stages of the menstrual cycle, including the roles of the hormones oestrogen and progesterone, in the control of the menstrual cycle

7.5 Explain the interactions of oestrogen, progesterone, FSH and LH in the control of the menstrual cycle, including

the repair and maintenance of the uterus wall, ovulation and menstruation

7.6 Explain how hormonal contraception influences the menstrual cycle and prevents pregnancy

7.7 Evaluate hormonal and barrier methods of contraception

7.8 Explain the use of hormones in Assisted Reproductive

Technology (ART) including IVF and Clomifene therapy

**• Topic 8 Exchange and transport in animals – respiration (8.9–8.12)**

8.9 Describe cellular respiration as an exothermic reaction which occurs continuously in living cells to release energy for metabolic processes, including aerobic and anaerobic respiration

8.10 Compare the process of aerobic respiration with the process of anaerobic respiration

8.11 Core Practical: Investigate the rate of respiration in living organisms

8.12 Calculate heart rate, stroke volume and cardiac output, using the equation cardiac output = stroke volume × heart rate

**• Topic 9 Ecosystems and material cycles – organisms and the environment (9.4–9.5)**

9.4 Describe how the survival of some organisms is dependent on other species, including parasitism and mutualism

9.5 Core Practical: Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects

**• Topic 9 Ecosystems and material cycles – conservation and material cycles (9.10–9.15)**

9.10 Explain the benefits of maintaining local and global biodiversity, including the conservation of animal species and the impact of reforestation

9.12 Describe how different materials cycle through the abiotic and biotic components of an ecosystem

9.13 Explain the importance of the carbon cycle, including the processes involved and the role of microorganisms as

decomposers

9.14 Explain the importance of the water cycle, including the processes involved and the production of potable water in areas of drought including desalination

9.15 Explain how nitrates are made available for plant uptake, including the use of fertilisers, crop rotation and the role of bacteria in the nitrogen cycle

**Core practical activities that will be assessed:**

**• Core Practical 8.11 Investigate the rate of respiration in living organisms.**

**• Core Practical 9.5 Investigate the relationship between organisms and their environment using field-work techniques, including quadrats and belt transects.**