**F212: Molecules, Biodiversity, Food and Health**

**Revision Booklet**

**Each page is headed by statements from your specification. Fill the space below with notes that fit in with the statement. This will make sure you complete every area of the specification in enough detail. Good luck!**

Candidates should be able to:

1. describe how hydrogen bonding occurs between water molecules, and relate this, and other properties of water, to the roles of water in living organisms (HSW1);

 (b) describe, with the aid of diagrams, the structure of an amino acid;

(c) describe, with the aid of diagrams, the formation and breakage of peptide bonds in the synthesis and hydrolysis of dipeptides and polypeptides;

 (d) explain, with the aid of diagrams, the term *primary structure;*

(e) explain, with the aid of diagrams, the term *secondary structure* with reference to hydrogen bonding;

(f) explain, with the aid of diagrams, the term *tertiary structure*, with reference to hydrophobic and hydrophilic interactions, disulfide bonds and ionic interactions;

(g) explain, with the aid of diagrams, the term *quaternary structure*, with reference to the structure of haemoglobin;

(h) describe, with the aid of diagrams, the structure of a collagen molecule;

(i) compare the structure and function of haemoglobin (as an example of a globular protein) and collagen (as an example of a fibrous protein);

(j) describe, with the aid of diagrams, the molecular structure of alpha-glucose as an example of a monosaccharide carbohydrate;

(k) state the structural difference between alpha- and beta-glucose;

(l) describe, with the aid of diagrams, the formation and breakage of glycosidic bonds in the synthesis and hydrolysis of a disaccharide (maltose) and a polysaccharide (amylose);

(m) compare and contrast the structure and functions of starch (amylose) and cellulose;

(n) describe, with the aid of diagrams, the structure of glycogen;

(o) explain how the structures of glucose, starch (amylose), glycogen and cellulose molecules relate to their functions in living organisms;

(p) compare, with the aid of diagrams, the structure of a triglyceride and a phospholipid;

(q) explain how the structures of triglyceride, phospholipid and cholesterol molecules relate to their functions in living organisms;

(r) describe how to carry out chemical tests to identify the presence of the following molecules: protein (biuret test), reducing and non-reducing sugars (Benedict’s test), starch (iodine solution) and lipids (emulsion test);

(s) describe how the concentration of glucose in a solution may be determined using colorimetry (HSW3).

 (a) state that deoxyribonucleic acid (DNA) is a polynucleotide, usually double stranded, made up of nucleotides containing the bases adenine (A), thymine (T), cytosine (C) and guanine (G);

(b) state that ribonucleic acid (RNA) is a polynucleotide, usually single stranded, made up of nucleotides containing the bases adenine (A), uracil (U), cytosine (C) and guanine (G);

(c) describe, with the aid of diagrams, how hydrogen bonding between complementary base pairs (A to T, G to C) on two antiparallel DNA polynucleotides leads to the formation of a DNA molecule, and how the twisting of DNA produces its ‘double-helix’ shape (HSW1);

(d) outline, with the aid of diagrams, how DNA replicates semi-conservatively, with reference to the role of DNA polymerase;

(e) state that a gene is a sequence of DNA nucleotides that codes for a polypeptide (HSW3);

(f) outline the roles of DNA and RNA in living organisms (the concept of protein synthesis must be considered in outline only).

 (a) state that enzymes are globular proteins, with a specific tertiary structure, which catalyse metabolic reactions in living organisms;

(b) state that enzyme action may be intracellular or extracellular;

1. describe, with the aid of diagrams, the mechanism of action of enzyme molecules, with reference to specificity, active site, lock and key hypothesis, induced-fit hypothesis, enzyme-substrate complex, enzyme-product complex and lowering of activation energy;

(d) describe and explain the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity;

(e) describe how the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme activity can be investigated experimentally;

(f) explain the effects of competitive and non-competitive inhibitors on the rate of enzyme-controlled reactions, with reference to both reversible and non-reversible inhibitors;

(g) explain the importance of cofactors and coenzymes in enzyme-controlled reactions;

(h) state that metabolic poisons may be enzyme inhibitors, and describe the action of one named poison;

(i) state that some medicinal drugs work by inhibiting the activity of enzymes (HSW6a).

 (a) define the term *balanced diet*;

(b) explain how consumption of an unbalanced diet can lead to malnutrition, with reference to obesity (HSW4);

(c) discuss the possible links between diet and coronary heart disease (CHD);

1. discuss the possible effects of a high blood cholesterol level on the heart and circulatory system, with reference to high-density lipoproteins (HDL) and low-density lipoprotein (LDL) (HSW1);

(e) explain that humans depend on plants for food as they are the basis of all food chains. (**No** details of food chains are required);

(f) outline how selective breeding is used to produce crop plants with high yields, disease resistance and pest resistance (HSW6a);

(g) outline how selective breeding is used to produce domestic animals with high productivity (HSW6a);

(h) describe how the use of fertilisers and pesticides with plants and the use of antibiotics with animals can increase food production (HSW6a, 6b);

(i) describe the advantages and disadvantages of using microorganisms to make food for human consumption;

(j) outline how salting, adding sugar, pickling, freezing, heat treatment and irradiation can be used to prevent food spoilage by microorganisms.

 (a) discuss what is meant by the terms *health* and *disease*;

(b) define and discuss the meanings of the terms *parasite* and *pathogen*;

(c) describe the causes and means of transmission of malaria, AIDS/HIV and TB (knowledge of the symptoms of these diseases is not required);

(d) discuss the global impact of malaria, AIDS/HIV and TB (HSW4, 6a, 7c);

(e) define the terms *immune response*, *antigen* and *antibody*;

(f) describe the primary defences against pathogens and parasites (including skin and mucus membranes) and outline their importance. (**No** details of skin structure are required);

(g) describe, with the aid of diagrams and photographs, the structure and mode of action of phagocytes;

(h) describe, with the aid of diagrams, the structure of antibodies;

(i) outline the mode of action of antibodies, with reference to the neutralisation and agglutination of pathogens;

(j) describe the structure and mode of action of T lymphocytes and B lymphocytes, including the significance of cell signalling and the role of memory cells;

(k) compare and contrast the primary and secondary immune responses;

(l) compare and contrast active, passive, natural and artificial immunity;

(m) explain how vaccination can control disease (HSW6a, 7c);

(n) discuss the responses of governments and other organisations to the threat of new strains of influenza each year (HSW7b, 7c);

(o) outline possible new sources of medicines, with reference to microorganisms and plants and the need to maintain biodiversity (HSW 6a, 6b, 7b);

(p) describe the effects of smoking on the mammalian gas exchange system, with reference to the symptoms of chronic bronchitis, emphysema (chronic obstructive pulmonary disease) and lung cancer;

(q) describe the effects of nicotine and carbon monoxide in tobacco smoke on the cardiovascular system with reference to the course of events that lead to atherosclerosis, coronary heart disease and stroke;

(r) evaluate the epidemiological and experimental evidence linking cigarette smoking to disease and early death (HSW3, 6a, 7a, 7b, 7c).

 (a) define the terms *species*, *habitat* and *biodiversity*;

(b) explain how biodiversity may be considered at different levels; habitat, species and genetic;

(c) explain the importance of sampling in measuring the biodiversity of a habitat (HSW7a, 7b, 7c);

(d) describe how random samples can be taken when measuring biodiversity;

(e) describe how to measure species richness and species evenness in a habitat;

(f) use Simpson’s Index of Diversity (*D*) to calculate the biodiversity of a habitat, using the formula *D* = 1-(Σ(*n*/*N*)2) (HSW3);

(g) outline the significance of both high and low values of Simpson’s Index of Diversity (*D*);

(h) discuss current estimates of global biodiversity (HSW7a, 7b, 7c).

 (a) define the terms *classification*, *phylogeny* and *taxonomy*;

(b) explain the relationship between classification and phylogeny;

(c) describe the classification of species into the taxonomic hierarchy of domain, kingdom, phylum, class, order, family, genus and species;

(d) outline the characteristic features of the following five kingdoms: Prokaryotae (Monera), Protoctista, Fungi, Plantae, Animalia;

(e) outline the binomial system of nomenclature and the use of scientific (Latin) names for species;

(f) use a dichotomous key to identify a group of at least six plants, animals or microorganisms;

(g) discuss the fact that classification systems were based originally on observable features but more recent approaches draw on a wider range of evidence to clarify relationships between organisms, including molecular evidence (HSW1, 7a);

(h) compare and contrast the five kingdom and three domain classification systems (HSW4, 7a, 7b).

 (a) define the term *variation*;

(b) discuss the fact that variation occurs within as well as between species;

(c) describe the differences between continuous and discontinuous variation, using examples of a range of characteristics found in plants, animals and microorganisms;

(d) explain both genetic and environmental causes of variation;

(e) outline the behavioural, physiological and anatomical (structural) adaptations of organisms to their environments;

(f) explain the consequences of the four observations made by Darwin in proposing his theory of natural selection; (HSW1)

(g) define the term *speciation*;

(h) discuss the evidence supporting the theory of evolution, with reference to fossil, DNA and molecular evidence (HSW1, 4, 7a, 7b);

(i) outline how variation, adaptation and selection are major components of evolution;

(j) discuss why the evolution of pesticide resistance in insects and drug resistance in microorganisms has implications for humans (HSW6a, 7c).

 (a) outline the reasons for the conservation of animal and plant species, with reference to economic, ecological, ethical and aesthetic reasons (HSW6b);

(b) discuss the consequences of global climate change on the biodiversity of plants and animals, with reference to changing patterns of agriculture and spread of disease (HSW6a, 6b, 7a, 7b, 7c);

(c) explain the benefits for agriculture of maintaining the biodiversity of animal and plant species (HSW6a, 6b, 7c);

(d) describe the conservation of endangered plant and animal species, both *in situ* and *ex situ*, with reference to the advantages and disadvantages of these two approaches (HSW4, 6a, 6b);

(e) discuss the role of botanic gardens in the *ex situ* conservation of rare plant species or plant species extinct in the wild, with reference to seed banks;

(f) discuss the importance of international co-operation in species conservation with reference to The Convention in International Trade in Endangered Species (CITES) and the Rio Convention on Biodiversity (HSW6b, 7b, 7c);

(g) discuss the significance of environmental impact assessments (including biodiversity estimates) for local authority planning decisions. (HSW6b, 7c).