

MARINA INTERNATIONAL SCHOOL

BIOLOGY SCHEME OF WORK

FORM 5 - TERM 1

| WEEK | TOPIC | TOPIC DETAILS |
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| 1.1 | Asexual reproduction | <ul style="list-style-type: none">• Define asexual reproduction as a process resulting in the production of genetically identical offspring from one parent.• Identify examples of asexual reproduction from information provided.• Discuss the advantages and disadvantages of asexual reproduction:<ul style="list-style-type: none">• to a population of a species in the wild• to crop production. |
| 1.2 | Mitosis | <ul style="list-style-type: none">• Define mitosis as nuclear division giving rise to genetically identical cells (details of stages are not required).• State the role of mitosis in growth, repair of damaged tissues, replacement of cells and asexual reproduction.• State that the exact duplication of chromosomes occurs before mitosis.• State that during mitosis, the copies of chromosomes separate, maintaining the chromosome number (details of |
| 1.3 | mitosis | <ul style="list-style-type: none">• stages of mitosis are not required).• Describe stem cells as unspecialised cells that divide by mitosis to produce daughter cells that can become specialised for specific functions. |
| 2.1 | Sexual reproduction | <ul style="list-style-type: none">• Define sexual reproduction as a process involving the fusion of the nuclei of two haploid gametes (sex cells) to form a diploid zygote and the production of offspring that are genetically different from each other.• Define fertilisation as the fusion of gamete nuclei.• Discuss the advantages and disadvantages of sexual reproduction:<ul style="list-style-type: none">• to a population of a species in the wild• to crop production |

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| 2.2 | Meiosis | <p>State that meiosis is involved in the production of gametes.</p> <p>Define meiosis as nuclear (reduction) division in which the chromosome number is halved from diploid to haploid resulting in genetically different cells (details of stages are not required).</p> <p>Explain how meiosis produces variation by forming new combinations of maternal and paternal chromosomes (specific details are not required).</p> |
| 3.1 | Sexual reproduction in plants | <ul style="list-style-type: none"> • Identify and draw, using a hand lens if necessary, the sepals, petals, stamens, filaments and anthers, carpels, style, stigma, ovary and ovules, of an insect-pollinated flower. • State the functions of the sepals, petals, anthers, stigmas and ovaries. • Use a hand lens to identify and describe the anthers and stigmas of a wind-pollinated flower. • Distinguish between the pollen grains of insect-pollinated and wind-pollinated flowers |
| 3.2 | 3 Sexual reproduction in plants | <ul style="list-style-type: none"> • Define pollination as the transfer of pollen grains from the anther to the stigma. • Define self-pollination as the transfer of pollen grains from the anther of a flower to the stigma of the same flower or different flower on the same plant. • Define cross-pollination as transfer of pollen grains from the anther of a flower to the stigma of a flower on a different plant of the same species. • Discuss the implications to a species of self-pollination and cross-pollination in terms of variation, capacity to respond to changes in the environment and reliance on pollinators. • Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (details of production of endosperm and development are not required). Describe the structural adaptations of insect-pollinated and wind-pollinated flowers. • State that fertilisation occurs when a pollen nucleus fuses with a nucleus in an ovule. • Investigate and state the environmental conditions that affect germination of seeds, limited to the requirement for water, oxygen and a suitable temperature. |
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| 4.1 | Sexual Reproduction in humans | <ul style="list-style-type: none"> • Identify and name on diagrams of the male reproductive system: the testes, scrotum, sperm ducts, prostate gland, urethra and penis, and state the functions of these parts. • Identify and name on diagrams of the female reproductive system: the ovaries, oviducts, uterus, cervix and vagina, and state the functions of these parts. • Describe fertilisation as the fusion of the nuclei from a male gamete (sperm) and a female gamete (egg cell/ovum). • Compare male and female gametes in terms of size, structure, motility and numbers. • State and explain the adaptive features of sperm, limited to flagellum, mitochondria and enzymes in the acrosome. • State and explain the adaptive features of egg cells, limited to energy stores and the jelly coat that changes at fertilisation. |
| 5.1 | Sexual reproduction in human | <ul style="list-style-type: none"> • State that in early development, the zygote forms an embryo which is a ball of cells that implants into the wall of the uterus. • State and describe the functions of the amniotic sac and amniotic fluid, placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products and providing a barrier to toxins and pathogens (structural details are not required). • State that some toxins, e.g. nicotine, and pathogens, e.g. rubella virus, can pass across the placenta and affect the fetus. |
| 5.2 | Sexual reproduction in human | <ul style="list-style-type: none"> • Outline the growth and development of the fetus in terms of increasing complexity in the early stages and increasing size towards the end of pregnancy. • Describe the ante-natal care of pregnant women, limited to special dietary needs and the harm from smoking and alcohol consumption. • Outline the processes involved in labour and birth, limited to: <ul style="list-style-type: none"> • breaking of the amniotic sac • contraction of the muscles in the uterus wall • dilation of the cervix • passage through the vagina • tying and cutting the umbilical cord • delivery of the afterbirth. • Discuss the advantages and disadvantages of breast-feeding compared with bottle-feeding using formula milk. |

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| 5.3 | Sex hormones in humans | <ul style="list-style-type: none"> • Describe the roles of testosterone and oestrogen in the development and regulation of secondary sexual characteristics during puberty. • Describe the sites of production of oestrogen and progesterone in the menstrual cycle and in pregnancy. • Describe the menstrual cycle in terms of changes in the lining of the uterus and ovaries. • Explain the role of hormones in controlling the menstrual cycle and pregnancy, limited to FSH, LH, progesterone and oestrogen. |
| 6.1 | Methods of birth control in humans | <ul style="list-style-type: none"> • Outline the following methods of birth control: <ul style="list-style-type: none"> • natural, limited to abstinence, monitoring body temperature and cervical mucus • chemical, limited to IUD, IUS, contraceptive pill, implant and injection • barrier, limited to condom, femidom, diaphragm • surgical, limited to vasectomy and female sterilisation. • Outline the use of hormones in contraception and fertility treatments. • Outline artificial insemination (AI). • Outline the following methods of birth control: <ul style="list-style-type: none"> • natural, limited to abstinence, monitoring body temperature and cervical mucus • chemical, limited to IUD, IUS, contraceptive pill, implant and injection • barrier, limited to condom, femidom, diaphragm • surgical, limited to vasectomy and female sterilisation. • Outline the use of hormones in contraception and fertility treatments. • Outline artificial insemination (AI). • Outline in vitro fertilisation (IVF). • Discuss the social implications of contraception and fertility treatments. |

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| 6.2 | Chromosomes, Genes and Proteins | <ul style="list-style-type: none"> • Define sexually transmitted infection as an infection that is transmitted via body fluids through sexual contact. • State that human immunodeficiency virus (HIV) is an example of an STI. Explain how the spread of STIs is controlled. • Describe the methods of transmission of HIV. • State that HIV infection may lead to AIDS. • Outline how HIV affects the immune system, limited to decreased lymphocyte numbers and reduced ability to produce antibodies. |
| 7.1 | Inheritance | <ul style="list-style-type: none"> • Define inheritance as the transmission of genetic information from generation to generation. |
| 7.2 | Chromosomes, genes, and proteins | <ul style="list-style-type: none"> • Define chromosome as a thread-like structure of DNA, carrying genetic information in the form of genes. • Define gene as a length of DNA that codes for a protein. • Define allele as a version of a gene. • Describe the inheritance of sex in humans with reference to XX and XY chromosomes. • Explain that the sequence of bases in a gene is the genetic code for putting together amino acids in the correct order to make a specific protein (knowledge of the details of nucleotide structure is not required). • Explain that DNA controls cell function by controlling the production of proteins (some of which are enzymes), antibodies and receptors for neurotransmitters. • Explain how a protein is made, limited to: |

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| 7.3 | Chromosomes, genes, and proteins | <ul style="list-style-type: none"> • the gene coding for the protein remains in the nucleus • mRNA molecules carry a copy of the gene to the cytoplasm • the mRNA passes through ribosomes • the ribosome assembles amino acids into protein molecules • the specific order of amino acids is determined by the sequence of bases in the mRNA (knowledge of the details of transcription or translation is not required). • Explain that all body cells in an organism contain the same genes, but many genes in a particular cell are not expressed because the cell only makes the specific proteins it needs. • Define a haploid nucleus as a nucleus containing a single set of unpaired chromosomes, e.g. in gametes. • Define a diploid nucleus as a nucleus containing two sets of chromosomes, e.g. in body cells. • State that in a diploid cell, there is a pair of each type of chromosome and in a human diploid cell there are 23 pairs. |
| 8.1 | Monohybrid inheritance | <ul style="list-style-type: none"> • Define genotype as the genetic make-up of an organism in terms of the alleles present. • Define phenotype as the observable features of an organism. • Define homozygous as having two identical alleles of a particular gene. • State that two identical homozygous individuals that breed together will be pure-breeding. • Define heterozygous as having two different alleles of a particular gene. • State that a heterozygous individual will not be pure-breeding. • Define dominant as an allele that is expressed if it is present. • Define recessive as an allele that is only expressed when there is no dominant allele of the gene present. |
| 8.2 | Monohybrid inheritance | <ul style="list-style-type: none"> • Interpret pedigree diagrams for the inheritance of a given characteristic. • Use genetic diagrams to predict the results of monohybrid crosses and calculate phenotypic ratios, limited to 1:1 and 3:1 ratios. • Explain how to use a test cross to identify an unknown genotype. • Use Punnett squares in crosses which result in more than one genotype to work out and show the possible different genotypes. |

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| 8.3 | Codominance and sex linkage | <ul style="list-style-type: none"> • Explain co-dominance by reference to the inheritance of ABO blood groups – phenotypes being A, B, AB and O blood groups and alleles being I^A, I^B and I^o. • Define a sex-linked characteristic as a characteristic in which the gene responsible is located on a sex chromosome and that this makes it more common in one sex than in the other. • Describe colour blindness as an example of sex linkage. • Use genetic diagrams to predict the results of monohybrid crosses involving co-dominance or sex linkage and calculate phenotypic ratios. |
| 9.1 | variation | <ul style="list-style-type: none"> • Define variation as differences between individuals of the same species. • Distinguish between phenotypic variation and genetic variation. • State that phenotypic variation is caused by both genetic and environmental factors. • State that continuous variation results in a range of phenotypes between two extremes, e.g. height in humans. • State that discontinuous variation results in a limited number of phenotypes with no intermediates, e.g. tongue rolling. |
| 9.3 | variation | <ul style="list-style-type: none"> • Describe the symptoms of sickle-cell anaemia. • Explain how a change in the base sequence of the gene for haemoglobin results in abnormal haemoglobin and sickle-shaped red blood cells. • Use genetic diagrams to show how sickle-cell anaemia is inherited. • State that people who are heterozygous (Hb^SHb^A) for the sickle-cell allele have a resistance to malaria. • Explain the distribution of the sickle-cell allele in human populations with reference to the distribution of malaria |
| 9.4 | variation | |
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| 10.1 | Adaptive features | <ul style="list-style-type: none"> • Define adaptive feature as an inherited feature of an organism that increase its fitness (that helps an organism to survive and reproduce in its environment). • Define fitness as the probability of an organism surviving and reproducing in the environment in which it is found. • Interpret images or other information about a species to describe its adaptive features. • Explain the adaptive features of hydrophytes and xerophytes to their environments. |
| 10.2 | selection | <ul style="list-style-type: none"> • Describe natural selection with reference to: <ul style="list-style-type: none"> • variation within populations • production of many offspring • competition for resources • struggle for survival • reproduction by individuals that are better adapted to the environment than others • passing on of their alleles to the next generation. • Describe evolution as the change in adaptive features of a population over time as the result of natural selection. • Define the process of adaptation as the process, resulting from natural selection, by which populations become more suited to their environment over many generations. • Describe the development of strains of antibiotic resistant bacteria as an example of evolution by natural selection. |

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| 10.3 | selection | <ul style="list-style-type: none"> • Describe natural selection with reference to: <ul style="list-style-type: none"> • variation within populations • production of many offspring • competition for resources • struggle for survival • reproduction by individuals that are better adapted to the environment than others • passing on of their alleles to the next generation. • Describe evolution as the change in adaptive features of a population over time as the result of natural selection. • Define the process of adaptation as the process, resulting from natural selection, by which populations become more suited to their environment over many generations. • Describe the development of strains of antibiotic resistant bacteria as an example of evolution by natural selection. • Describe selective breeding with reference to: <ul style="list-style-type: none"> • selection by humans of individuals with desirable features |
| 10.4 | selection | <ul style="list-style-type: none"> • crossing these individuals to produce the next generation • selection of offspring showing the desirable features. • State the differences between natural and artificial selection. • Outline how selective breeding by artificial selection is carried out over many generations to improve crop plants and domesticated animals. |
| 11.1 | Biotechnology and genetic engineering | <ul style="list-style-type: none"> • State that bacteria are useful in biotechnology and genetic engineering due to their rapid reproduction rate and their ability to make complex molecules. • Discuss why bacteria are useful in biotechnology and genetic engineering, limited to: <ul style="list-style-type: none"> • lack of ethical concerns over their manipulation and growth • genetic code shared with all other organisms • presence of plasmids |

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| 11.2 | Biotechnology and genetic engineering | <ul style="list-style-type: none"> • Describe the role of anaerobic respiration in yeast during production of ethanol for biofuels. • Describe the role of anaerobic respiration in yeast during bread-making. • Investigate and describe the use of pectinase in fruit juice production. • Investigate and describe the use of biological washing powders that contain enzymes. • Investigate and explain the use of lactase to produce lactose-free milk. • Describe the role of the fungus <i>Penicillium</i> in the production of the antibiotic penicillin. • Explain how fermenters are used in the production of penicillin. |
| 12.1 | GENETIC ENGINEERING | <ul style="list-style-type: none"> • Define genetic engineering as changing the genetic material of an organism by removing, changing or inserting individual genes. • State examples of genetic engineering: <ul style="list-style-type: none"> • the insertion of human genes into bacteria to produce human insulin • the insertion of genes into crop plants to confer resistance to herbicides • the insertion of genes into crop plants to confer resistance to insect pests • the insertion of genes into crop plants to provide additional vitamins. |
| 12.2 | GENETIC ENGINEERING | <ul style="list-style-type: none"> • Outline genetic engineering using bacterial production of a human protein as an example, limited to: isolation of the DNA making up a human gene using restriction enzymes, forming sticky ends • cutting of bacterial plasmid DNA with the same restriction enzymes, forming complementary sticky ends • insertion of human DNA into bacterial plasmid DNA using DNA ligase to form a recombinant plasmid • insertion of plasmid into bacteria (specific detail is not required) • replication of bacteria containing recombinant plasmids which make human protein as they express the gene. • Discuss the advantages and disadvantages of genetically modifying crops, such as soya, maize and rice. |

BIOLOGY SCHEME OF WORK

FORM 5 - TERM 2

| WEEK | TOPIC | TOPIC DETAILS |
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| 1.1 | Energy flow | <ul style="list-style-type: none">• State that the Sun is the principal source of energy input to biological systems.• Describe the flow of energy through living organisms including light energy from the sun and chemical energy in organisms and its eventual transfer to the environment. |
| 1.2 | Food chains and food web | <ul style="list-style-type: none">• Define a food chain as showing the transfer of energy from one organism to the next, beginning with a producer.• State and describe how energy is transferred between organisms in a food chain (trophic levels) by ingestion.• Define trophic level as the position of an organism in a food chain, food web, pyramid of numbers or pyramid of biomass.• Construct simple food chains.• Define a food web as a network of interconnected food chains.• Define producer as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis. |

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| 1.3 | Food chains and food webs | <ul style="list-style-type: none"> • Define consumer as an organism that gets its energy by feeding on other organisms. • State that consumers may be classed as primary, secondary and tertiary according to their position in a food chain. • Define herbivore as an animal that gets its energy by eating plants. • Define carnivore as an animal that gets its energy by eating other animals. • Interpret food chains and food webs in terms of identifying producers and consumers. • Identify producers, primary consumers, secondary consumers, tertiary consumers and quaternary consumers as the trophic levels in food webs, food chains, pyramids of numbers and pyramids of biomass. • Explain why the transfer of energy from one trophic level to another is inefficient. |
| 2.1 | FOOD CHAIN AND FOOD WEB | <ul style="list-style-type: none"> • Define a food chain as showing the transfer of energy from one organism to the next, beginning with a producer. • State and describe how energy is transferred between organisms in a food chain (trophic levels) by ingestion. • Define trophic level as the position of an organism in a food chain, food web, pyramid of numbers or pyramid of biomass. • Construct simple food chains. • Define a food web as a network of interconnected food chains. • Define producer as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis. • Define consumer as an organism that gets its energy by feeding on other organisms. • State that consumers may be classed as primary, secondary and tertiary according to their position in a food chain. |

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| 2.2 | FOOD CHAIN AND FOOD WEB | <ul style="list-style-type: none"> • Define herbivore as an animal that gets its energy by eating plants. • Define carnivore as an animal that gets its energy by eating other animals. • Interpret food chains and food webs in terms of identifying producers and consumers. • Identify producers, primary consumers, secondary consumers, tertiary consumers and quaternary consumers as the trophic levels in food webs, food chains, pyramids of numbers and pyramids of biomass. • Explain why the transfer of energy from one trophic level to another is inefficient. • Explain why food chains usually have fewer than five trophic levels. • Explain why there is a greater efficiency in supplying plants as human food, and that there is a relative inefficiency in feeding crop plants to livestock that will be used as food. |
| 2.3 | FOOD CHAIN AND FOOD WEB | <ul style="list-style-type: none"> • Draw, describe and interpret pyramids of numbers and biomass. • Discuss the advantages of using a pyramid of biomass rather than a pyramid of numbers to represent a food chain. • Define decomposer as an organism that gets its energy from dead or waste organic material. • Use food chains and food webs to describe the impacts humans have through over-harvesting of food species and through introducing foreign species to a habitat. |
| 3.1 | Nutrient cycles | <ul style="list-style-type: none"> • Describe the carbon cycle, limited to photosynthesis, respiration, feeding, decomposition, fossilisation and combustion. • Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the carbon dioxide concentrations in the atmosphere. • Describe the water cycle, limited to evaporation, transpiration, condensation and precipitation. |
| 4.1 | Nutrient cycles | <p>Describe the nitrogen cycle in terms of:</p> <ul style="list-style-type: none"> • decomposition of plant and animal protein to ammonium ions • nitrification • nitrogen fixation by lightning and bacteria • absorption of nitrate ions by plants |

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| 4.2 | Nutrient cycles | <ul style="list-style-type: none"> • production of amino acids and proteins • feeding and digestion of proteins • deamination • denitrification. <p>• State the roles of micro-organisms in the nitrogen cycle, limited to decomposition, nitrification, nitrogen fixation and denitrification (generic names of individual bacteria, e.g. Rhizobium, are not required)</p> |
| 5.1 | Population size | <ul style="list-style-type: none"> • Define population as a group of organisms of one species, living in the same area, at the same time. • Define community as all of the populations of different species in an ecosystem. • Define ecosystem as a unit containing the community of organisms and their environment, interacting together, e.g. a decomposing log, or a lake. • Identify and state the factors affecting the rate of population growth for a population of an organism, limited to food supply, predation and disease. • Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources. |
| 5.2 | Population size | <ul style="list-style-type: none"> • Explain the factors that lead to each phase in the sigmoid curve of population growth, making reference, where appropriate, to the role of limiting factors. • Discuss the increase in human population size over the past 250 years and its social and environmental implications. • Interpret graphs and diagrams of human population growth. |
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| 6.1 | Food supply | <ul style="list-style-type: none"> • Food supply • State how modern technology has resulted in increased food production in terms of: <ul style="list-style-type: none"> • agricultural machinery to use larger areas of land and improve efficiency • chemical fertilisers to improve yields • insecticides to improve quality and yield • herbicides to reduce competition with weeds • selective breeding to improve production by crop plants and livestock, e.g. cattle, fish and poultry. • Describe the negative impacts to an ecosystem of large-scale monocultures of crop plants. • Describe the negative impacts to an ecosystem of intensive livestock production. • Discuss the social, environmental and economic implications of providing sufficient food for an increasing human global population. • Discuss the problems which contribute to famine including unequal distribution of food, drought and flooding, increasing population and poverty. |
| 7.1 | Habitat Destruction | <ul style="list-style-type: none"> • Describe the reasons for habitat destruction, limited to: <ul style="list-style-type: none"> • increased area for food crop growth, livestock production and housing • extraction of natural resources • marine pollution. • State that through altering food webs and food chains, humans can have a negative impact on habitats. • List and explain the undesirable effects of deforestation as an example of habitat destruction, to include extinction, loss of soil, flooding and increase of carbon dioxide in the atmosphere |
| 8.1 | Pollution | <ul style="list-style-type: none"> • State the sources and effects of pollution of land and water, e.g. rivers, lakes and the sea, by insecticides, herbicides and by nuclear fall-out. |

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| 8.2 | Pollution | <ul style="list-style-type: none"> • State the sources and effects of pollution of water (rivers, lakes and the sea) by chemical waste, discarded rubbish, untreated sewage and fertilisers. • Explain the process of eutrophication of water in terms of: <ul style="list-style-type: none"> • increased availability nitrate and other ions • increased growth producers • increased decomposition after death of producers • increased aerobic respiration by decomposers • reduction in dissolved oxygen death of organisms requiring dissolved oxygen in water. • Discuss the effects of non-biodegradable plastics in the environment, in both aquatic and terrestrial ecosystems. |
| 8.3 | Pollution | <ul style="list-style-type: none"> • State the sources and effects of pollution of the air by methane and carbon dioxide, limited to the enhanced greenhouse effect and climate change. • Discuss the causes and effects on the environment of acid rain. • State the measures that are taken to reduce sulfur dioxide pollution and reduce the impact of acid rain. • Explain how increases in carbon dioxide and methane concentrations in the atmosphere cause an enhanced greenhouse effect that leads to climate change. • Describe the negative impacts of female contraceptive hormones in water courses, limited to reduced sperm count in men and feminisation of aquatic organisms. |
| 9.1 | Conservation | <ul style="list-style-type: none"> • Define a sustainable resource as one which is produced as rapidly as it is removed from the environment so that it does not run out. • Define the term sustainable development as development providing for the needs of an increasing human population without harming the environment. • Explain the need to conserve non-renewable resources, limited to fossil fuels. |

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| 9.2 | Conservation | <ul style="list-style-type: none"> • State that some resources can be maintained, limited to forests and fish stocks. • State that products can be reused or recycled, limited to paper, glass, plastic and metal. • Explain how forests and fish stocks can be sustained using education, legal quotas and re-stocking. • Explain that sustainable development requires: <ul style="list-style-type: none"> • management of conflicting demands • planning and co-operation at local, national and international levels. • Outline how sewage is treated to make the water that it contains safe to return to the environment or for human use. • Explain why organisms become endangered or extinct, limited to climate change, habitat destruction, hunting, pollution and introduced species. |
| 9.3 | Conservation | <ul style="list-style-type: none"> • Describe how endangered species can be conserved, limited to monitoring and protecting species and habitats, education, captive breeding programmes and seed banks. • Explain the risks to a species if the population size drops, reducing variation (knowledge of genetic drift is not required). • Explain reasons for conservation programmes, to include: <ul style="list-style-type: none"> • reducing extinction • protecting vulnerable environments • maintaining ecosystem functions, limited to nutrient cycling and resource provision, e.g. food, drugs, fuel and genes. |