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Homeostasis and Response	Homeostasis	1. Homeostasis is the regulation of the internal conditions of a cell or organism to maintain optimum conditions. 2. Homeostasis maintains optimal conditions for enzymes. 3. Control systems may involve nervous or chemical responses. 4. All control systems include – • cells called receptors which detect stimuli • coordination centres eg brain, spinal cord and pancreas that receive and process information from receptors. • Effectors eg muscles or glands, which bring about responses which restore optimum levels.
	Human Nervous System	5. The nervous system enables humans to react to their surroundings and to coordinate their behaviour. 6. Information is passes as an electrical impulse along cells called neurones. 7. The central nervous system is the brain and spinal cord. 8. Stimulus → receptor → coordinator → effector → response 9. Reflexes are rapid and automatic. 10. Reflexes do not use the brain, the impulse travels across the relay neurone in the spinal cord. 11. Synapse is a gap between two neurones. 12. Chemicals diffuse across the synapse to start a new chemical message in the next neurone.
	Endocrine System	13. The endocrine system is made up of glands which secrete chemicals called hormones directly into the blood stream. 14. Hormones are chemical messengers. 15. The blood carries the hormone to a target organ where it produces an effect. 16. Compared to the nervous system the effects of hormones are slower but act or longer. 17. The pituitary gland is a "master gland" which secretes several hormones into the blood. These hormones in turn act on other glands to stimulate other hormones to be released to bring about effects.
	Blood Glucose Regulation	18. Blood glucose in monitored and controlled by the pancreas. 19. If blood glucose is too high, the pancreas produces insulin. 20. Insulin causes glucose to move from the blood into the cells. In liver and muscle cells excess glucose is converted to glycogen for storage. 21. *If blood glucose is too low, the pancreas produces glucagon.* 22. *Glucagon causes glycogen to be converted to glucose.* 23. Type 1 diabetes is where the pancreas fails to produce enough insulin. Sufferers have uncontrolled high blood glucose levels and is normally treated with insulin injections. 24. In Type 2 diabetes body cells no longer respond to insulin. A carbohydrate controlled diet and exercise are common treatments. Obesity is a risk factor for type 2 diabetes.

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	Hormones in human reproduction	25. During puberty reproductive hormones cause secondary sex characteristics to develop, for example, breast development in females and voice deepening in males. 26. Oestrogen in the main female sex hormone, produced in the ovary. 27. Testosterone is the main male sex hormone, produced by the testes, testosterone stimulates sperm production. 28. The menstrual cycle releases an egg and prepares a woman's body for pregnancy. 29. The menstrual cycle is, on average, 28 days long. 30. Ovulation is the release of a mature egg from the ovary. 31. Menstruation, a period, lasts on average, 5 days. 32. Several hormones control the menstrual cycle – • Follicle stimulating hormone (FSH) causes eggs to mature an egg in the ovary and stimulates the production of oestrogen. • Oestrogen inhibits (stops) the production of FSH, stimulates the lining of the uterus and stimulates the production of oestrogen. • Luteinising hormone (LH) stimulates ovulation (release of a mature egg from the ovary). • Progesterone maintains the lining of the uterus.
	Contraception	33. Fertility can be controlled by a variety of hormonal and non-hormonal methods of contraception. These include – • Oral contraceptives contain hormones (oestrogen & progesterone) to inhibit FSH production so no eggs mature to be fertilised. • Injection, implant or skin patch of slow release progesterone to stop the maturing and release of eggs for a number of months or years. • Barrier methods of contraception, eg. Condoms and diaphragm which prevent sperm reaching an egg. • Intrauterine devices prevent the implantation of an embryo (IUD) or release a hormone (IUS). • Spermicidal agents which kill or disable sperm • Abstaining from intercourse when an egg may be in the oviduct • Surgical methods of male and female sterilisation.
	Hormones to treat infertility	*34. Infertility (where a couple are unable to get pregnant) can be helped by giving a "fertility drug". This drug includes the hormones FSH and LH, she may then become pregnant in the normal way.* *35. In Vitro Fertilisation (IVF) treatment involves –* • *Giving the mother FSH & LH to stimulate the maturing of several eggs.* • *The eggs are collected from the mother and fertilised by sperm from the father in the lab.* • *The fertilised eggs develop into embryos.* • *At the stage when the embryo's are tiny balls of cells, one or two embryo's are inserted into the mother's uterus.* *36. Fertility treatment gives a woman the chance to have a baby of her own, but it can be –* • *Very emotionally and physically stressful* • *The success rates are low* • *Can lead to multiple births which increase the risks to both mothers and babies.*

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	Negative Feedback	*37. Adrenaline is produced by the adrenal glands in times of fear or stress. It increases the heart rate and the amount of oxygen and glucose to the brain and muscles, preparing the body for 'flight or fight'.* *38. Thyroxine from the thyroid gland stimulates the basal metabolic rate. It plays an important role in growth and development.* *39. Thyroxine levels are controlled by negative feedback.*
Inheritance	Reproduction	40. Sexual reproduction involves the joining (fusion) of male and female gametes: • Sperm & egg cells in animals • Pollen & egg cells in flowering plants 41. In sexual reproduction there is a mixing of genetic information, this leads to variety in the offspring. 42. Gametes are produced by meiosis. 43. Asexual reproduction involves one parent. 44. There is no joining of gametes so there is no mixing of genetic information. 45. Asexual reproduction leads to genetically identical offspring – clones. 46. Asexual reproduction uses mitosis. 47. Cells in ovarys and testes divide by meiosis to form gametes. 48. When a cell divides to form gametes: • Copies of genetic information are made • The cell divides twice to form four gametes, each with a single set of chromosomes • All gametes are genetically different from each other 49. Gametes join at fertilisation to restore the normal number of chromosomes. 50. The new cell divides by mitosis to form an embryo. As the embryo develops the cells differentiate.
	DNA & the genome	51. The genetic material in the nucleus of a cell is composed of a chemical called DNA. 52. DNA is a polymer and has two strands forming a double helix. 53. DNA is contained in structures called chromosomes. 54. A gene is a small section of DNA on a chromosome. 55. Each gene contains the instructions for a sequence of amino acids, to make a specific protein. 56. The genome of an organism is the entire genetic material of that organism. 57. The whole human genome has been studied. This is important – • For medicine in the future • To search for genes linked to different types of disease • Understanding and treatment of inherited diseases. • For tracing human migration patterns from the past.

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	Genetic Inheritance	58. Some characteristics are controlled by a single gene eg fur colour in mice and red green colour blindness in humans. 59. Each gene may have different forms called alleles. 60. The combination of alleles present is the organisms genotype. 61. The characteristics that are expressed is the organism's phenotype. 62. A dominant allele is always expressed, even if only one copy is present. 63. A recessive allele is only expressed if two copies are present (no dominant allele present) 64. If two of the same alleles are present, the organisms are homozygous for that characteristic. 65. If two different alleles are present the organism is heterozygous for that characteristic.
	Inherited disorders	66. Some disorders are caused by the inheritance of certain alleles. 67. Polydactyly – having extra fingers or toes – is caused by a dominant allele. 68. Cystic fibrosis – a disorder of the cell membranes – is caused by a recessive allele. 69. Embryo's can be screened (have their genetic information checked) to see if they have any alleles for a genetic disorder.
	Sex determination	70. Human body cells contain 23 chromosomes. One pair of chromosomes determines sex. 71. Females have sex chromosomes XX 72. Males have sex chromosomes XY.
Variation & Evolution	Variation	73. Differences in the characteristics of individuals in a population is called variation. 74. Variation is due to – • Genes that are inherited (genetic causes) • The conditions the organism has developed in (environmental causes) • Combination of genes and the environment. 75. Mutations occur continuously. 76. Very rarely a mutation will lead to a new phenotype (characteristic).
	Evolution	77. The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago.
	Fossils	78. Fossils are the remains of organisms from millions of years ago, which are found in rocks. 79. Fossils may be formed – • From parts of organisms that have not decayed • Parts of the organism are replaced by minerals • Preserved traces of organisms eg footprints, burrows & rootlet traces 80. Many early forms of life were soft bodied so left few traces behind. Any traces that have been left behind have mainly been destroyed by geological activity. 81. Few fossils mean scientists cannot be certain how life began on Earth. 82. Fossils can tell us how much or how little different organisms have changed as life developed on Earth.
	Extinction	83. Extinctions occur when there are no remaining individuals of a species still alive. 84. Extinction can occur for many reasons including, new predators, new disease, new more successful competitors, catastrophic events & changes to the environment over geological time.

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	Classification	85. Carl Linnaeus classified living organisms depending on their structure and characteristics. 86. Linnaeus classified living things into kingdom, phylum, class, order, family, genus, species. 87. Organisms are named by the binomial system of genus and species. 88. As evidence and knowledge of internal structures became more developed due to improvements in microscopes and the understanding of biochemical processes, new models of classification were proposed. 89. Carl Woese developed a three domain system, which sits above Linnaeus' system above. 90. The three domains are – • Archaea – primitive bacteria living in extreme environments (extremophiles) • Bacteria – true bacteria • Eukaryota – protists, fungi, plants and animals. 91. Evolutionary trees are used to show how organisms are related. They use current classification data for living organisms and fossil data for extinct organisms.
	Selective Breeding	92. Selective breeding is the process by which humans breed plants and animals for particular genetic characteristics. 93. Humans have been doing this for thousands of years since they first bred food crops from wild plants and domesticated animals. 94. Characteristics for selective breeding can be chosen for usefulness or appearance – • Disease resistance in food crops • Animals which produce more meta or milk • Domestic dogs with a gentle nature • Large or unusual flowers. 95. Selective breeding can lead to "inbreeding" where some breeds are prone to disease or inherited defects.
	Genetic Engineering	96. Genetic engineering is when the genome from one organism is changed by inserting a gene from another organism to give a desired characteristic. 97. Genes are "cut out" from one organisms using enzymes. 98. Plant crops have been genetically engineered to be resistant to disease, produce bigger better fruits, are resistant to insect attack or herbicides. 99. Genetically engineered (or modified) crops generally show increased yield. 100. Bacterial cells have been genetically engineered to produce useful substances such as human insulin to treat diabetes. 101. Concerns about genetically modified crops include the effect on populations of wild flowers and insects and the effect of eating GM crops on human health. 102. *In genetic engineering –* • *Enzymes are used to isolate the required gene, this gene is inserted into a vector* • *The vector is used to insert the gene into the required cells* • *Genes are transferred to the cells of animals, plants or microorganisms at an early stage in their development so that they develop with the desired characteristics.*

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Ecology	Adaptations, interdependence & competition	103. An ecosystem is the interaction of a community of living organisms (biotic) with the non-living (abiotic) parts of their environment. 104. Plants in a community often compete with each other for light, space, water and mineral ions from the soil. 105. Animals often compete with each other for food, mates and territory. 106. Within a community each species depends on other species for food, shelter, pollination, seed dispersal etc. If one species is removed if can affect the whole community – this is interdependence. 107. A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant. 108. Abiotic (non living) factors which affect a community are – • Light intensity • Temperature • Moisture levels • Soil pH and mineral content • Wind intensity and direction • Carbon dioxide levels for plants • Oxygen levels for aquatic plants. 109. Biotic (living) factors which affect a community are – • Availability of food • New predators arriving • New pathogens • One species outcompeting another so the numbers are no longer sufficient to breed. 110. Organisms have features (adaptations) that enable them to survive in the conditions in which they normally live. These adaptations may be structural (camouflage), behavioural (basking in the sun) or functional (controlling the amount of urine produced to conserve water). 111. Some organisms live in environments that are very extreme, for example, high pressure, high temperature or high salt concentration. 112. These organisms are called extremophiles. 113. Bacteria living in deep sea vents are called extremophiles.
	Organisation of an ecosystem	114. Producers are organisms that carry out photosynthesis. Producers always start a food chain. 115. Producers are eaten by primary consumers, which are eaten by secondary consumers and then tertiary consumers. 116. Consumers that kill and eat other animals are predators and those eaten are prey. 117. In a stable community the numbers of predators and prey rise and fall in cycles. 118. Quadrats are used to measure the population of organisms in a habitat. 119. Transects are used to measure the distribution of organisms in a habitat.

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	How materials are cycled	120. All materials in the living world are recycled to provide the building blocks for future organisms. 121. The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis. 122. The main processes in the carbon cycle are photosynthesis, respiration, combustion and decay. 123. Proteins, fats and carbohydrates all contain carbon atoms. 124. Microorganisms return carbon to the atmosphere as carbon dioxide in respiration and return mineral ions to the soil. 125. All energy absorbed by producers from the sun is eventually transferred to the environment. 126. The water cycle provides fresh water for plants and animals on land before draining into the seas. 127. Water is continually evaporated and precipitated.
	Biodiversity	128. Biodiversity is the variety of all the different species of organism on earth, or within an ecosystem. 129. A large biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the environment. 130. The future of the human species on Earth relies on us maintaining a good level of biodiversity. 131. Many human activities are reducing biodiversity and only recently have measures been put in place to try to stop this reduction.
	Waste Management	132. Rapid growth in the human population and an increase in the standard of living mean that more resources are used and more waste is produced. 133. Unless waste and chemical materials are properly handled, more pollution will be caused. 134. Pollution can occur: • In water, from sewage, fertiliser or toxic chemicals • In air, from smoke and acidic gases • On land, from landfill and from toxic chemicals 135. Pollution kills plants and animals which can reduce biodiversity.
	Land Use	136. Humans reduce the amount of land available for other animals and plants by building, quarrying, farming and dumping waste. 137. The destruction of peat bogs and other areas of peat to produce garden compost, reduces the area of this habitat and thus the variety of different plant, animal and microorganism species that live there (biodiversity). 138. The decay or burning of the peat releases carbon dioxide into the atmosphere.
	Deforestation	139. Large scale deforestation in tropical areas has occurred to : • Provide land for cattle and rice fields • Grow crops for biofuels

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	Global Warming	140. Levels of carbon dioxide and methane in the atmosphere are increasing and contribute to global warming. 141. Biological consequences of global warming (be able to describe how these may happen with examples) – • Loss of habitat • Changes in distribution of organisms • Changes in migration patterns • Reduced biodiversity
	Maintaining Biodiversity	142. Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity. 143. These include – • Breeding programmes for endangered species • Protection and regeneration of rare habitats • Reintroduction of field margins and hedgerows in agricultural areas where farmers grow only on type of crop. • Reduction of deforestation and carbon dioxide emissions by some governments • Recycling resources rather than dumping waste in landfill.