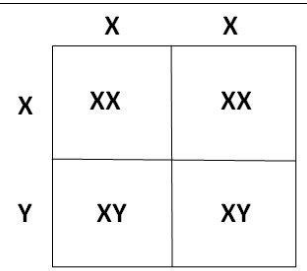
Core questions – Biology Unit 6 - Inheritance

No.	Question	Answer
1	What is sexual reproduction?	Involves the joining (fusion) of male and female gametes
2	What is a gamete?	A sex cell
3	What are animal gametes called?	Sperm and egg
4	What are plant gametes called?	Pollen and egg
5	How many chromosomes are in a human gamete?	23
6	Why is there variation in sexual reproduced organisms?	The genetic information from the male and female is mixed when gametes fuse
7	How many parents are involved in asexual reproduction?	One parent
8	Why is the no variation in asexual reproduction?	There is no mixing of genetic information, so the offspring is genetically identical
9	What is a genetically identical offspring called?	A clone
10	What is meiosis?	When cells divide to produce cells with half the number of chromosomes as a normal cell
11	Where does meiosis happen?	In the reproductive organs of an organism
12	Describe what happens when a cell divides by meiosis?	1. Copies of the genetic information are made 2. The cell divides twice to form four gametes, each with a single set of chromosomes 3. All the gametes are genetically different from each other
13	Why do gametes only have half the number of chromosomes as a normal cell?	So when two gametes fuse during fertilisation the total number of chromosomes is restored to normal
14	What are the advantages of sexual reproduction? **(Triple only)**	• Provides variation in the offspring • Variation gives a survival advantage if the environment changes • We can use selective breeding to speed up natural selection
15	What are the advantages of asexual reproduction? **(Triple only)**	• Only one parent is needed • More time and energy efficient not needing to find mate • Faster than sexual reproduction • Many identical offspring can be produced in favourable conditions
16	What organisms can reproduce using both methods? **(Triple only)**	Parasites, fungi, plants
17	How do parasites reproduce both asexually and sexually? **(Triple only)**	They reproduce sexually in the mosquito, but asexually in the human host
18	How do fungi reproduce asexually? **(Triple only)**	They reproduce asexually by producing spores
19	How do plants reproduce asexually? **(Triple only)**	Strawberry plants produce runners Plants can grow bulbs
20	How do plants reproduce sexually? **(Triple only)**	By producing seeds
21	What is a chromosome?	A long molecule of DNA
22	Describe the structure of DNA?	DNA is a polymer made up of two strands coiled together in the shape of double helix
23	What is a gene?	A small section of DNA that codes for a particular sequence of amino acids to make a protein

24	What is a genome?	The entire genetic material of an organism
25	Why is it important for scientists to understand the human genome?	• Scientists can search for genes linked to different types of disease • Can help us to understand and treat inherited disorders better • They are used in tracing human migration patterns from the past
26	What is the structure of a nucleotide? **(Triple only)**	One sugar molecule, one phosphate molecule and one 'base'
27	How many bases does DNA contain and what are they? **(Triple only)**	Four: A, C, G and T
28	What are the complementary base pairings? **(Triple only)**	A – G; T – C
29	What do the order of bases on the DNA control? **(Triple only)**	The order of amino acids in a protein
30	How are amino acids coded for? **(Triple only)**	By a sequence of 3 bases
31	Where are proteins made? **(Triple only)**	On ribosomes, in the cytoplasm of the cell
32	Why can't DNA leave the nucleus? **(Triple only) (HT)**	It is too big
33	What is mRNA? **(Triple only) (HT)**	Messenger RNA
34	What is the function of mRNA? **(Triple only) (HT)**	It copies code from the DNA and carries the code to the ribosomes
35	How are amino acids brought to the ribosomes? **(Triple only) (HT)**	By carrier molecules
36	What happens to the protein when it is completed? **(Triple only) (HT)**	It folds up to form a unique shape
37	What different functions do proteins carry out in the body? **(Triple only) (HT)**	• Enzymes – biological catalysts • Hormones – used to carry messages around the body • Structural proteins – physically strong (e.g. collagen)
38	What is a mutation? **(Triple only) (HT)**	When the sequence of DNA bases are changed randomly
39	What affect can a mutation have on a protein? **(Triple only) (HT)**	• It could change the shape of an enzyme, meaning the substrate may no longer fit the active site • A structural protein could lose its strength
40	What happens if a mutation occurs in the non-coding DNA? **(Triple only) (HT)**	It can alter how genes are expressed (if they are switched on or off)
41	What types of mutation are there? **(Triple only) (HT)**	Insertions, deletions, substitutions
42	What is an insertion mutation? **(Triple only) (HT)**	Where a new base is inserted into the DNA base sequence
43	What is a deletion mutation? **(Triple only) (HT)**	When a random base is deleted from the DNA base sequence
44	What is a substitution mutation? **(Triple only) (HT)**	When a random base in the DNA base sequence is changed to a different base
45	What is an allele?	A different version of the same gene
46	Why do animals have two copies of each gene?	Because there are two of each chromosome – one from each parent
47	What is a dominant allele?	An allele that is always expressed, even if only one copy is present
48	What is a recessive allele?	An allele that is only expressed if two copies are present (so no dominant allele present)

49	What is a homozygous pair of alleles?	When the two alleles present are the same
50	What is a heterozygous pair of alleles?	Where the two alleles present are different
51	What is a genotype?	The combination of alleles that you have (e.g Bb)
52	What is a phenotype?	The characteristics that are expressed (e.g. Blue eyes)
53	What diagram do we use to predict the probability of having offspring with specific characteristics?	Punnett Square
54	What is polydactyly?	A condition in which you have extra fingers and toes
55	What type of allele is the inherited disorder Polydactyly caused by?	Dominant allele
56	What is cystic fibrosis?	A disorder of cell membranes
57	What type of allele is the inherited disorder Cystic fibrosis caused by?	Recessive allele
58	What is embryo screening?	Removing a cell from an embryo and analysing its genes for inherited disorders
59	What are the arguments for genetic screening?	• Helps stop people suffering • Could save money for expensive treatments • There are currently strict laws for what it can be used for
60	What are the arguments against genetic screening?	• It implies that people with genetic problems are 'undesirable' • Screening is expensive • It could lead to people wanting 'designer babies'
61	What are the sex chromosomes in a female?	XX
62	What are the sex chromosomes in a male?	XY
63	What does a genetic diagram look like for the probability of getting a boy or a girl?	
64	What is variation?	The differences in the characteristics of individuals in a population
65	What is genetic variation?	Variation due to the genes they have inherited
66	What examples are there of characteristics that are only controlled by genes?	Blood group, eye colour, inherited disorders
67	What is environmental variation?	Variation due to the conditions in which they have developed
68	What examples are there of characteristics that are only controlled by environment?	Losing a toe, suntans, tattoos
69	Where does all genetic variation arise from?	Mutations

70	What happens if a mutation occurs that causes a new phenotype?	It may lead to a rapid change in the species, if it is advantageous
71	What is evolution?	A change in the inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species
72	What is the theory of evolution by natural selection?	All species of living things have evolved from simple life forms that first developed more than three billion years ago
73	Describe the process of natural selection?	1. All species show wide **variation** 2. Organisms **compete** for limited resources 3. The organisms with the most suitable characteristics for the environment will **survive** 4. These organisms survive and **reproduce**, passing on the successful alleles to the offspring 5. Over time the beneficial characteristics become more common in a population
74	What is a species?	A group of similar organisms that can reproduce to give fertile offspring
75	What is speciation?	The development of a new species – when populations of the same species become too different
76	Who proposed the theory of evolution by natural selection?	Charles Darwin
77	What evidence can be used to support Darwin's theory of evolution?	• Fossils show how changes in organisms have developed over time • The recent discovery of how bacteria are able to evolve to become resistant to antibiotics
78	What evidence did Charles Darwin have for his theory of evolution by natural selection? **(Triple only)**	From observations on a round the world expedition and knowledge of geology and fossils
79	When was Darwin's theory published? **(Triple only)**	In *'On the Origin of Species'* in 1859
80	Why did it take such a long time for Darwin's theory to be accepted? **(Triple only)**	• The theory challenged the idea that God made all the animals and plants that live on Earth • There was insufficient evidence at the time the theory was published to convince many scientists • The mechanism of inheritance and variation (genes) was not known until 50 years after publication
81	What other theories of evolution were there other than Darwin's? **(Triple only)**	Jean-Baptiste Lamarck
82	What was Jean-Baptiste Lamarck's theory? **(Triple only)**	That changes an organism acquires during its lifetime will be passed on to its offspring
83	Why was Lamarck's hypothesis eventually rejected? **(Triple only)**	Experiments didn't support his hypothesis
84	Describe the process of speciation? **(Triple only)**	1. A population of the same species become **isolated** 2. Isolation can happen due to a **physical barrier** (e.g. Earthquakes, floods) 3. **Conditions** on each side of the barrier are slightly **different** 4. **Natural selection** in each population will act differently 5. Eventually individuals in each population will have changed so much, they will be **unable to breed successfully**

85	Who was Alfred Russel Wallace? **(Triple only)**	Wallace independently proposed the theory of evolution by natural selection. He published joint writings with Darwin in 1858 (the year before Darwin published *'On the Origin of Species'*)
86	What is Alfred Russel Wallace most famous for? **(Triple only)**	His work on warning colouration in animals and his theory of speciation
87	Who was Gregor Mendel? **(Triple only)**	An Austrian monk who trained in maths and natural history
88	What did Mendel investigate? **(Triple only)**	He carried out breeding experiments on plants
89	When did Mendel do his experiments on pea plants? **(Triple only)**	Mid-19th Century
90	What conclusions did Gregor Mendel make? **(Triple only)**	• Characteristics in plants are determined by 'hereditary units' • One unit from each parent is passed on to descendants unchanged • 'Hereditary units' can be dominant or recessive
91	Why was the significance of Mendel's work not recognised until after his death? **(Triple only)**	They didn't have the background knowledge about genes, DNA and chromosomes
92	What discovery was made in the late 1800s using Mendel's work as a starting point? **(Triple only)**	Scientists became familiar with chromosomes and were able to observe how they behaved during cell division
93	When was it discovered that Mendel's 'hereditary units' were actually genes? **(Triple only)**	Early 20th Century
94	When was the structure of DNA determined? **(Triple only)**	1953
95	What is selective breeding?	When humans artificially select the plants or animals that are going to breed so that the genes for particular characteristics remain in the population
96	What characteristics may be selected for in plants?	• Crops with disease resistance • Plants with big or unusual flowers
97	What characteristics may be selected for in animals?	• Animals that produce more milk or meat • Pets with a gentle temperament
98	Describe the process of selective breeding?	1. Select characteristics you want from the animals/plants you already have 2. Breed them with each other 3. Select the best offspring and breed them together 4. Repeat this process over several generations until all offspring have the correct characteristics
99	What are the disadvantages of selective breeding?	It reduces the gene pools, leading to 'inbreeding' which can cause health problems
100	What is genetic engineering?	A process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic
101	Describe the process of genetic engineering? **(HT only)**	1. A useful gene is isolated and cut out of the chromosome using enzymes 2. The gene is inserted into a vector 3. The vector is usually a bacterial plasmid or a virus 4. The vector is introduced to the target organism (plant, animal or microorganism) and the useful gene is inserted into its cells

102	What examples of genetic modification are there?	• Bacteria used to produce human insulin • Crops have been genetically modified to improve size or quality of fruit, or make them resistant to disease, insects and herbicides • Sheep have been genetically engineered to produce drugs in their milk
103	What is gene therapy?	When faulty genes, caused by inherited diseases, are replaced with working genes
104	What concerns are there about genetic modification?	• GM crops may have health effects on human health and cause more allergies to food • Transplanted genes may get out into the natural environment, (e.g. herbicide resistant weeds)
105	What is a clone?	A genetically identical offspring
106	What methods can be used to clone plants? **(Triple only)**	Tissue culture; cuttings
107	What is a 'tissue culture'? **(Triple only)**	Using small groups of cells from part of a plant to grow identical new plants
108	What is the advantage of tissue culture? **(Triple only)**	Lots of new plants can be made quickly, meaning rare plant species can be preserved
109	What is a plant 'cutting'? **(Triple only)**	A method used by gardeners to produce many identical new plants from a parent plant
110	What methods can be used to clone animals? **(Triple only)**	Embryo transplants; adult cell cloning
111	Describe the process of an 'embryo transplant'? **(Triple only)**	1. An egg is fertilised outside the womb 2. The developing embryo is then split may time before cells become specialised 3. The embryos are implanted into lots of other cows 4. The offspring are identical to each other, but not the surrogate mother
112	Describe the process of 'adult cell cloning'? **(Triple only)**	1. The nucleus is removed from an unfertilised egg cell 2. The nucleus from an adult body cell, such as a skin cell, is inserted into the egg cell 3. An electric shock stimulates the egg cell to divide to form an embryo 4. The embryo cells contain the same genetic information as the adult skin cell 5. When the embryo has developed into a ball of cells, it is implanted into the womb of a surrogate mother
113	What is a fossil?	The 'remains' of organisms from millions of years ago, which are found in rocks
114	Describe 3 ways that fossils may be formed?	1. From parts of organisms that have not decayed because one of more of the conditions needed for decay are absent 2. When parts of the organism are replaced by minerals as they decay 3. As preserved traces of organisms, such as footprints, burrow and rootlet traces
115	Why is it difficult to use fossils to prove how life began and evolved?	• Many of the early forms of life were soft-bodied, meaning they left few traces behind • Lots of fossils that formed have been destroyed by geological activity
116	What is extinction?	When there are no remaining individuals of a species alive
117	What factors can lead to the extinction of an individual species?	• The environment changes too quickly • A new predator kills them • A new disease kills them • A new competitor outcompetes them for resources (e.g. food)
118	What can lead to the mass extinction of many species?	A catastrophic event such as a volcano, or asteroid collision

119	What is antibiotic resistance?	When bacteria evolve and become resistant to antibiotics
120	Describe how bacteria become resistant to antibiotics?	1. Mutations of bacterial pathogens produce a new strain 2. Some strains are resistant to antibiotics so are not killed 3. They survive and reproduce so the population of the resistant strain increases 4. The resistant strain can then spread because people are not immune to it
121	What is MRSA?	A bacteria that is resistant to many types of antibiotic
122	What steps should be taken to reduce the rate of development of antibiotic resistant strains?	• Doctors should not prescribe antibiotics inappropriately • Patients should complete their course of antibiotics so all bacteria are killed and can't mutate • Agricultural use (farming) of antibiotics should be restricted
123	How are living organisms classified?	By their structure and characteristics in a system developed by Carl Linnaeus
124	What are organisms sub divided into in the Linnaean system?	Kingdom, phylum, class, order, family, genus, species
125	How are organisms named?	Through a binomial system of genus and species (e.g. *Homo sapiens*) Homo – genus, Sapiens – species
126	Why have systems of classification improved?	As improvements in microscopes and the understanding of biochemical processes progressed, which helped us better understand the internal structures of organisms
127	What system did Carl Woese develop?	The 'three-domain system'
128	What are organisms divided into in the three domain system?	Archaea, Bacteria and Eukaryota
129	What is an 'archaea' domain?	Primitive bacteria (a type of prokaryotic cell) usually living in extreme conditions
130	What is a 'bacteria' domain?	This domain contains true bacteria
131	What is a 'eukaryota' domain?	This domain includes a broad range of organisms including fungi, plants, animals and protists
132	What is an evolutionary tree?	A method used by scientists to show how they believe organisms are related