B3 (Higher) Key Questions that will help you get the level you deserve
Learn these! Try each one. Ones you don't know try again and again
Fold over 'The Answers' column and reveal having attempted the questions

DNA			
1.	What is the role of mitochondria in an animal cell?		Respiration occurs in the mitochondria providing energy for life processes
2.	Where in the cell are chromosomes found?		Nucleus
3.	What make up chromosomes and what do they carry		They are made of a long coiled molecule called DNA They carry coded information in the forms of genes which code for proteins
4.	What is the role of the genetic code to the body?		The genetic code controls cell activity and characteristics of an organism
5.	What is the role of proteins in the body?		Needed for growth Repair cells
6.	Who discovered the structure of DNA?		Watson and Crick
7.	Explain why liver and muscle cells have large numbers of mitochondria		Mitochondria is the site of respiration. This is therefore where energy is released. The liver and muscle cells require energy to function.
8.	Why can we not see some organelles in the cell like ribosomes?		They are too small to be seen with light microscopes – the resolution is too low.
9.	What are ribosomes and where are they found in cells?		Ribosomes are the site of protein synthesis. Ribosomes are found in the cytoplasm.
10.	Describe the structure of DNA		Two strands coiled to form a double helix, each strand containing chemicals called bases. There are 4 types A,T,C and G.
11.	What are the complementary base pairings?		A and T C and G
12.	What is a gene?		Contains a specific sequence of bases Codes for a particular protein
13.	Where are proteins made in a cell?		By ribosomes found in the cytoplasm
14.	Why are copies of genes needed to code for a protein rather than the original gene found on the DNA in the nucleus?		The gene does not leave the nucleus. A copy of the gene is always protected and available in the nucleus this way.
15.	How is the protein structure determined by the DNA base code?		The base sequence determines the order (sequence) of amino acids. Each amino acids is coded for by a sequence of 3 bases (codon). The order of the amino acids codes for the protein.
16.	Why is the order of amino acids important to a protein?		The amino acids make up the protein and therefore the bonds that the protein has to make the 3d shape. The shape is important to the function of enzyme and determines that shape of the active site which binds with the substrate.

17.	How is the code needed to produce a protein carried from the DNA to the ribosome?		mRNA (Messenger RNA)
18.	Describe how Watson and Crick used data from other scientists to build a model of DNA.		X-ray data showed there were two chains wound in a helix. Data indicated that the bases occurred in pairs.
19.	Why was Watson and Crick's discovery not accepted or rewarded immediately?		The importance of other scientists repeating or testing the work.
Proteins / Enzymes			
20.	Give some examples of proteins		Collagen Insulin Haemoglobin
21.	Describe enzymes structure and their function		They are proteins They speed up a chemical reaction They work best at a particular temperature
22.	How does an enzyme work?		The enzyme has an active site. This is a specific shape that the substrate fits into. A reaction takes place when this happens.
23.	Describe gene mutations		Changes to genes. Occur spontaneously Occur more often by radiation or chemicals
24.	Why do only one enzyme work for an organism or to produce a particular reaction?		Enzymes are specific. The active site fit the substrate like a lock and key. They have a high specificity for their substate.
25.	Describe some functions of proteins		Structural (eg. Collagen) Hormones (eg. Insulin) Carrier molecules (eg. Haemoglobin) Enzymes
26.	Describe how changing temperature and pH generally affect reactions		They change the rate of reaction Enzymes have an optimum temperature.
27.	Explain how enzyme activity is affected by extremes in pH and temperature		Lower collision rates at low temperatures Denaturing at extremes of pH and high temperatures Denaturing as an irreversible change inhibiting enzyme function Denaturing changing the shape of the active site
28.	How do you calculate the Q10 value for a reaction?		$\frac{\text{The rate at higher temperature}}{\text{Rate at lower temperature}}$
Respiration			
29.	How is the energy provided by respiration needed in plants and in animals?		Needed for all key life processes eg. Respiration Protein synthesis Muscle contraction Control of body temperature in mammals
30.	What is the word equation for aerobic respiration?		Glucose + Oxygen $\rightarrow$ Carbon dioxide + water
31.	What is the symbol equation for aerobic respiration?		$C_6H_{12}O_6 + 6CO_2 \rightarrow 6CO_2 + 6H_2O$
32.	How would you calculate the respiratory quotient (RQ)? Ie what is the formula?		$RQ = \frac{\text{carbon dioxide produced}}{\text{Oxygen used}}$
33.	What is the energy source produced during respiration?		ATP
34.	How can the rate of oxygen consumption (in a practical or graph) be used?		To estimate a relative metabolic rate because aerobic respiration requires oxygen.

35.	Explain why the rate of respiration is influenced by changes in temperature and pH		Respiration involves enzymes. Enzyme activity varies due to changes in their shape caused by temperature and pH.
36.	Why does anaerobic respiration take place during hard exercise in addition to aerobic respiration?		Not enough ATP is produced or a lack of oxygen means an incomplete breakdown of glucose occurs.
37.	What is the word equation for anaerobic respiration?		Glucose $\rightarrow$ Lactic acid
38.	How is anaerobic respiration difference to aerobic respiration in terms of ATP made?		Aerobic respiration produces significantly more ATP (energy) than Anaerobic respiration per glucose molecule.
39.	How is the energy released during respiration is used by the organism. The energy may be used as what?		To build larger molecules from smaller ones. In animals, to enable muscles contract In mammals and birds, to maintain a steady body temperature in colder surroundings In plants, to build up sugars, nitrates and other nutrients into amino acids and from these into proteins.
40.	What are some changes that take place during exercise?		The heart rate increases The rate and depth of breathing increases.
41.	Why are the changes that happen during exercise important? (helpful to the body)		Increase blood flow to the muscles Increase the supply of sugar and oxygen Increase the removal of carbon dioxide
42.	How and where can glucose be stored?		Stored as glycogen Stored in the muscle
43.	What does you body do if you need energy but have insufficient oxygen?		Anaerobic respiration
44.	What is anaerobic respiration?		The incomplete breakdown of glucose that produces lactic acid
45.	Compare anaerobic and aerobic respiration		Anaerobic + quicker + can happen with less oxygen - oxygen debt, needs to be repaid - less energy made
46.	What is oxygen debt?		How we get rid of lactic acid that has been made due to the incomplete breakdown of glucose. Becomes carbon dioxide and water
47.	What is happening when muscles become fatigued?		They stop contracting efficiently
48.	What is one of the causes of muscle fatigue?		Build up of lactic acid in the muscles
49.	How do you get rid of lactic acid?		Breathe deeply and at a faster rate to get oxygen in to oxidise the acid. Increase blood flow to the muscles (eg. massage the body part)
50.	Explain fatigue in terms of lactic acid build up (oxygen debt) and how this is removed during recovery.		Hard exercise causing lack of oxygen in cells The incomplete breakdown of glucose Continued panting replacing oxygen Increased heart rate to allow blood to carry lactic acid away to the liver.

51.	Why is getting or moving around more oxygen is important for sports people?		More oxygen for aerobic respiration. More energy Better performance.
52.	How does haemoglobin support aerobic respiration?		Haemoglobin combines with oxygen.
53.	What causes fatigue in muscle cells?		Build up lactic acid Lack of oxygen Lead to oxygen debt Incomplete breakdown of glucose
Cell division			
54.	Describe the difference between simple organisms which are unicellular and more complex organisms which are multicellular.		Simple organisms are made of one cell Complex organisms are made of many cells
55.	What are the advantages of being multicellular rather than unicellular?		The organism can be larger Cells can differentiate (have different functions) The organism can be more complex
56.	What is the problem with being a multicellular organisms?		Communication between cells eg. Nervous system Supplying the cells with nutrients Controlling exchanges with the environment
57.	How are chromosomes normally found in a normal cell?		In pairs
58.	How would you describe a normal cell in the body? (in terms of chromosomes)		Diploid (full number and chromosomes in pairs)
59.	How would you describe a gamete in the body? (in terms of chromosomes)		Haploid
60.	Why is mitosis needed by organisms?		Replacement of worn out cells Repair damaged tissue Asexual reproduction
61.	What happens to gametes for fertilisation to take place?		They fuse
62.	How many chromosomes do gametes have?		Half the number of chromosomes
63.	How does sexual reproduction produce a unique individual?		Half the genes from each parent
64.	Why are sperm cells produced in large numbers?		To increase the chance of fertilisation.
65.	What are the advantages of being multicellular?		Allows organism to be larger Allows for cell differentiation Allows organism to be more complex
66.	Describe how DNA replication occurs		Unzipping to form single strands New double strands are formed by complementary base pairs
67.	Describe what happens to the chromosomes in mitosis		Line up along the centre of the cell They then divide The copies move to opposite poles of the cell
68.	How are gametes formed?		Meiosis
69.	What happens in DNA replication?		DNA unzips This forms 2 complementary strands Free bases join the exposed bases on each strand. This forms 2 semi-conservative molecules
Fertilisation			
70.	Explain why fertilisation results in genetic variation		Gametes combine to form a diploid zygote Genes on the chromosomes combine to control the characteristics of the zygote

71.	Explain how the structure of a sperm cell is adapted to its function		Many mitochondria to provide energy An acrosome that releases enzymes to digest the egg membrane
72.	Explain why, in meiosis, the chromosome number is halved and gametes are genetically different		One chromosome from each pair separate to opposite poles of the cell in the first division Chromosomes divide and the copies move to opposite poles of the cell in the second division.
Circulation			
73.	Describe the structure and function of red blood cells		They are bi-concave in shape and have no nucleus They carry oxygen Large surface area to volume ratio Haemoglobin (a pigment) attaches to oxygen to form oxyhaemoglobin
74.	Describe the structure and function of white blood cells		They are large They engulf microbes They produce antibodies They produce antitoxins
75.	Describe the structure and function of arteries		Arteries have thick elasticated and muscular walls They pulse under pressure Arteries carry blood away from the heart
76.	Describe the structure and function of veins		Veins have elasticated walls Veins have valves Veins have large lumens Veins carry blood back from the heart
77.	Describe the structure and function of capillaries		Capillaries are one cell thick Capillaries are permeable Capillaries carry oxygen and glucose to the muscle cells and waste products back to the lungs
78.	What is the role of the right side of the heart?		Pumping blood to the lungs
79.	What is the role of the left side of the heart?		Pumping blood to the rest of the body
80.	Explain the advantage of the double circulatory system in mammals		Higher pressure Greater rate of flow to the tissues
81.	What is the role of valves in the heart and veins?		Prevent back flow
82.	Explain why the left ventricle has a thicker muscle wall than the right.		The left ventricle pumps blood around the whole body. The right ventricle pumps blood only to the lungs.
Cells			
83.	What is the role of vacuole in a plant cell?		Contains cell sap Provides support
84.	What is the role of the cell wall in a plant cell?		Made of cellulose to provide support
85.	How can we measure growth in plants?		Growth can be measured as an increase in height, wet mass or dry mass
86.	What is specialisation of a cell?		The process that a cell's structure becomes specialised for a function
87.	What is the difference between the growth of animal and plant cells?		Animals grow in the early stages of their lives – plants grow continually Parts of an animal are involved in growth – plants grow at specific parts of the plant (eg. Meristems)

			Cell enlargement is the main method by which plants gain height Plant cells retain the ability to differentiate but most animal cells lose it at an early stage
88.	What is the major differences between bacterial cells/plant cells and animal cells?		Bacterial cells lack: A 'true' nucleus Mitochondria Chloroplasts
89.	Describe the difference between the arrangement of DNA in a bacterial cell and a plant/animal cells.		Bacteria do not have a nucleus Bacteria instead have a single circular strand whereas animal cells have chromosomes
90.	What is the role of the nucleus in a cell?		To control the activities of the cell
91.	What is the role of the cytoplasm in a cell?		Where most chemical reactions take place
92.	What is the role of the cell membrane in a cell?		To control the passage of substances in and out of the cell
93.	What 3 'organelles' (parts) do plant cells have that animal cells don't?		Cell wall, vacuole, chloroplasts
94.	What is the role of the vacuole?		Contains cell sap
95.	What is the role of the mitochondria?		To produce energy in respiration
96.	What is the role of ribosomes?		This is where protein synthesis occurs
97.	What is the role of the cell wall?		To strengthen the cell
98.	What is the role of the chloroplasts?		Contain chlorophyll which absorbs light energy to make food
99.	What makes up plant and algal cell walls?		Cellulose
100.	What makes up a bacterial cell?		Cytoplasm, membrane, cell wall and the genes are not in a distinct nucleus
101.	What makes up yeast?		Nucleus, cytoplasm, membrane and cell wall
102.	How are sperm cells designed to fertilise eggs?		Tail provides movement Head contains enzymes that breaks through the cell membrane of the egg The nucleus contains genetic information to pass on to offspring
103.	How are root hair cells designed for absorbing?		The long root hair cell increases the surface area of the root to absorb water Thin cell wall makes it easy for minerals to pass across
104.	How are egg cells designed for their role?		They have a large food store to allow for the embryo to develop The nucleus contains genetic information to pass onto offspring
105.	What is the name given to when a sperm and egg join?		Fertilisation
106.	What name is given to cells that have a particular job/role?		Specialised cells
107.	Why do the muscle cells of an athlete need many mitochondria?		Increased respiration More energy (released)

Stem Cells			
108.	What can undifferentiated cells (like stem cells) develop into?		Different cells, tissues and organs
109.	How can stem cells be obtained and used?		Obtained from embryonic tissue Potentially used to treat medical conditions
110.	What is an embryonic stem cell?		A stem cell generated from an embryo. This is undifferentiated.
111.	When do most animal cells differentiate?		Early stage (differentiate means to become a particular type of cell)
112.	When do most plant cells differentiate?		Retain the ability to differentiate throughout life
113.	Where are stem cells made?		Human embryos and adult bone marrow
114.	What does differentiation mean?		When a cell becomes a specific type eg. nerve cell
115.	Why is stem cell research important?		May help in the treatment of paralysis
116.	What form of cell division is produced by asexual reproduction?		Mitosis
Selective breeding, genetic engineering, cloning			
117.	How does selective breeding work?		Selection of desired characteristics Cross breeding Selection of suitable offspring over many generations
118.	What is genetic engineering?		A gene coding for desired characteristics are chosen When selected genes are artificially transferred from one living organism to another
119.	Disadvantage of continued selective breeding leads to what?		A reduced gene pool **Recessive characteristics** are expressed that lead to disease or difficulties for the organism.
120.	Give an example of the effect of selective breeding have in dogs?		A reduced gene pool – more likely disease. Flat noses cause breathing problems.
121.	What features of plants and animals might be selected for a genetic engineering programme?		Resistance to frost Higher yield Greater milk production Greater nutrition value
122.	What problems are caused by selective breeding?		Reduce gene pool leading to problems of inbreeding: Accumulation of harmful recessive characteristics Reduction in variety
123.	Explain some potential advantages and risks of genetic engineering		Advantage – organisms with desired features are produced rapidly Risks – inserted genes may have unexpected harmful effects
124.	Describe, in outline only, some examples of genetic engineering		Production of insulin Resistance to herbicide Golden rice (beta-carotene rich rice)
125.	What are the stages in genetic engineering?		Selection of desired characteristics Isolation of genes responsible Insertion of the genes into other organisms Replication of these organisms

126.	Cloning is an example of what type of cell division		Cloning is an example of asexual reproduction
127.	What is produced during cloning?		Genetically identical copies
128.	What are naturally occurring clones?		Identical twins
129.	How can plants be cloned?		Grown from cuttings or tissue culture
130.	Describe some possible uses of animal cloning		Mass producing animals with desirable characteristics Producing animals that have been genetically engineered to produce human products Producing human embryos to supply stem cells for therapy
131.	Describe in outline the cloning technique used to produce Dolly		Nucleus removed from an egg cell Egg cell nucleus replaced with the nucleus for an udder cell Egg cell given an electric shock to make it divide Embryo implanted into a surrogate mother sheep Embryo grows into a clone of the sheep from which the udder cell came.
132.	Give advantages of commercially using cloned plants		Characteristics of the plants (genetically identical) Can mass produce plants difficult to grow from seed
133.	Give disadvantages of commercially using cloned plants		All cloned plants will be susceptible to disease or change in conditions Lack of genetic variation
134.	Describe plant cloning by tissue culture		Selection for characteristics Large number of small pieces of tissue Aseptic technique Use of suitable growth medium and conditions