

# B2a answers

**Remember:**

Check which grade you are working at.

## Page 70 Cells

- 1 a** B chloroplast; C nucleus (1)  
**b** A controls what enters and leaves the cell; D holds the cell in shape (1)  
**c** Ribosomes – where proteins are made (1);  
 mitochondria – where (aerobic) respiration takes place (1)

## Page 70 Specialised Cells

- 2 a** Sweep mucus (containing trapped bacteria and dirt) up from the lungs (1)  
**b** They have cilia which can move in unison (1); they have many mitochondria to provide energy for the movement of the cilia (1)  
**3 a** To absorb water and mineral ions from the soil (1)  
**b** They have a large surface area (1)  
**c** (Any 2:) Smaller; no large vacuole; no chloroplasts

## Page 71 Diffusion 1

- 1 a** Diffusion is the spreading of the **particles** / **molecules** of a **gas**, or of any substance in solution. This results in a **net** movement from a region where they are in a **higher** concentration. (4)  
**b** Particles are moving faster; have more kinetic energy so they spread out faster (1); bump into each other more often (1)  
**2 a** Mitochondria (1)  
**b** Respiration happens faster / oxygen used up more rapidly resulting in a lower concentration of oxygen in the cell (1); so there is a greater concentration gradient (between the cell and outside) (1)  
**c** Blood coming to lungs is low in oxygen and high in carbon dioxide so oxygen diffuses from high concentration in alveoli to low concentration in blood carbon dioxide diffuses from high concentration in blood to low concentration in alveoli (2)

## Page 71 Diffusion 2

- 3 a** Carbon dioxide (1)  
**b** Carbon dioxide is used in photosynthesis (1); so there is a lower concentration inside the leaf than in the air / there is a concentration gradient from the air to the leaf (1)  
**c** (Any 2:) Photosynthesis will take place faster; so concentration of carbon dioxide in the leaf will be lower; so diffusion into the leaf will be faster

# B2a answers

## Page 72 Osmosis 1

- 1** Osmosis is the **diffusion** of **water** from a **dilute** to a more concentrated solution, through a **partially** permeable membrane. (4)
- 2 a** (Any 3:) Water molecules can go through the membrane; sugar molecules are too large to go through; water molecules diffuse / move by osmosis from the more dilute solution to the concentrated one; idea of random movement
- b** Heat the liquids (1); increase the concentration of the sugar solution (1)

## Page 72 Osmosis 2

- 3 a** It will burst (2)
- b** The strong cell wall stops it bursting (2)
- c** (Any 3:) It has been put in concentrated sugar solution; it has lost water; by osmosis; because the cytoplasm is a less concentrated solution than the sugar solution; contents have shrink and pulled away from the cell wall

## Page 73 Photosynthesis

- 1 a** Carbon dioxide + water → glucose + oxygen (2)
- b** (Any 2:) Absorbs energy from light; the energy is used to make glucose; from carbon dioxide and water
- c** Starch, energy store (1); cellulose, to make cell walls sucrose (1); to transport to other parts of the plant (1); proteins, for growth fats, as food stores in seeds (1)

## Page 73 Leaves

- 2 a i** Near the upper surface so light can easily reach them / so they get a lot of light (2)
- ii** Cell in epidermis (either upper or lower) (1)
- b** (Any 2:) Starch is insoluble; it cannot get out of the cell; it will not interfere with reactions in the cell; it will not affect the concentration of the cell and so will not affect osmosis

# B2a answers

## Page 74 Limiting factors

- 1 a 32.0 (1)
- b The number of bubbles given off per minute (1)
- c (Any 2:) The number of bubbles increases with each reading; suggesting the plant was still responding to the increase in light intensity; she should have waited until the plant was photosynthesising steadily
- d (Any 2:) Yes; the more light the plant is given, the faster it photosynthesises; suggesting that lack of light was stopping it from photosynthesising faster; however, at the highest light intensities the rate of photosynthesis seems to be levelling off; suggesting some other factor is beginning to be the limiting factor
- e (Any 2:) The number of bubbles might rise (but not so much as before) or it might stay the same; light will no longer be a limiting factor; some other factor will limit the rate of photosynthesis; for example carbon dioxide concentration
- 2 Carbon dioxide produced which increases rate of photosynthesis (1); heat produced which raises temperature and increases rate of photosynthesis (1)

## Page 74 Healthy plants

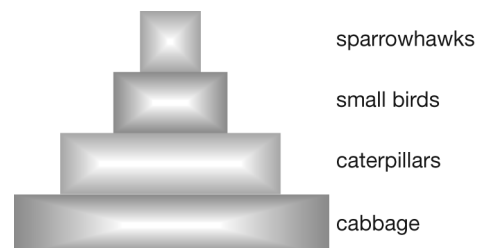
- 3 a Plants obtain mineral ions from the **soil**. They need nitrate ions for producing amino acids, which are then used to form **proteins**. They need **magnesium** ions for making chlorophyll (4)
- b i (Any 2:) The soil was short of nitrate ions; so giving the plant more allowed it to make more amino acids; which could then be used to make proteins; some of which would be used to help the grain to grow
- ii (Any 2:) This could have increased the concentration in the soil; so it became greater than in the plants' roots; so that they lost water by osmosis; the plants became short of water and could not grow well

## Page 75 Food chains

- 1 a As chemical potential energy (in food) (1)
- b (Any 2:) Some light does not hit their leaves; some light passes straight through the leaves; some light is reflected from the leaves; chlorophyll does not absorb all wavelengths (colours) of light
- c i Chloroplast (1)
- ii 200 units (1)
- 2 (Any 2:) Glucose broken down by respiration; to provide heat energy (to keep warm); this is lost to the environment; so there is less energy for the next organism in the chain

## Page 75 Biomass

- 3 a From bottom up: producers; primary consumers / herbivores; secondary consumers / carnivores; tertiary consumers / top carnivores (1)



- b i (see diagram) (1)
- ii Energy is lost between each trophic level as heat / in respiration / other way in which it is lost (1); so there is less energy available for animals at successive trophic levels so fewer animals can be supported at successive levels (1)

# B2a answers

## Page 76 Food production

- 1 (Any 2:) The chickens do not need to produce heat in their bodies; which involves respiration; and uses up food so more of their food becomes chicken meat
- 2 (Any 4:) The shorter the food chain the less energy is lost; being vegetarian means eating at the end of a short food chain; however, not all land is suitable for growing crops; only suitable for animals to graze / only produces grass which we cannot eat; many subsistence farmers in developing countries need animals to provide transport / leather / other products, as well as to provide food; animals can be used for food in winter when plant crops may be in short supply

## Page 76 The cost of good food

- 3 a (Any 2:) There are greater energy losses; because the chickens use energy moving around; so less eggs produced per, chicken / square metre / quantity of food provided
- b (Any 2:) They may think they taste better; they may think they are better for health; they may dislike the idea of hens being reared in battery cages
- 4 a Transport vehicles emit pollutants (1); especially carbon dioxide, which may cause global warming (1)
- b (Any 2:) Glasshouses will need heating and lighting in winter; which may use electricity; generated from fossil fuels; which produces carbon dioxide; no need for this in Spain where it is warmer and light levels are higher / winter days are longer

## Page 77 Death and decay

- 1 a 100 (1)
- b Area A 43%; Area B 34% (1)
- c Detritivores / microorganisms / bacteria fungi; feeding on paper; which contained cellulose (1)
- d (Any 2:) More decay organisms in the wood than on the flower bed; because of dead leaves / leaf litter; more moisture on the woodland floor than on the flower bed; because evaporation from soil reduced by dead leaves; warmer in the wood
- e i The type of site (wood, flower bed) (1)
- ii The number of squares that had decayed (1)
- f Use several pieces of paper in each area, count each one and calculate the average (1)

## Page 77 Cycles

- 2 a Organisms such as earthworms, which eat dead leaves and other plant remains, are called **detritus** feeders. They help to recycle the materials in the plant remains, so that they become available to other members of the **community** of organisms in the ecosystem. For example, they release some of the carbon in the leaves back into the air, in the form of carbon dioxide, by the process of **respiration**. (3)
- b All of them (1)
- c (Any 2:) They eat food that has been produced by other organisms; they need organic nutrients / they need carbohydrates, fats and proteins; they do not photosynthesise

# B2a answers

## Page 78 The carbon cycle 1

- 1 a** Light intensity (1)
- b** (Any 2:) To remove carbon dioxide from the air (that humans would breathe out); to add oxygen to the air (that humans need to breathe in); to provide food

## Page 78 The carbon cycle 2

- 2 a** (Any 2:) Microorganisms; break down carbon compounds in dead bodies / wastes; use them in respiration (which produces carbon dioxide)
- b** 70 billion tons (1)
- c** (Any 3:) Plants take in more carbon than they give out; so they help to remove carbon dioxide from the atmosphere; reducing the concentration of carbon dioxide; which traps heat and is contributing to a global rise in temperature
- d** (Any 2:) Carbon came from, animals / plants / waste materials; decomposer break them down; parts of the decomposers / dead bodies / faeces remain in the soil
- e** Tiny plants / phytoplankton, remove carbon dioxide for photosynthesis (1); they and sea animals release carbon dioxide by respiration (1)

# B2b answers

**Remember:**

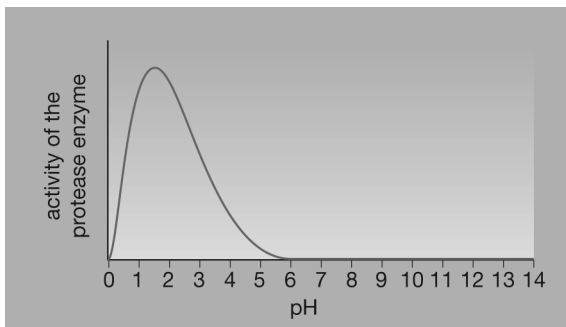
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## Page 80 Enzymes – biological catalysts 1

- 1 Enzymes are biological **catalysts**. They are **protein** molecules. Each kind of enzyme only works on a particular kind of **substrate**, which fits perfectly into a fold in the enzyme called the **active** site. (4)
- 2 a (Any 3:) Particles moving faster / have more kinetic energy (as temperature increases); more frequent collisions; more energetic collisions; between enzyme and substrate
- b (Any 3:) Enzymes are not alive so cannot be killed; the enzyme is denatured (at high temperatures); the enzyme molecule loses its shape; so its substrate cannot fit into its active site

## Page 80 Enzymes and digestion

- 3 a Mouth (1); pancreas (1)
- b It digests starch to maltose (1)
- c



(3)

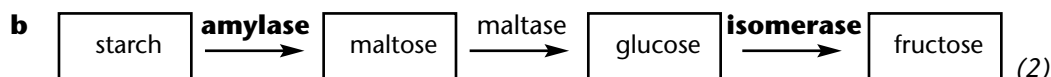
- d Bile neutralises the acid from the stomach; it is produced in the liver / stored in the gall bladder / flows in down the bile duct; when there is food in the stomach / food moving out of the stomach; contains a base / contains sodium hydrogencarbonate

## Page 81 Enzymes at home

- 1 a (Any 2:) Haemoglobin (from blood) is a protein; proteases break down proteins; turns them into amino acids; that can be washed away
- b This is the optimum temperature for the enzymes in them (1); enzymes are denatured if they get too hot (1)
- c Hands / cells, contain proteins (1); the enzymes could start to digest these proteins (1)

## Page 81 Enzymes and industry

- 2 a DNA / genes, have been altered (1); addition of genes from a different (species of) organism (1)



- c Less needs to be used so cheaper for manufacturers (1); and fewer calories / kilojoules for dieters (1)
- d Reactions work too slowly at lower temperatures / optimum temperature for enzymes is 40 °C or above (1)
- e (Any 2:) Anti-GM feelings among some people much of this is not founded on any scientific understanding; it is very unlikely; there would be health risks from the GM potatoes / discussion of health risks given in answer unlikely; that the GM potatoes would cause any environmental damage / discussion of environmental damage given in answer

# B2b answers

## Page 82 Respiration and energy

- 1 a** Carbon dioxide (1)  
**b** Every cell in the body (1)  
**c** (Any 2:) Aerobic respiration takes place in mitochondria so many mitochondria; supply a lot of energy; sperm need a lot of energy for swimming

## Page 82 Removing waste: lungs

- 2 a** Oxygen in exhaled air around 16% (1); nitrogen in inhaled air around 79% (1)  
**b** Body cells use oxygen in respiration (1); so blood arriving at the lungs is low in oxygen (1)  
**c** Oxygen moves between the alveoli and the blood (1); by diffusion (1); down a concentration gradient (1); diffusion only occurs until concentrations are equal (another reason is that not all of the air that is breathed into and out of the lungs ever reaches the alveoli) (1)  
**d** Might have a greater concentration of carbon dioxide (1); because cells are producing carbon dioxide more rapidly so concentration of carbon dioxide in the blood arriving at the lungs is greater (1)

## Page 83 Removing waste: liver and kidneys

- 1 a** There is more urea in the urine than in the blood because the kidneys remove urea from the blood (1)  
**b** Glucose is useful to the body (1); it provides energy (1)  
**c** If there are too few sodium or chloride ions, the kidneys can keep most of them in the blood (1); if there are too many, they can excrete more of them in the urine (1)

## Page 83 Homeostasis

- 2 a** (Any 2:) In sweat, in breath, in faeces  
**b** (Any 2:) More sweat is lost on hot days; so there is less water in the body; so the kidneys conserve water  
**c** Temperature (1); glucose concentration (1)  
**3** (Any 2:) Their cells contain a more concentrated solution than water; so water enters their bodies by osmosis; through the gills; they need to excrete dilute urine to reduce the amount of water in the body

# B2b answers

## Page 84 Keeping warm, staying cool

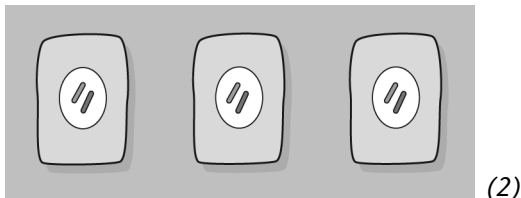
- 1 a** Enzymes; are denatured by high temperatures; so cannot catalyse metabolic reactions (2)
- b** The brain measures the temperature of the blood flowing through (1); its temperature sensors in the skin measure the temperature of the environment (1)
- c i** Water in sweat evaporates (1); taking heat from the skin (1)
- ii** Dilate / get wider (1)
- iii** More blood flows near to the surface of the skin (1); loses heat by radiation (1)

## Page 84 Treating diabetes

- 2 a** It would rise (1); and stay high for some time (1)
- b** (Any 1:) No insulin will be produced to lower the blood glucose level; it will only fall as the body cells use it up (in respiration)
- c** Take care about when he eats foods containing carbohydrates and how much carbohydrate he eats (1)
- 3 a** (Any 2:) The dog had no pancreas; so did not make insulin; it was given an injection of glucose
- b** (Any 2:) The blood glucose concentration was very high; because the dog had no pancreas / there was no insulin; that would normally lower the blood glucose concentration (in normal circumstances there is no glucose in the urine)
- c** (Any 2:) Yes; the hypothesis is supported; in a dog with no pancreas the blood glucose concentration became too high; injecting pancreas extract lowered the blood glucose level

## Page 85 Cell division – mitosis

**1 a**



- b** Genetically (1)
- 2 a** 2 (one in each set of chromosomes) (1)
- b** Mitosis (1)
- c** (Any 2:) The cell could divide uncontrollable; forming a tumour; cancer could develop

## Page 85 Gametes and fertilisation

- 3 a** So that after fertilisation the new cell has the correct number of 46 (1)
- b i** Meiosis (1)
- ii** (Any 3:) Copies of the chromosomes are made; chromosomes from each set pair up; then separate as the cell divides; it divides twice; forming four cells each with one set of chromosomes
- 4 a** A variety of a gene (1)
- b** (Any 3:) Some characteristics are determined by genes; the parents may have different mixtures of alleles; so the gametes also have different mixtures of alleles; so the offspring have different mixtures of alleles (and therefore characteristics)



# B2b answers

## Page 86 Stem cells

- 1 a i** A cell that is not yet specialised / a cell that can divide to form other specialised cells (1)  
**ii** The development of an unspecialised cell into one that is specialised for a particular function (1)
- b i** Embryo stem cells can form every different kind of cell (1); bone marrow stem cells can only form blood cells (1)  
**ii** Embryo stem cells could be made to produce new nerve cells (1); which could help to mend the spinal cord (1)
- 2** (Any 2:) Take stem cells from an embryo; place them in the brain where the cells have died; the stem cells may be able to form specialised nerve cells; that secrete dopamine

## Page 86 Chromosomes, genes and DNA

- 3 a** DNA (1)
- b** The sequence of bases in the DNA determines the sequence of amino acids in the proteins that are made (1)
- c i** Can diagnose inherited illness before a person has symptoms / check for faulty genes in an embryo during IVF so that one with correct genes can be implanted (1)  
**ii** If a person is going to develop a genetic illness, they might prefer not to know / insurance companies might want to test a person to find out if they have genes that might make them ill or shorten their life (1)

## Page 87 Inheritance

- 1 a** T (1); its characteristic appears even when the other allele is present (1)  
**b** t and t (1)
- 2 a** BB (1)  
**b** bb (1)  
**c** b (in each sperm) (1)  
**d** parents **BB** x **bb**  
 gametes all **(B)** all **(b)**  
 offspring all **Bb** (3)

## Page 87 How is sex inherited?

- 3** The father's sperm (1); which could carry either an X chromosome (1); or a Y chromosome an egg always carries an X chromosome (1)
- 4** Female (1); they have two X chromosomes (1)

# B2b answers

## Page 88 Inherited disorders

**1** The allele for Huntington's disease must be dominant (1); for the child to get this allele at least one of her parent's must have it (1); and will therefore have the disorder (1)

**2 a** Angela and Sam's alleles: **Ff** **Ff**

gametes  $\text{F}$  and  $\text{f}$   $\text{F}$  and  $\text{f}$

offspring

	$\text{F}$	$\text{f}$
$\text{F}$	<b>FF</b>	<b>f</b>
$\text{f}$	<b>Ff</b>	<b>ff</b>

There is therefore a 1 in 4 chance that a child will have the alleles ff and therefore have cystic fibrosis (4)

**b** She could have a child with cystic fibrosis (1); if she is a carrier (Ff) and her partner is also a carrier (1); but she may not be a carrier, in which case she cannot have a child with the disorder (1)

## Page 88 DNA fingerprinting

**3** (Any 4:) Possible father B is the actual father; the child has some bands that have not come from its mother; these bands must have come from its father; not all of these bands are present in possible father A; they are all present in possible father B