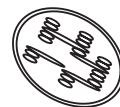


Active Biology - Student worksheets for VCE Biology Units 1 & 2 (second edition) contains the following worksheets (including answer sheets):

1. Cell organelles and their functions (4-5)	26. Controlling blood glucose (84-85)
2. Why are cells so small? (6-7)	27. Mendel's model of inheritance (86-87)
3. Animal and plant cells (8-9)	28. Genetics: important terms (88-89)
4. Eukaryotes and prokaryotes (10-11)	29. Organising chromosomes (90-95)
5. Which cell organelle? (12-13)	30. Changes to chromosomes (96-98)
6. Cell organelles: revision worksheet (14-18)	31. Meiosis: first division (99-100)
7. Movement across the plasma membrane (19-20)	32. Meiosis: second division (101-102)
8. The plasma membrane: revision worksheet (21-26)	33. Meiosis: effect of crossing over (103-104)
9. Osmosis and cells (27-28)	34. Phenotypes and genotypes (105-108)
10. Binary fission (29-30)	35. Human variation (109-112)
11. The cell cycle (31-32)	36. Epigenetics (113-114)
12. Mitosis (33-34)	37. Monohybrid crosses (115-117)
13. Apoptosis (35-38)	38. Dihybrid crosses (118-121)
14. Stem cells (39-42)	39. Pedigrees (122-125)
15. Types of stem cells (43-44)	40. Asexual V sexual reproduction (126-127)
16. Levels of organisation (45-46)	41. Types of asexual reproduction (128-131)
17. Plant structures and functions (47-50)	42. Cloning in horticulture (132-133)
18. Plant structures that support photosynthesis (51-52)	43. Animal cloning (134-137)
19. Stomata (53-56)	44. Animal adaptations (138-141)
20. The digestive system (57-62)	45. Plant adaptations (142-144)
21. The endocrine system (63-66)	46. Thermoregulation: physiological and behavioural responses (145-146)
22. Endocrine glands and their hormones (67-68)	47. Ecosystems (147-150)
23. The excretory system (69-73)	48. Relationships in ecosystems (151-152)
24. Thermoregulation (74-79)	49. Population growth and distribution (153-156)
25. Osmoregulation (80-83)	50. Estimating population density (157-159)
	51. Interacting populations (160-163)



CELL ORGANELLES AND THEIR FUNCTIONS



Using a system of colour-coding, match the name of the organelle to its correct function:

Lysosomes

Packaging of proteins for export from cell

Cell wall

Structural support in plants

nucleus

Fluid part of a cell

Synthesis of proteins

Production of ATP

Chloroplast

Ribosomes

Control centre of cell

Plasma membrane

Transport of proteins within cell

Contains enzymes responsible for breakdown of debris

Smooth endoplasmic reticulum

Cytosol

Vacuole

Synthesis of lipids and steroid hormones

Photosynthesis

Golgi complex

Mitochondria

Storage facility for fluid, enzymes, nutrients

Controls what enters and leaves the cell

Rough endoplasmic reticulum



CELL ORGANELLES AND THEIR FUNCTIONS (answers)



Lysosomes

Packaging of proteins for export from cells

Cell wall

nucleus

Structural support in plants

Fluid part of a cell

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Chloroplast

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Golgi complex

Mitochondria

Storage facility for fluid, enzymes, nutrients

Controls what enters and leaves the cell

Rough endoplasmic reticulum

THE ENDOCRINE SYSTEM

1. Using words from the list provided below, fill in the gaps (some words can be used more than once):

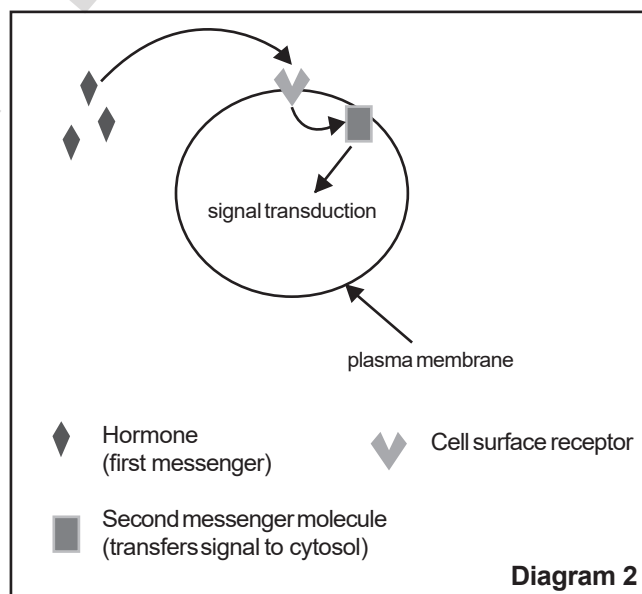
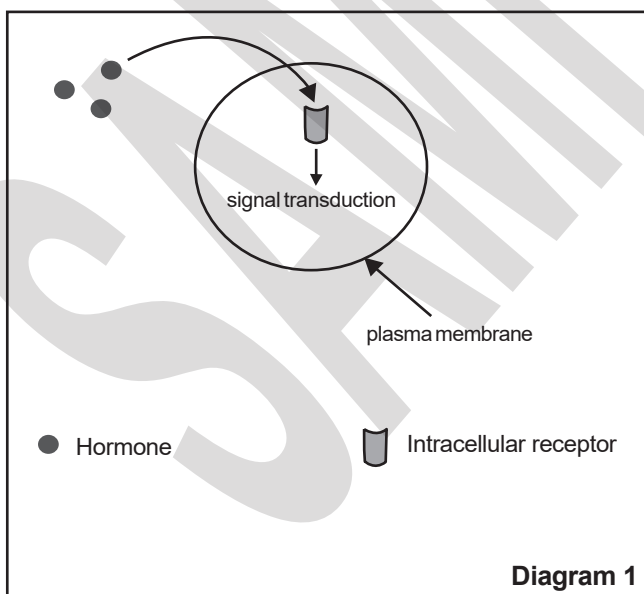
The endocrine system consists of a network of _____ glands that secrete _____. The endocrine system, along with the _____ system, is responsible for regulating the _____ of the body. _____ secreted by _____ glands are transported in the _____ to _____ cells, which must possess the correct _____ for a particular _____. Some examples of endocrine glands include the pituitary, _____ glands and the _____ gland.

Word list:

bloodstream - activities - target - adrenal - hormones - endocrine - thyroid - nervous - receptors - hormone

2. List four differences between the *endocrine* system and the *nervous* system.

3. The diagrams below show how two different types of hormones work:

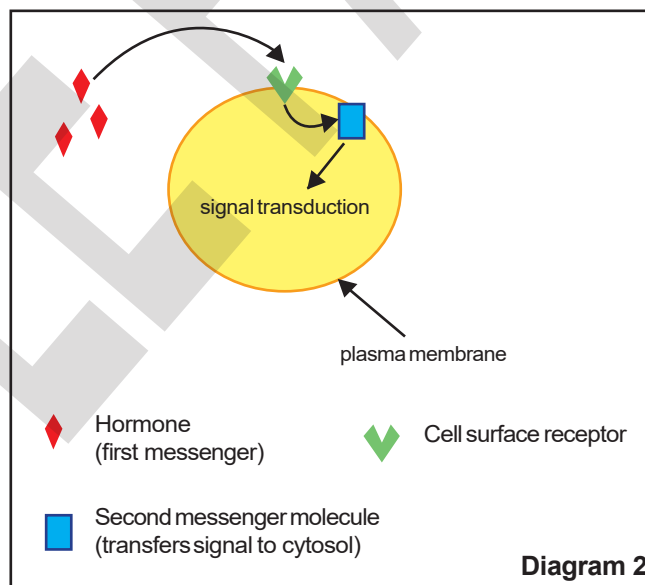
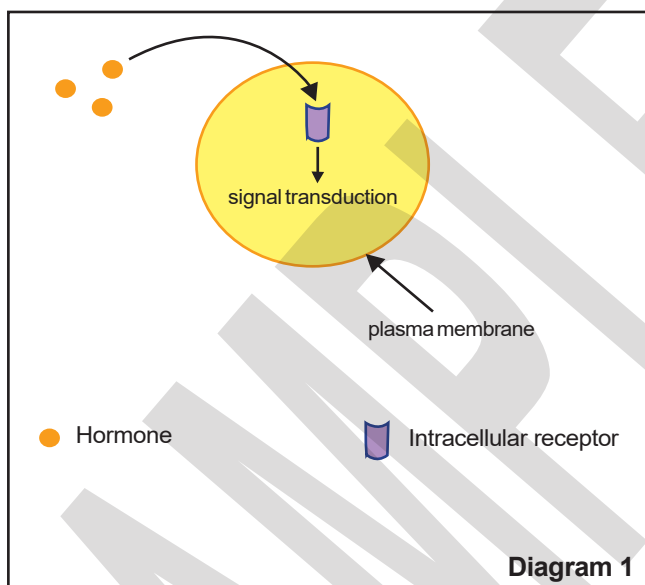


4. (a) Which diagram shows how a *hydrophilic* hormone works? How do you know?

THE ENDOCRINE SYSTEM (answers)

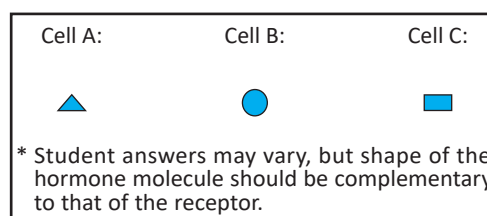
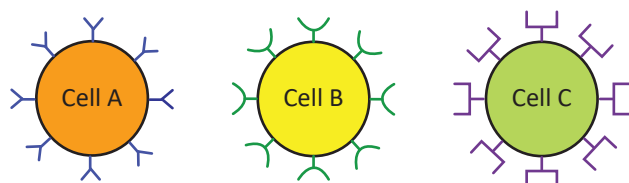
1. The endocrine system consists of a network of **endocrine** glands that secrete **hormones**. The endocrine system, along with the **nervous** system, is responsible for regulating the **activities** of the body. **Hormones** secreted by **endocrine** glands are transported in the **bloodstream** to **target** cells, which must possess the correct **receptors** for a particular **hormone**. Some examples of endocrine glands include the pituitary, **adrenal** glands and the **thyroid** gland.
2. Any four of: (i) hormones are *chemical* signalling molecules, while the nervous system transmits messages via *electrical* impulses (ii) messages travel faster in the nervous system compared to the endocrine system (iii) nervous impulses are transmitted through nerve cells, or *neurons*, while hormones are transmitted via the bloodstream (iv) the effects of hormones are longer-lasting than those of nervous impulses (v) the nervous system is under both voluntary and involuntary control, while the endocrine system is under involuntary control only (vi) nervous impulses use neurotransmitters at synaptic clefts to enter target cells, while hormones enter cells by diffusing across the plasma membrane or binding to cell receptors.

3.

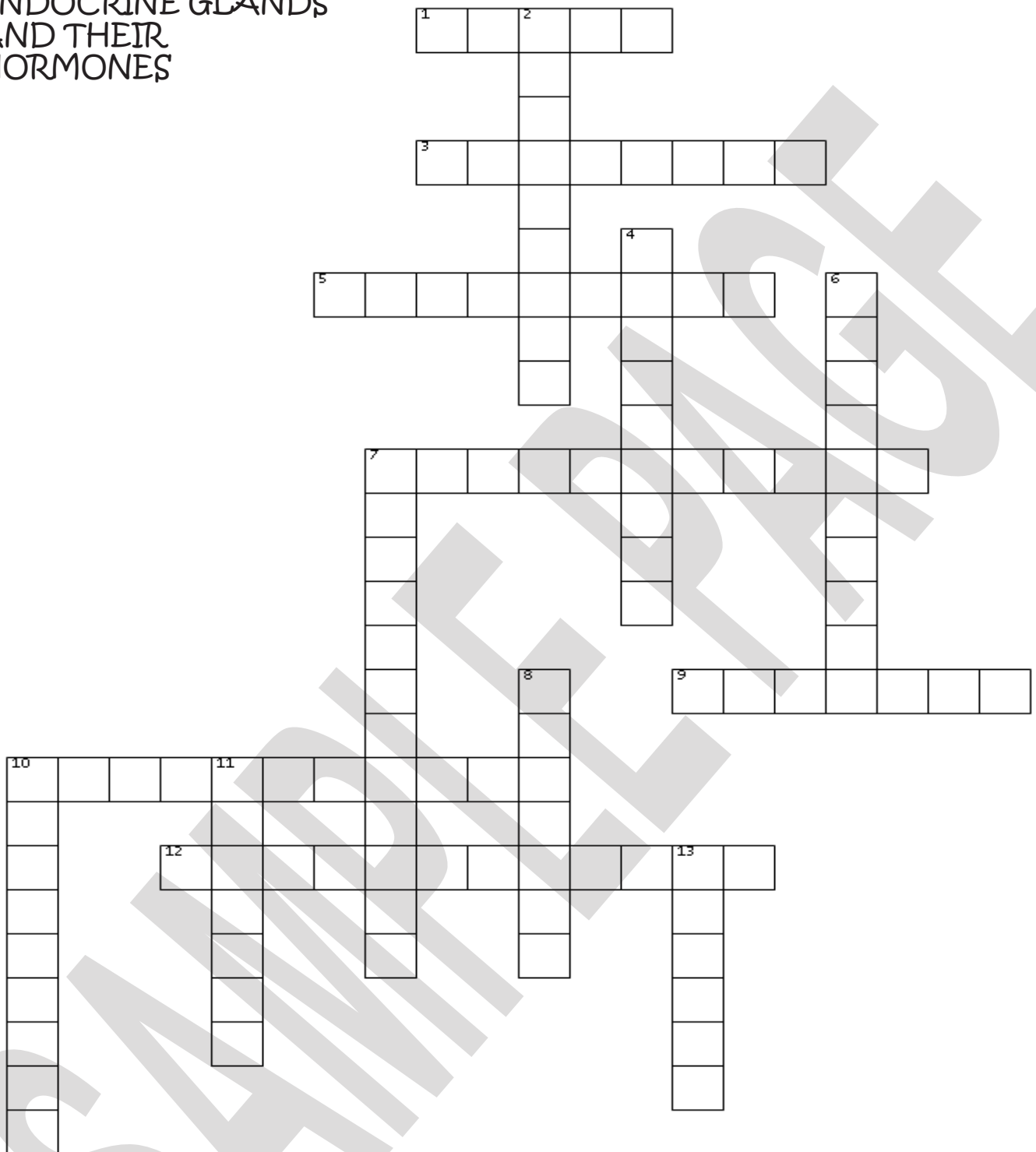


4. (a) Diagram 2 shows how a *hydrophilic* hormone works. Hydrophilic hormones cannot diffuse across the plasma membrane and can therefore bind only to cell surface receptors, as shown (a second messenger molecule is needed to carry the signal into the cell cytosol).
(b) A protein hormone is more likely to be hydrophilic because, while soluble in water, it is *insoluble* in lipids and therefore cannot diffuse across the membrane's lipid bilayer (steroid hormones are soluble in lipids and can therefore dissolve through the membrane).

5.



ENDOCRINE GLANDS AND THEIR HORMONES



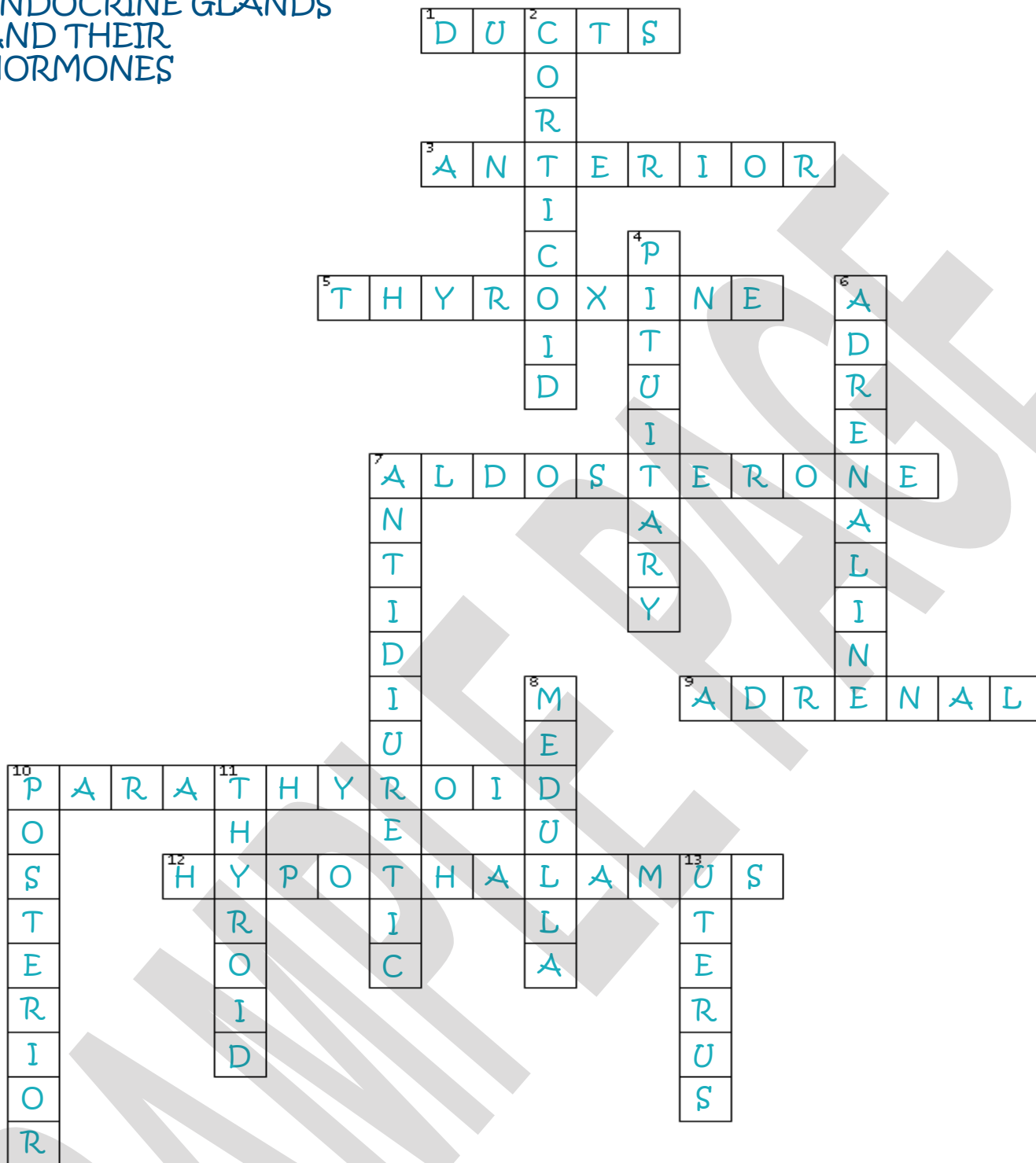
ACROSS

1. Endocrine glands, unlike other glands, do not have these.
3. Part of the pituitary gland that releases thyroid-stimulating hormone (TSH).
5. Hormone that leads to an increase in metabolism.
7. Hormone, released by the adrenal glands, which regulates blood pressure.
9. These paired glands are located on top of the kidneys.
10. This hormone is released when calcium levels are too low.
12. Region in the brain that controls the pituitary gland.

DOWN

2. Types of hormones produced by cells of the cortex of adrenal glands.
4. This gland is known as the 'master gland'.
6. Hormone involved in the 'fight or flight' response.
7. Hormone released by the pituitary gland that regulates the water content in blood.
8. Adrenal gland is made up of an outer cortex and an inner _____.
10. Part of the pituitary gland that releases antidiuretic hormone (ADH).
11. Gland that releases the hormone thyroxine.
13. Target organ of the hormone oxytocin (OXT).

ENDOCRINE GLANDS AND THEIR HORMONES



ACROSS

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THERMOREGULATION: PHYSIOLOGICAL & BEHAVIOURAL RESPONSES



Complete the following table by (i) stating whether each response is *physiological* or *behavioural* and (ii) indicating (with a tick) whether the response *produces heat*, *increases heat loss* or *decreases heat loss*.

RESPONSE	PHYSIOLOGICAL or BEHAVIOURAL?	PRODUCES HEAT	INCREASES HEAT LOSS	DECREASES HEAT LOSS
Shivering				
Increase in metabolism				
Adding clothing				
Sweating (humans)				
Exercising vigorously				
Vasoconstriction				
Rubbing hands together				
Using an ice pack				
Piloerection				
Huddling				
Panting (dogs)				
Vasodilation				



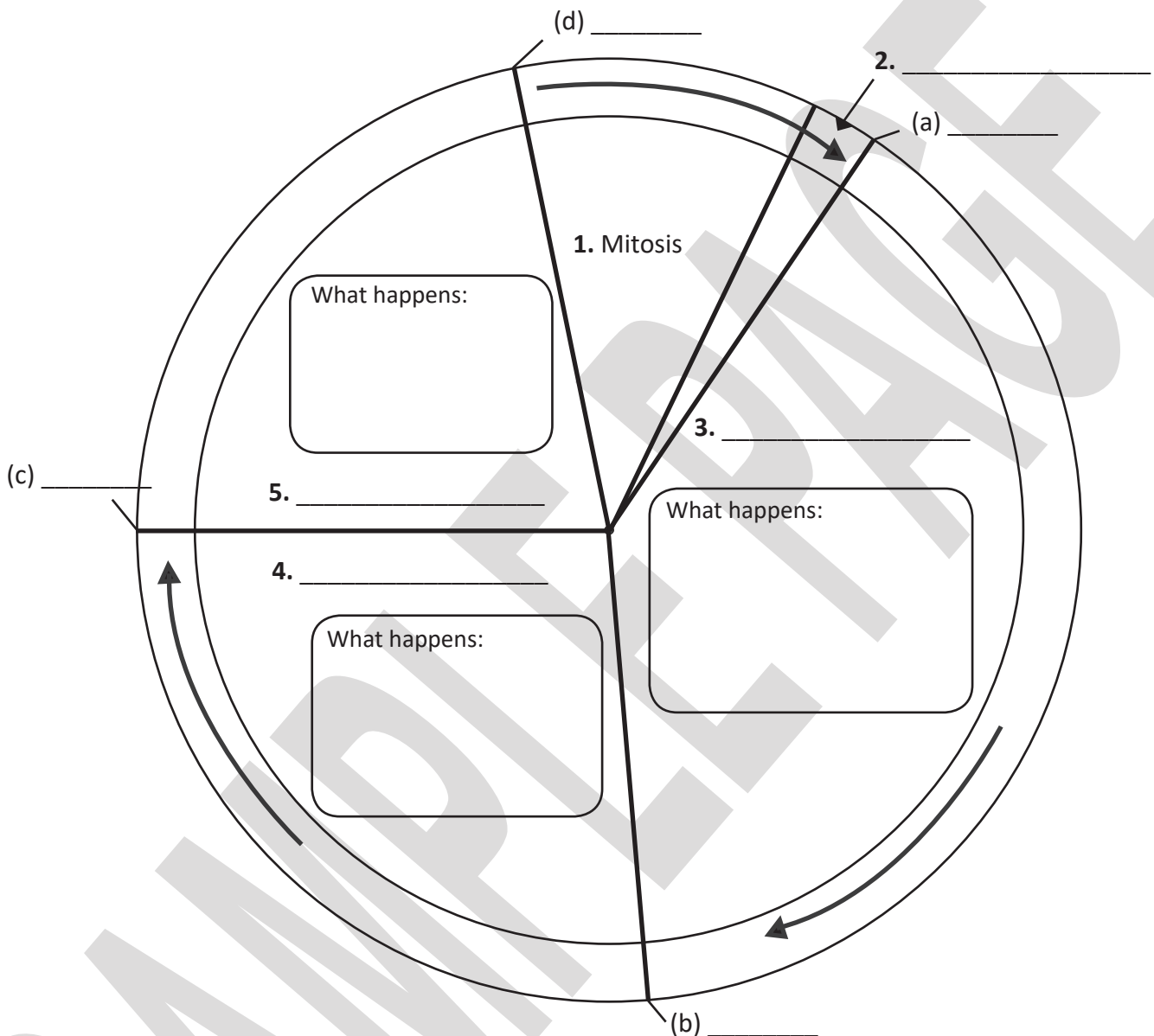
THERMOREGULATION: PHYSIOLOGICAL & BEHAVIOURAL RESPONSES (answers)



RESPONSE	PHYSIOLOGICAL or BEHAVIOURAL?	PRODUCES HEAT	INCREASES HEAT LOSS	DECREASES HEAT LOSS
Shivering	Physiological	✓		
Increase in metabolism	Physiological	✓		
Adding clothing	Behavioural			✓
Sweating (humans)	Physiological		✓	
Exercising vigorously	Behavioural	✓		
Vasoconstriction	Physiological			✓
Rubbing hands together	Behavioural	✓		
Using an ice pack	Behavioural		✓	
Piloerection	Physiological			✓
Huddling	Behavioural			✓
Panting (dogs)	Behavioural		✓	
Vasodilation	Physiological		✓	

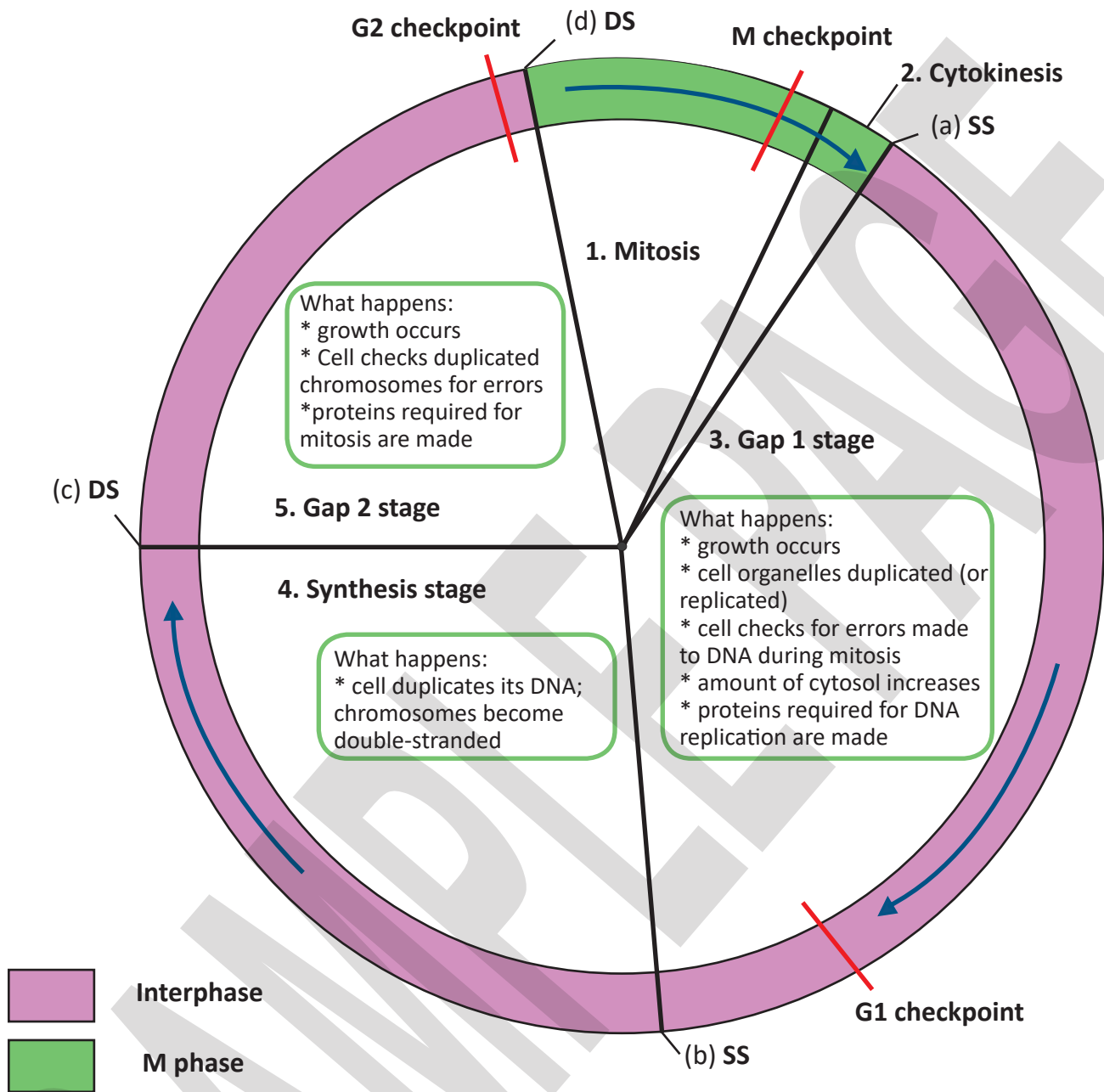
THE CELL CYCLE

The following diagram shows the cell cycle:



1. On the diagram, add the names of the stages **2**, **3**, **4** and **5**.
2. In the spaces provided, briefly describe what happens during stages **3**, **4** and **5**.
3. At each point (a), (b), (c) and (d), indicate whether the DNA is single-stranded (**SS**) or double-stranded (**DS**).
4. Which stages make up (i) the *M phase*? (ii) *Interphase*? Use colour-coding and a key to show this.
5. On the diagram, show the positions of the three 'checkpoints' in the cell cycle.
6. At one of the checkpoints is a protein, p53, which acts as a 'tumour suppressor'; its job is to stop cells with damaged DNA from continuing on through the cell cycle. What would happen if p53 malfunctioned?

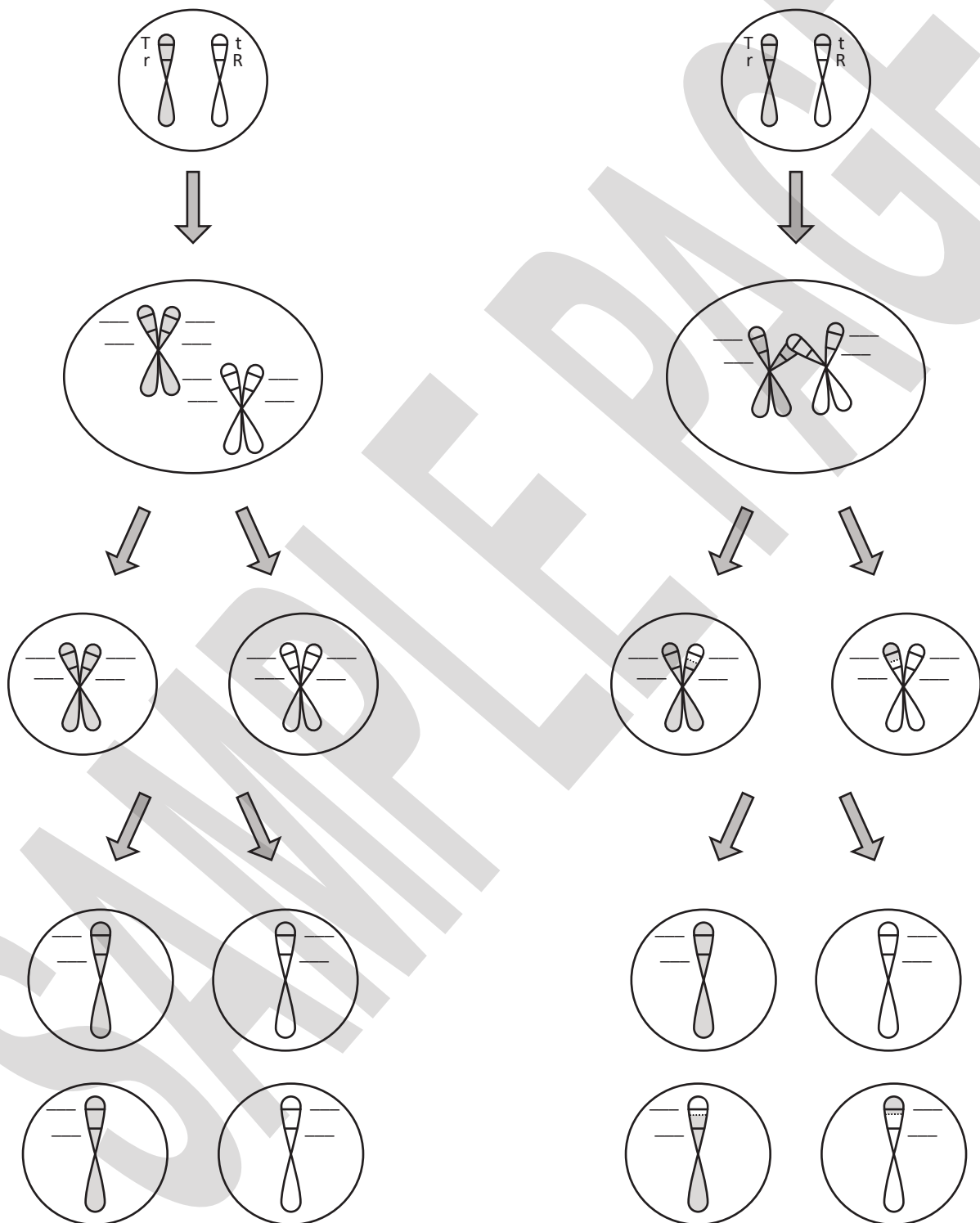
THE CELL CYCLE (answers)



1. See above diagram.
2. See above diagram.
3. See above diagram.
4. The M phase consists of Mitosis and Cytokinesis (shown in green); Interphase consists of the G1, S and G2 stages (shown in purple).
5. See above diagram.
6. If the p53 protein malfunctioned, damaged cells would continue on through the cell cycle unchecked, leading to proliferation of these cells. This can lead to cancer.

MEIOSIS: EFFECT OF CROSSING OVER

A tall plant that produces round seeds has the genotype **TtRr**. The two genes are *linked*, that is, they are located on the same chromosome. The following diagram shows the homologous pair of chromosomes during meiosis, (a) *without* crossing over and (b) *with* crossing over:

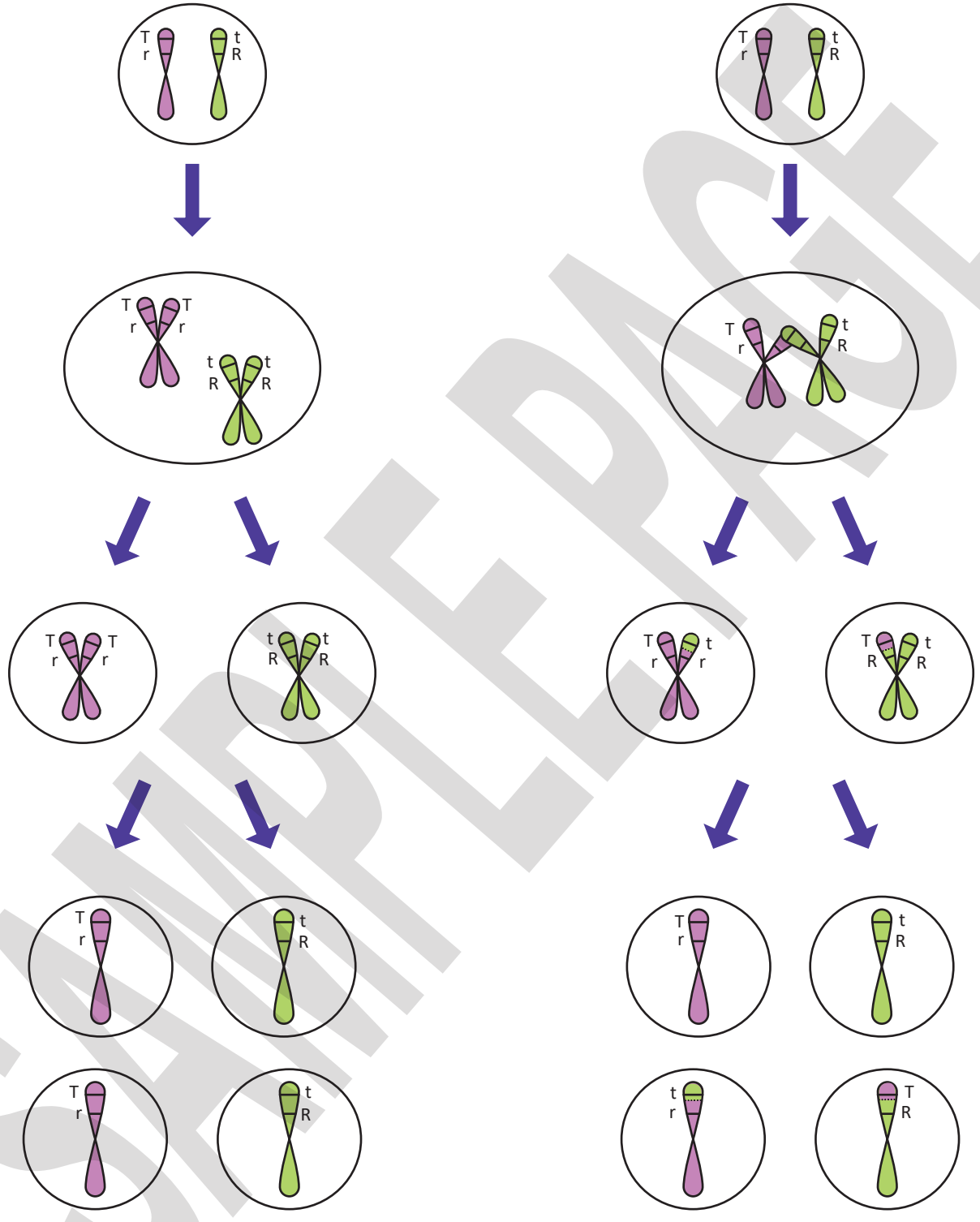


(a) No crossing over occurs

(b) Crossing over occurs

1. Complete the diagram by showing the alleles present on each chromosome/chromatid.
2. Identify the types of gametes that are produced (i) without crossing over (ii) with crossing over.

MEIOSIS: EFFECT OF CROSSING OVER (answers)



(a) No crossing over occurs

(b) Crossing over occurs

1. See above diagram.
2. (i) Tr and tR (ii) Tr, tR, tr and TR

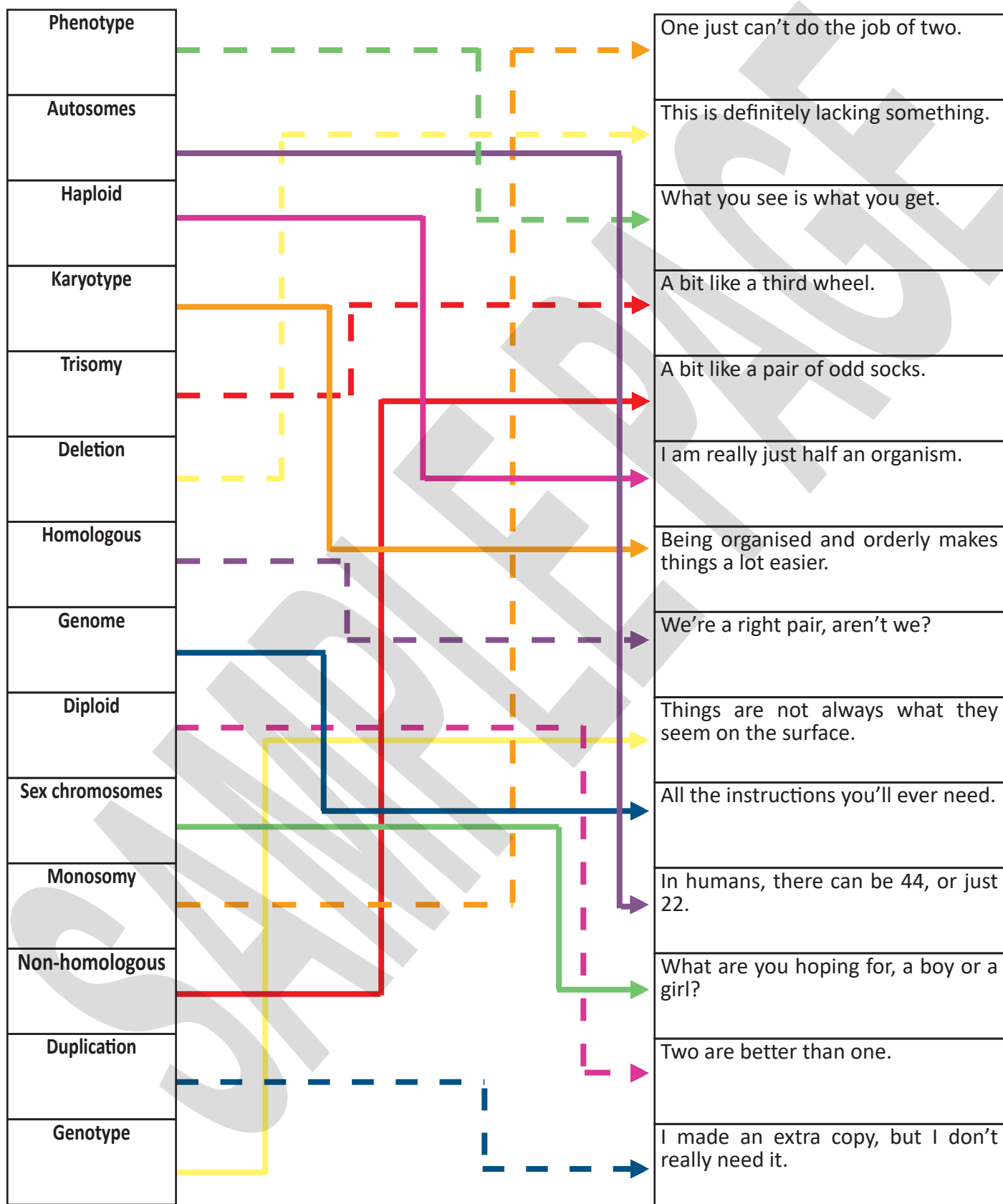
GENETICS: IMPORTANT TERMS

Connect the terms on the left with the 'clues' on the right:

Phenotype
Autosomes
Haploid
Karyotype
Trisomy
Deletion
Homologous
Genome
Diploid
Sex chromosomes
Monosomy
Non-homologous
Duplication
Genotype

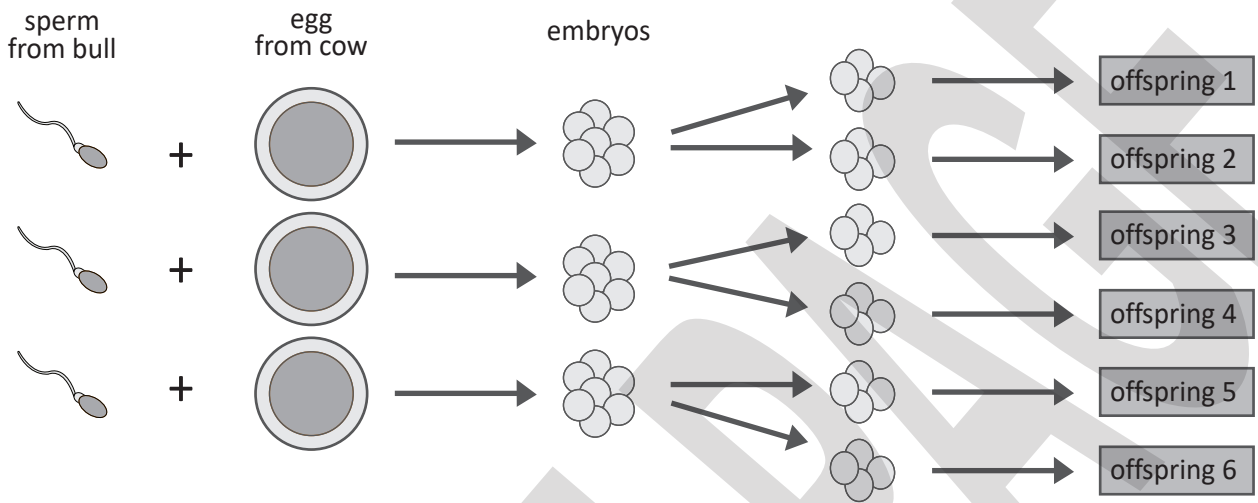
One just can't do the job of two.
This is definitely lacking something.
What you see is what you get.
A bit like a third wheel.
A bit like a pair of odd socks.
I am really just half an organism.
Being organised and orderly makes things a lot easier.
We're a right pair, aren't we?
Things are not always what they seem on the surface.
All the instructions you'll ever need.
In humans, there can be 44, or just 22.
What are you hoping for, a boy or a girl?
Two are better than one.
I made an extra copy, but I don't really need it.

GENETICS: IMPORTANT TERMS (answers)



ANIMAL CLONING

1. The following diagram illustrates the process of *embryo splitting*, a technique used in the artificial cloning of animals.



(a) Which of the offspring 1 - 6 will be clones of each other? Explain.

(b) Explain why offspring 1 and offspring 6 will NOT be identical.

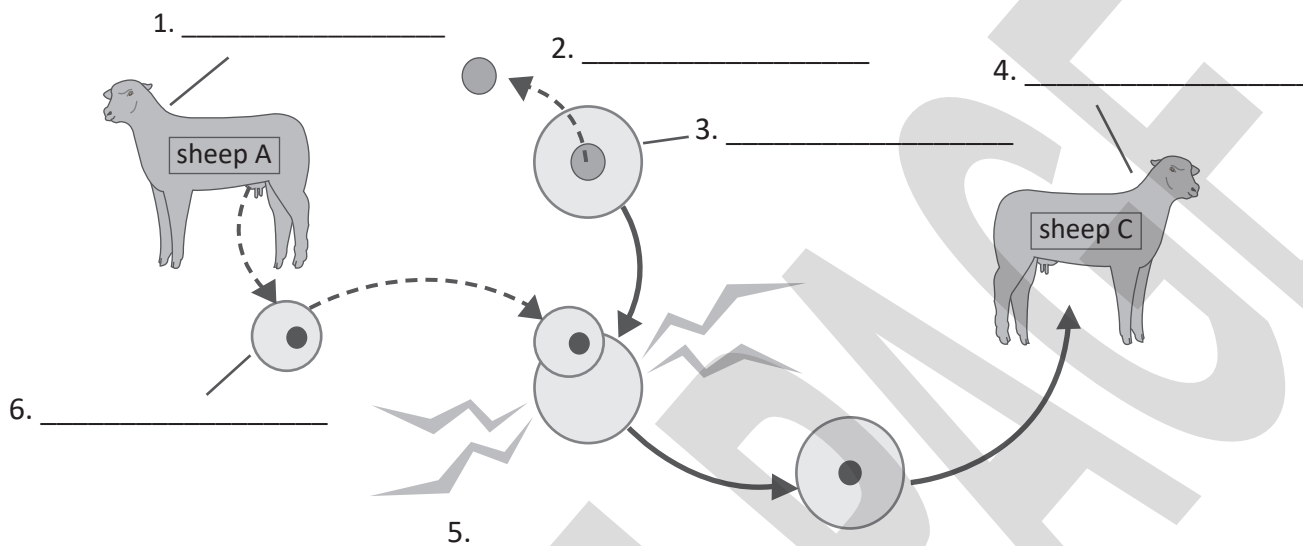
(c) Will the offspring produced be identical to either of the parents? Explain.

(d) In this process, each embryo will be implanted into a surrogate cow. Does this cow make any genetic contribution to the offspring? Explain.

2. The technique of embryo splitting has been used in the livestock industry for many years. What are the advantages of using this technique?

3. Another technique used in the artificial cloning of animals is SCNT. What does this stand for?

4. The diagram below shows some of the steps involved in creating 'Dolly the sheep' using SCNT.



(a) Using the following word list, label numbers 1 - 6 on the diagram.

enucleation - surrogate ewe - somatic cell - nuclear donor - cell fusion - donor egg

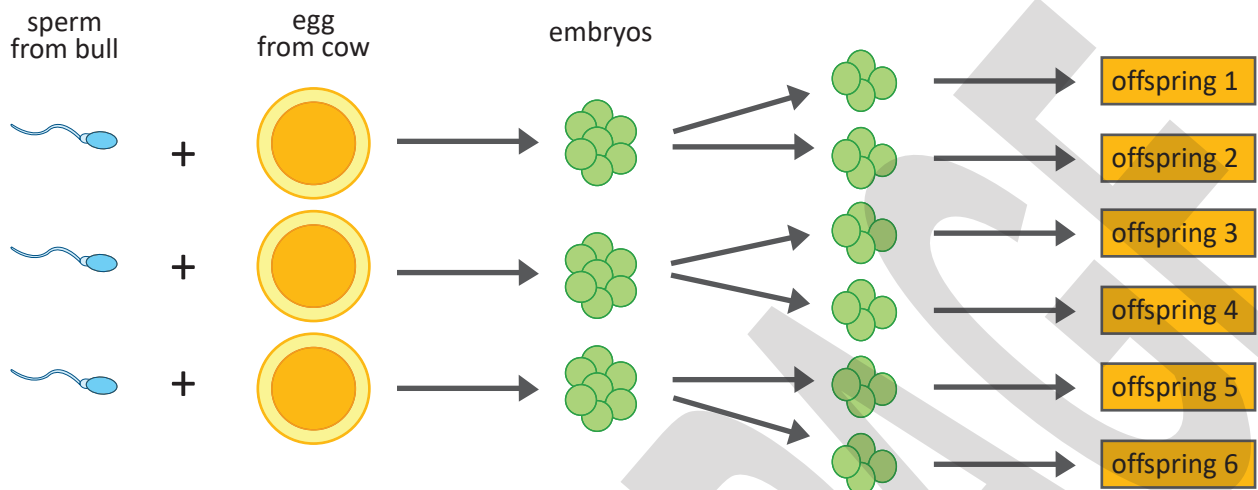
(b) Another sheep used in this process, sheep B, is not shown in the diagram. Explain the role played by sheep B in creating Dolly.

(c) To which sheep, A, B or C, would Dolly be identical? Explain.

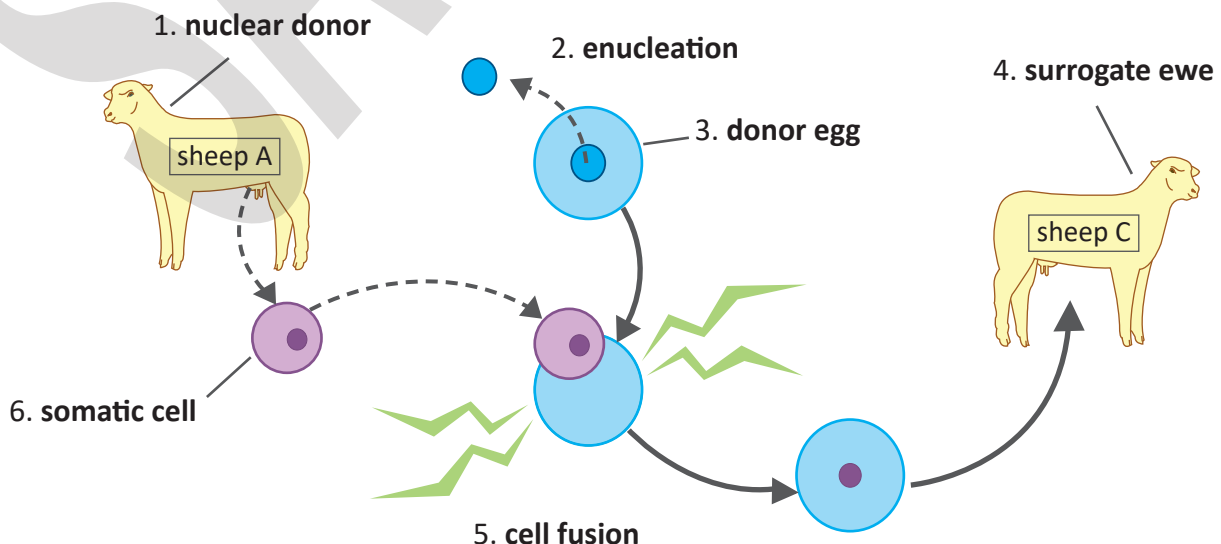
5. Dolly was not the first animal to be cloned using nuclear transfer. What made her so special?

6. The cloning of animals using SCNT is not without problems. Describe two problems/difficulties that have been associated with this technique.

ANIMAL CLONING (answers)



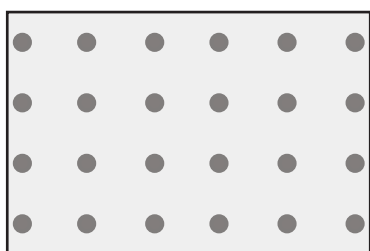
- Offspring 1 and 2 will be clones, as will offspring 3 and 4 and offspring 5 and 6. This is because in each case, the two offspring have come from the same embryo before it was split.
 - Offspring 1 and offspring 6 will *not* be identical because they are the result of two different sperm fertilising two different eggs. They will therefore be siblings, but not clones.
 - The offspring will not be identical to either parent because each will have received half the genetic material from one parent (the bull), and half from the other (the cow). They will therefore be a genetic mix of both parents.
 - The surrogate cow does not contribute any genetic material to the offspring because it was not her eggs that were used, but those of another cow.
- The advantage of using embryo splitting is that the breeder can increase the number of offspring produced by a stud bull or a prized cow. The parents are chosen because they possess certain desirable characteristics, such as high milk yield in the cow, or lean muscle in the bull, and by splitting the embryo, two calves are produced from each fertilised egg instead of just one.
- Somatic Cell Nuclear Transfer.
- See diagram below.



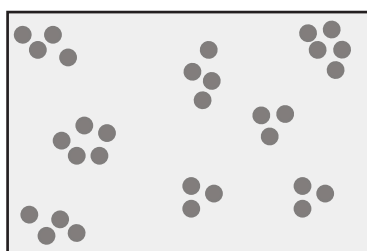
- (b) Sheep **B** donated the egg cell that was used in the process.
- (c) Dolly would be identical to sheep **A** because this is the sheep that donated the somatic cell used in the process. This cell, with its nucleus containing all the required genetic material, eventually became Dolly.
5. Dolly was special because she was the first animal to be cloned using a somatic cell. Previous cloning of animals used embryonic or fetal cells.
6. Any two of: (i) the success rate is extremely low; less than 1% of cloned embryos survive beyond birth (ii) of those animals that survive, many have abnormalities, including impaired immune systems and/or 'large offspring syndrome', in which the clones have abnormally large organs (iii) cloned animals tend to age more rapidly than normal, possibly due to the fact that they have developed from adult somatic cells with shortened chromosome ends (telomeres) that may be associated with cell ageing (iv) attitudes towards animal cloning are mixed, with many people opposed to such a practice because they feel it is 'interfering with nature'.

POPULATION GROWTH AND DISTRIBUTION

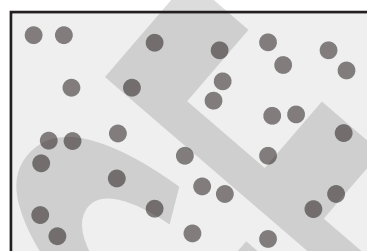
1. The following diagrams show three different types of distribution found in populations:



(i) _____



(ii) _____



(iii) _____

(a) On the diagram, label the type of distribution shown in (i), (ii) and (iii).

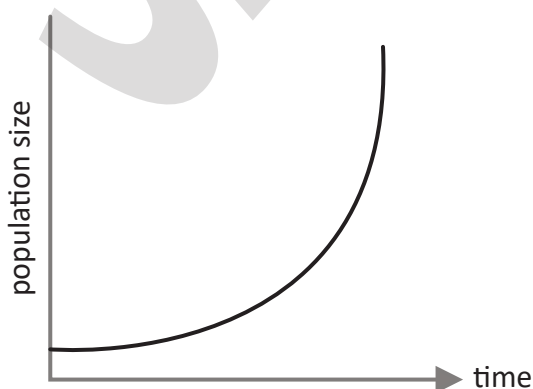
(b) Explain, using an example, how the type of distribution shown in (ii) can come about.

(c) In what situation might you expect to see the type of distribution shown in (i)? Include an example.

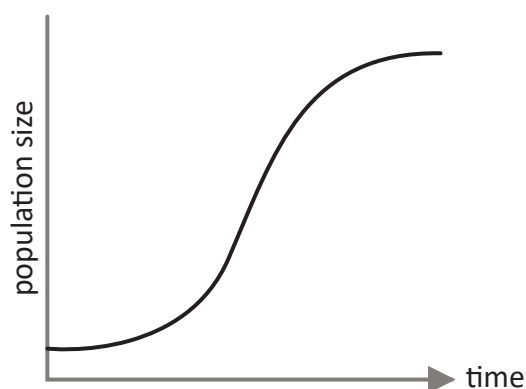
2. (a) Identify the four factors, or *primary ecological events*, that determine population size.

(b) What is meant by 'secondary ecological events' that can affect population size? Give examples.

3. The following diagrams show two models of population growth, the *J curve* and the *S curve*:



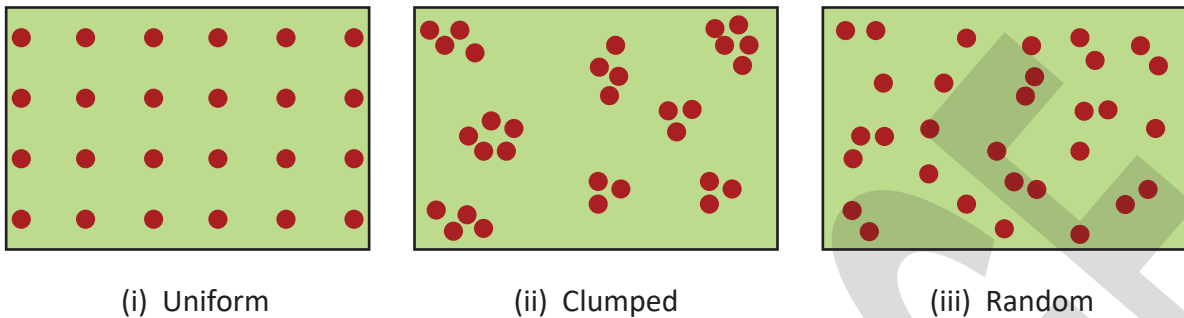
(i) J curve



(ii) S curve

POPULATION GROWTH AND DISTRIBUTION (answers)

1.



(a) See above diagram.

(b) A 'clumped' distribution can occur when there are slight differences in environmental conditions across a geographic area, for example, the pH or moisture content of soil may vary. This can result in 'groups' of plants growing in some parts of the region, but not in others (student examples will vary).

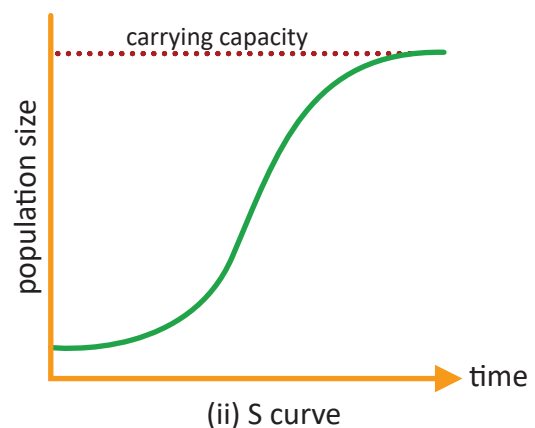
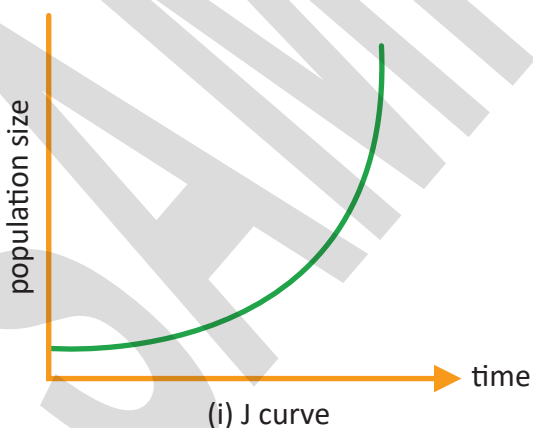
(c) A 'uniform' distribution can occur when individuals of the same species are competing with each other for space and must remain equidistant in order to survive in the available area. This can be seen when members of an animal population defend their territories (student examples will vary).

2.

(a) Births, deaths, immigration and emigration.

(b) *Secondary ecological events* that can affect population size are things like disease, predators and certain weather events that can influence births, deaths, immigration or emigration. Disease, for example, may increase deaths in a population, while an increase in available food may result in more births, or increased immigration (student examples will vary).

3.



(a) Both the *J curve* and *S curve* models show a period of exponential growth.

(b) Exponential growth is most likely to occur in a population when there are unlimited resources such as food and space. It commonly occurs during recovery of a population that has been greatly reduced in size due to a large-scale disaster, such as a fire.

INTERACTING POPULATIONS

The following table shows the number of organisms from three different species (unicellular algae, small fish and zooplankton), found in lake samples taken every two months over two years. The three species form a food chain.

TIME (months)	Species X	Species Y	Species Z	TIME (months)	Species X	Species Y	Species Z
0 (July)	420	270	120	14 (Sept)	345	180	150
2 (Sept)	510	150	90	16 (Nov)	480	135	60
4 (Nov)	645	195	60	18 (Jan)	720	180	30
6 (Jan)	720	270	15	20 (Mar)	600	360	30
8 (Mar)	735	330	30	22 (May)	510	345	45
10 (May)	660	480	45	24 (July)	315	240	150
12 (July)	420	360	120	—	—	—	—

1. Using the set of axes on the next page, graph the data for each of species X, Y and Z.

2. Which species, X, Y or Z, is the *producer* in this ecosystem? How can you tell?

3. What is *zooplankton*? Which species, X, Y or Z, represents this organism?

4. Infer why the numbers of species X fluctuate in the way they do over the two year period.

5. What is meant by a 'boom-and-bust' cycle in ecology, and does your graph show evidence of this? Explain.

INTERACTING POPULATIONS (answers)

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10 (May)	660	480	45	24 (July)	315	240	150
12 (July)	420	360	120	—	—	—	—

1. See graph on next page.
2. Species X, the unicellular algae, is the producer in this ecosystem. Species X has the largest number of organisms which suggests that it is at the bottom of the food chain where the amount of biomass is always highest (biomass decreases with each trophic level in an ecosystem).
3. *Zooplankton* is a type of heterotrophic plankton, typically microscopic animals that float or drift in the ocean, seas or bodies of fresh water. In this ecosystem, species Y represents zooplankton.
4. The population of species X fluctuates with the seasons, numbers being higher during the summer months and lower during winter. Algae carry out maximum photosynthesis during summer when more light is available, meaning that they produce more food for themselves.
5. A 'boom-and-bust' cycle refers to a population size that grows and then shrinks on a regular basis, the 'boom' being the period of rapid growth, and the 'bust' being the period where the population falls back to a minimal level. The graph shows evidence of this occurring in species X, Y and Z as definite fluctuations in population size are evident.
6. The number of prey tends to peak first, followed by the number of predators as more food becomes available to them. For example, the two peaks seen in species Y, the zooplankton, are followed by peaks in the population of small fish, which feed on the zooplankton.
7. There are fewer small fish than there are zooplankton because the small fish are higher up the food chain. In a food chain, an organism passes on only a fraction (about one-tenth) of the energy it receives from the food it eats. This means that each trophic level in a food chain supports fewer organisms than the one below it.