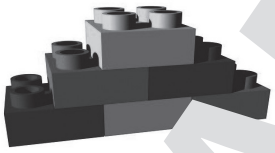
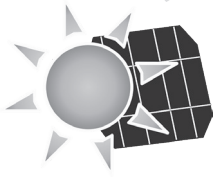
Active Biology - student worksheets for VCE Biology Units 1 & 2 **contains the following worksheets (plus answer sheets):**

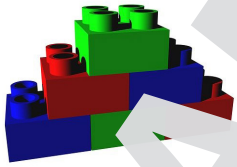
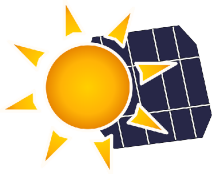
1.	Cell organelles and their functions	29.	Estimating population density
2.	Why are cells so small?	30.	The cell cycle
3.	Animal and plant cells (Venn diagram)	31.	Binary fission
4.	Eukaryotes and prokaryotes (Venn diagram)	32.	Mitosis
5.	Which cell organelle?	33.	Asexual V sexual reproduction
6.	Cell organelles: revision worksheet	34.	Types of asexual reproduction
7.	Movement across the plasma membrane	35.	Cloning in horticulture
8.	The plasma membrane: revision worksheet	36.	Animal cloning
9.	Osmosis and cells	37.	Meiosis: first division
10.	Photosynthesis	38.	Meiosis: second division
11.	Cellular respiration	39.	Antenatal human development (from egg to zygote)
12.	Anaerobic respiration		
13.	Levels of organisation	40.	Embryonic development
14.	Plant structures and functions	41.	Stem cells
15.	Plant structures that support photosynthesis	42.	Types of stem cells
16.	The digestive system	43.	The Human Genome Project
17.	The circulatory system	44.	Structure of DNA
18.	The excretory system	45.	Mendel's model of inheritance
19.	The respiratory system	46.	Genetics: important terms
20.	Animal adaptations	47.	Changes to chromosomes
21.	Plant adaptations	48.	Organising chromosomes
22.	Thermoregulation	49.	Structure of chromosomes and DNA
23.	Thermoregulation: physiological and behavioural responses	50.	Phenotypes and genotypes
		51.	Human variation
24.	Osmoregulation	52.	Monogenic and polygenic inheritance
25.	Controlling blood sugar	53.	Epigenetics
26.	Organising biodiversity	54.	Monohybrid crosses
27.	Ecosystems	55.	Dihybrid crosses
28.	Relationships in ecosystems	56.	Pedigrees

* Note that some of the above listed worksheets consist of two or more pages.

WHICH CELL ORGANELLE?

Analogy: this organelle is like...	Name of organelle	Explanation of analogy
		
		
		
		
		
		
		
		

WHICH CELL ORGANELLE?
(answers)

Analogy: this organelle is like...	Name of organelle	Explanation of analogy
	Endoplasmic reticulum	A **forklift** transports materials around a factory; the **endoplasmic reticulum** transports proteins around the cell.
	Vacuole	A **warehouse** serves as a storage area for goods and products; a **vacuole** stores nutrients, water and waste products in a cell.
	Plasma membrane	A **security guard** allows people to enter or leave a room; the **plasma membrane** allows substances to enter or exit a cell.
	Nucleus	An **instruction manual** contains the information required to carry out a task; the **nucleus** contains instructions, in the form of DNA, for making proteins.
	Golgi complex	The **boxes** form packages for various products; the **Golgi complex** is responsible for packaging proteins into vesicles, ready for export from the cell.
	Ribosome	**Building blocks** are joined together to construct various structures; **ribosomes** link a number of amino acids to construct proteins.
	Mitochondrion	A **fuel pump** provides the energy needed to run a vehicle; the **mitochondrion** provides the energy required for a cell to carry out its various functions.
	Chloroplast	**Solar panels** absorb the sun's energy and convert it into electricity; **chloroplasts** absorb the sun's energy and convert it into chemical energy.

THE EXCRETORY SYSTEM

1. (a) What is meant by 'excretion' of wastes?

_____

_____

(b) Name the three main excretory organs of the body and state what kind of waste they excrete.

_____

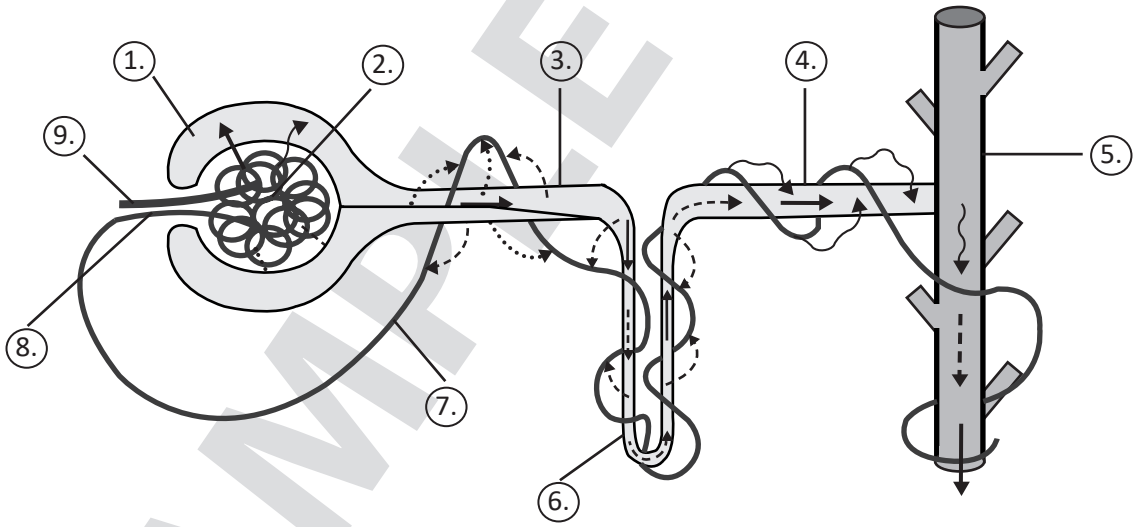
_____

(c) Explain the difference between *excretion* and *egestion* of wastes.

_____

_____

2. The following diagram shows a highly simplified version of a kidney nephron:



(a) Identify the structures 1 - 9.

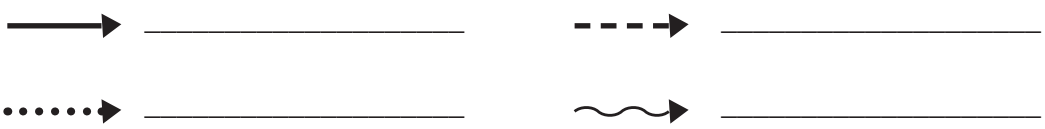
1 - _____ 2 - _____ 3 - _____

4 - _____ 5 - _____ 6 - _____

7 - _____ 8 - _____ 9 - _____

(b) The four representations of arrows on the diagram show the movement of four substances: water, urea, glucose and the drug penicillin. (i) State which arrow represents which substance and (ii) Explain your answer in each case (be sure to identify any important processes occurring).

(i)



(ii) _____

_____

_____

_____

_____

_____

_____

_____

(c) Explain why structure number **9** on the diagram is wider in diameter than structure number **8**.

_____

_____

_____

3. (a) What are 'N-wastes' and where do they come from?

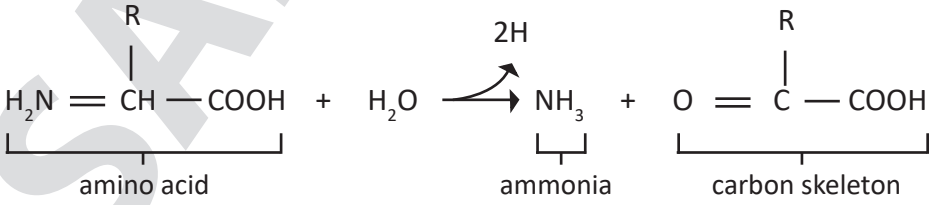
_____

_____

(b) What are the three major forms of N-wastes produced by animals?

_____

4. The following equation shows the process of *deamination* occurring in the liver of a mammal. In this process, an amino acid has its nitrogen-containing part removed as ammonia.



(a) Using three different colours, highlight the **carbon**, **hydrogen** and **oxygen** atoms.

(b) Count the number of **C**, **H, N** and **O** atoms on each side of the equation. Are they balanced?

_____

No. of carbon atoms = _____ No. of hydrogen atoms = _____

No. of oxygen atoms = _____ No. of nitrogen atoms = _____

(c) Explain what happens to the 'carbon skeleton' produced in this reaction.

_____

_____

(d) The process of deamination produces ammonia, yet the main N-waste of mammals is *urea.* Explain.

_____

_____

5. Apart from filtering the blood of waste, what are *two* other important functions of the kidneys?

_____

_____

_____

6. True or False?

(a)	Starting from the outside, the correct order of layers in the kidney is: cortex, medulla, pelvis.	
(b)	The presence of blood in a person's urine indicates that an error has occurred during the process of reabsorption.	
(c)	Birds excrete N-wastes as urea.	
(d)	The ureters transport urine to the bladder.	
(e)	Nephrons are contained within the cortex of the kidney.	
(f)	The process of reabsorption involves both diffusion and active transport.	

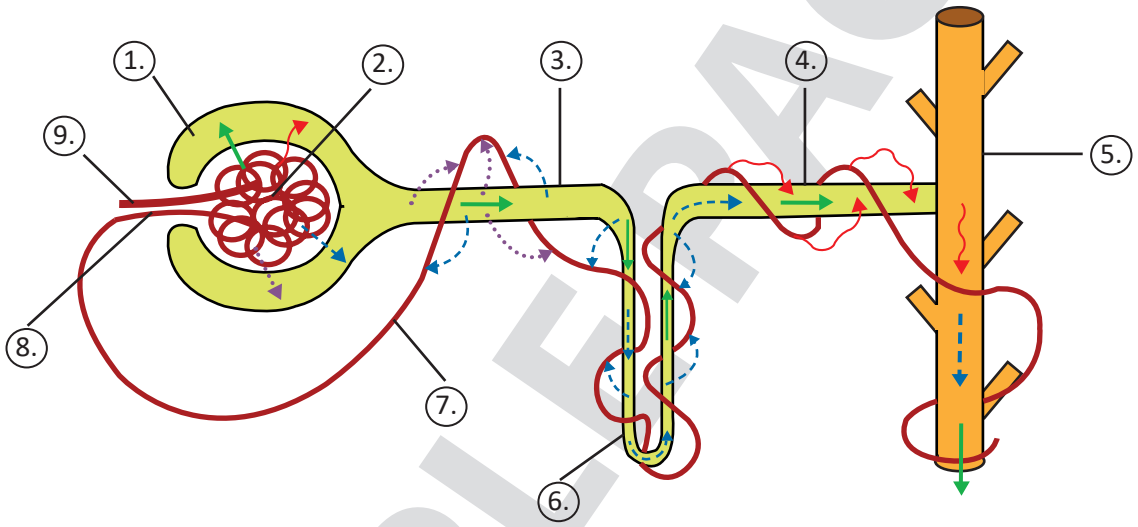
THE EXCRETORY SYSTEM
(answers)

1. (a) Excretion is the process in which metabolic wastes are eliminated from the body of an organism (metabolic wastes are those substances produced by cells as a result of their various activities).

(b) The three main excretory organs are (i) the kidneys, which excrete urea (ii) the lungs, which excrete carbon dioxide and (iii) the skin, which excretes water and salts.

(c) While excretion eliminates metabolic waste produced by cells, such as urea and carbon dioxide, *egestion* refers to the elimination of undigested food from the body. This type of waste is not produced by cells.

2.



(a) **1** - Bowman's capsule **2** - Glomerulus **3** - Proximal tubule **4** - Distal tubule **5** - Collecting duct **6** - Loop of Henle **7** - Blood vessel **8** - Efferent arteriole **9** - Afferent arteriole

(b)
(i)

(ii)

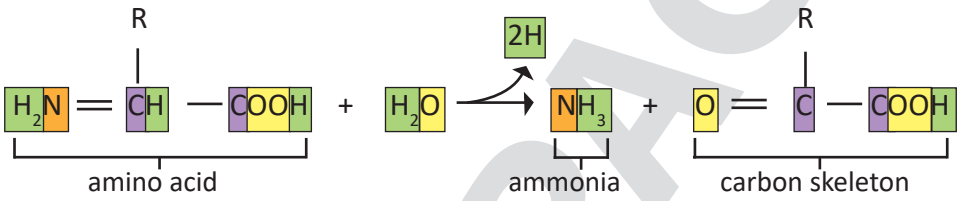
The solid (green) arrow represents **urea** because the diagram shows that this is a substance that does not get reabsorbed back into the blood at any stage. Urea is a waste product that must be completely eliminated from the body.
The dotted (purple) arrow represents **glucose** because this substance is not present in the collecting duct as part of urine. Glucose is a required nutrient and will therefore be completely reabsorbed back into the blood using the processes of diffusion and active transport.
The wavy (red) arrow represents **penicillin** because the diagram shows that this substance gets secreted from the blood into the distal tubule of the nephron to become part of urine. Drugs like penicillin - as well as excess ions - are not needed by the body and are therefore eliminated.
The dashed (blue) arrow represents **water** because this substance is reabsorbed back into the blood along the entire length of the tubule, particularly at the Loop of Henle where a narrowing of the tubule occurs. This narrowing results in large amounts of water being reabsorbed into the blood, concentrating the urine and conserving water.

(c) Structure **9** (afferent arteriole) is wider than structure **8** (efferent arteriole) because this puts the blood entering the glomerulus under pressure, facilitating the process of filtration. Because the blood has to squeeze through narrower spaces, many of the substances are forced out of the blood and into the Bowman's capsule, where they become part of the filtrate.

3. (a) N-wastes are wastes that contain nitrogen and they come from the breakdown of proteins in our diet.

(b) Ammonia, urea and uric acid.

4.



(a) See above diagram.

(b) No. of carbon atoms = **2** No. of hydrogen atoms = **6** * All atoms are balanced
No. of oxygen atoms = **3** No. of nitrogen atoms = **1**

(c) The carbon skeleton produced in this reaction can be used as a source of energy, or may be used to synthesise glucose or fats.

(d) The ammonia produced during deamination is immediately converted to urea, which will then be excreted. It is necessary to convert ammonia to urea because ammonia is highly toxic and its excretion requires large amounts of water to dilute it. By excreting urea, which is far less toxic, mammals conserve water.

5. Any two of: (i) maintaining water balance in the body (ii) regulating salt content (iii) regulating blood pressure (iv) maintaining blood pH (v) excreting excess hormones and vitamins (vi) processing vitamin D.

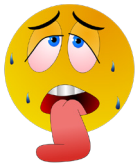
6.

(a)	True	
(b)	False	(presence of blood in a person's urine indicates that an error has occurred during *filtration*)
(c)	False	(birds excrete N-wastes as *uric acid*)
(d)	True	
(e)	False	(nephrons extend from the cortex into the medulla of the kidney)
(f)	True	

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				



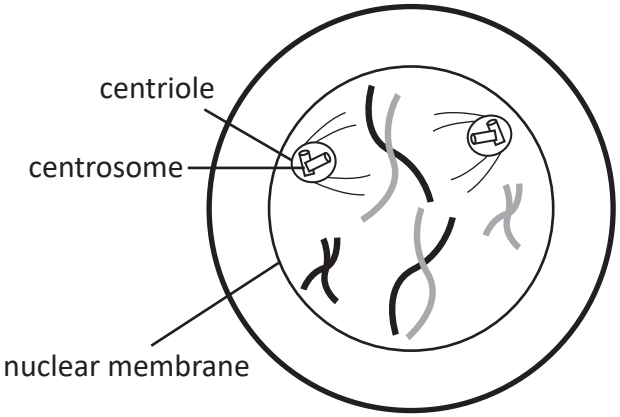
THERMOREGULATION: PHYSIOLOGICAL & BEHAVIOURAL RESPONSES (answers)

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**		✓	

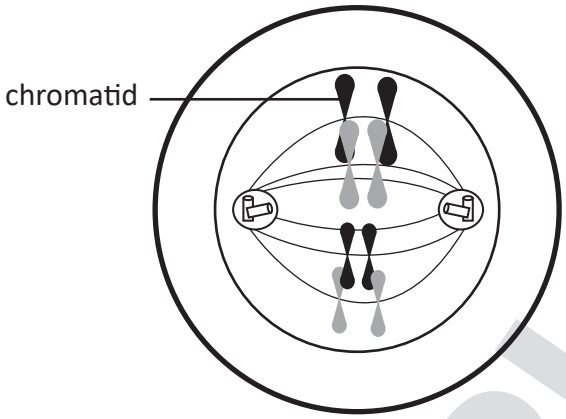
MITOSIS

The following diagrams show a cell, containing two pairs of double-stranded chromosomes, undergoing mitosis. The pairs differ in size (one long, one short) and the two members of each pair have been distinguished by colour/shade. Each of these diagrams contains some errors. Re-draw each one, correcting these errors.

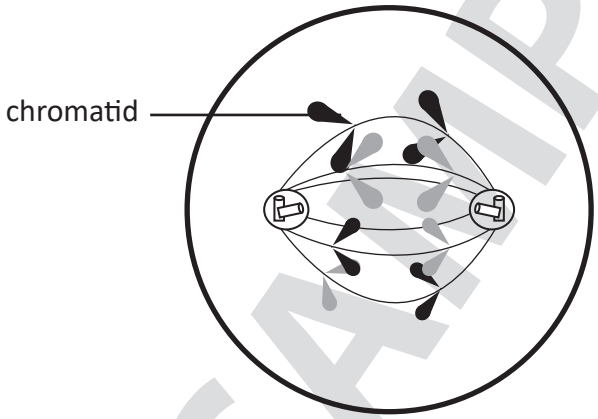
PROPHASE



METAPHASE

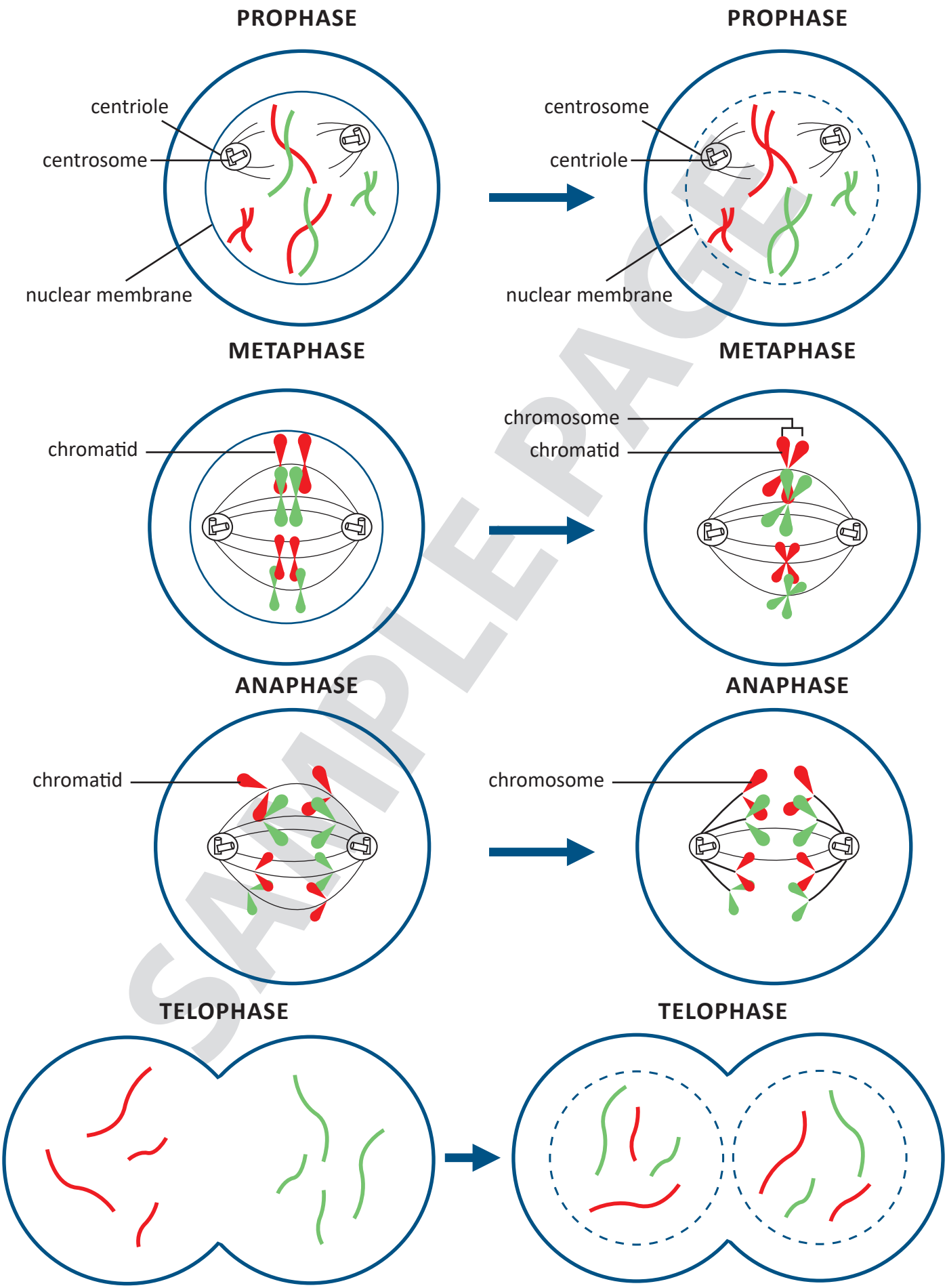


ANAPHASE



TELOPHASE

MITOSIS
(answers)

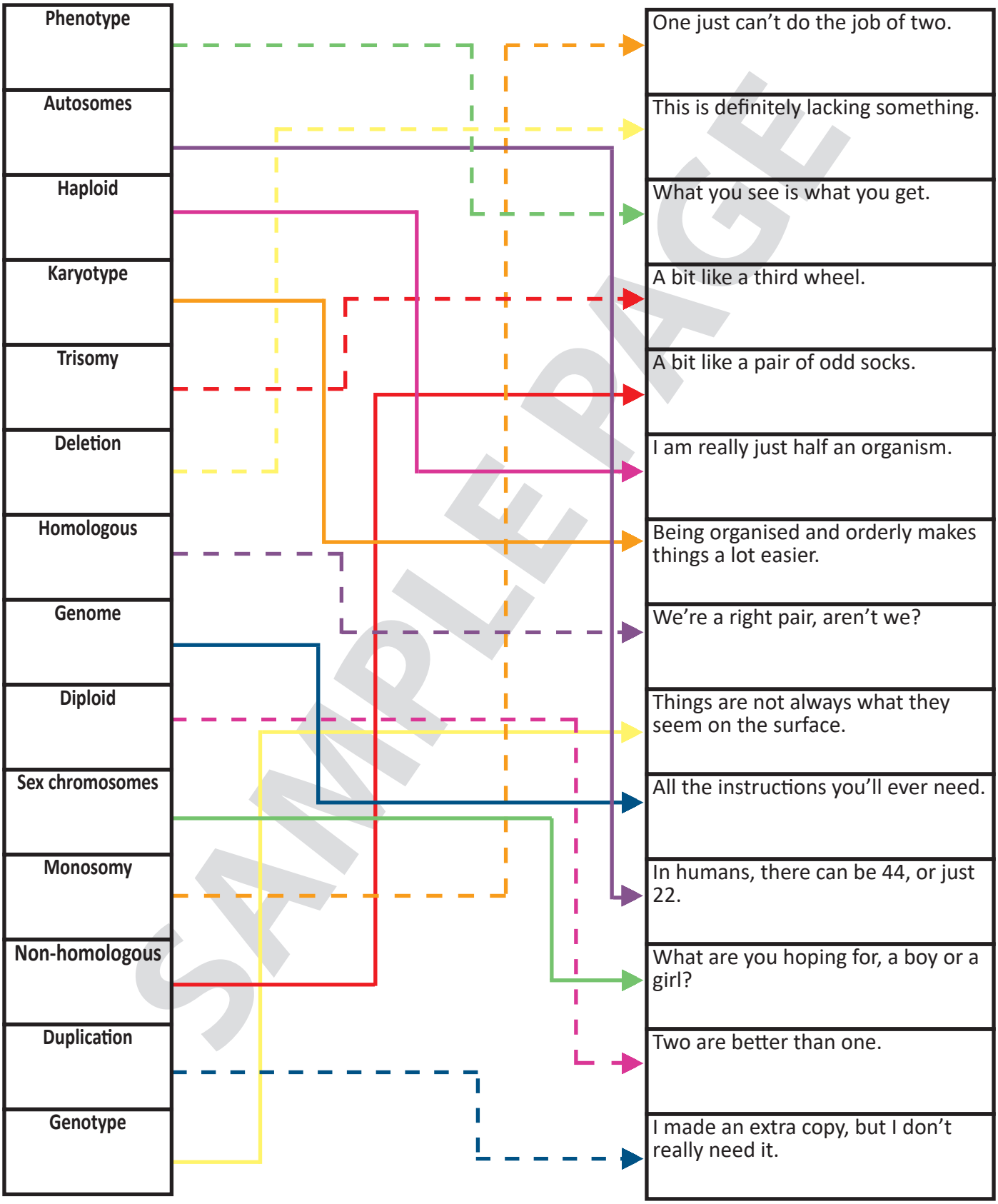


GENETICS: IMPORTANT TERMS

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

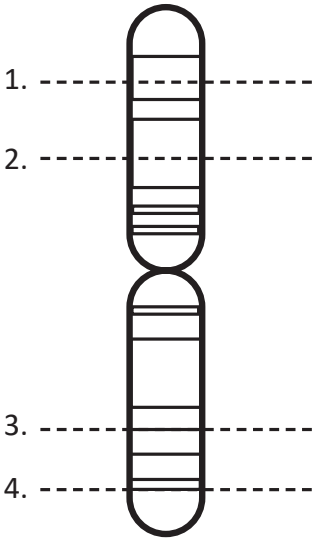
Phenotype	One just can't do the job of two.
Autosomes	This is definitely lacking something.
Haploid	What you see is what you get.
Karyotype	A bit like a third wheel.
Trisomy	A bit like a pair of odd socks.
Deletion	I am really just half an organism.
Homologous	Being organised and orderly makes things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

GENETICS: IMPORTANT TERMS
(answers)



CHANGES TO CHROMOSOMES

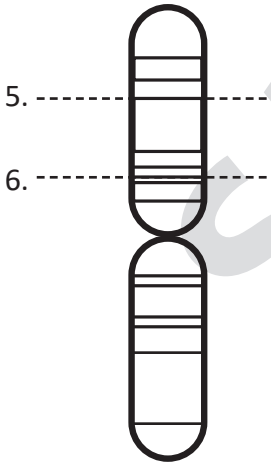
1. Colour in the different segments of chromosomes **A** and **B** as shown on the screen (see next page).
2. Redraw chromosome **A** showing a *duplication* of the segment between lines 1 and 2.
3. Redraw chromosome **A** showing a *deletion* of the segment between lines 3 and 4.
4. Redraw chromosome **B** showing an *inversion* between lines 5 and 6.
5. Draw the chromosomes that would result from a *reciprocal exchange* between the segments 1 - 2 of chromosome **A** and 5 - 6 of chromosome **B**.



Normal Chromosome **A**

Chromosome **A** with duplicated segment

Chromosome **A** with deleted segment



Normal Chromosome **B**

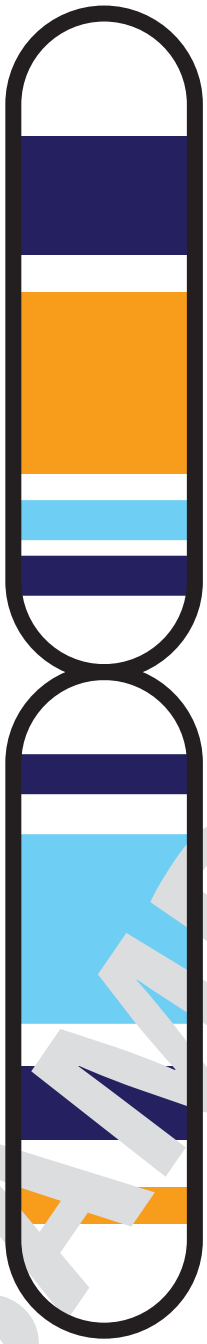
Chromosome **B** with inversion

Chromosome **A** following reciprocal exchange

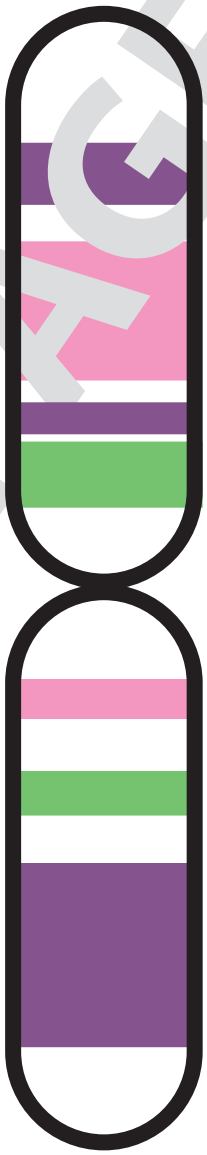
Chromosome **B** following reciprocal exchange

CHANGES TO CHROMOSOMES

Give chromosomes **A** and **B** the following colours:



Chromosome A



Chromosome B

CHANGES TO CHROMOSOMES
(answers)

Normal Chromosome **A**

Chromosome **A** with duplicated segment

Chromosome **A** with deleted segment

Normal Chromosome **B**

Chromosome **B** with inversion

Chromosome **A** following reciprocal exchange

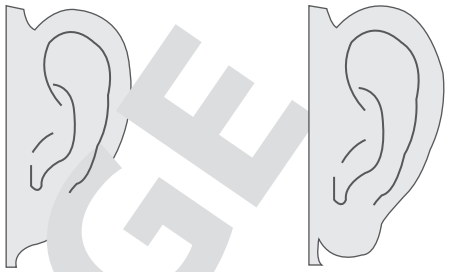
Chromosome **B** following reciprocal exchange

HUMAN VARIATION

The following shows eight pairs of inherited traits in humans. For each pair, one trait is dominant and the other is recessive.

tongue roller

non-roller

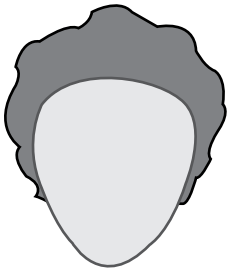


attached ear lobe free ear lobe

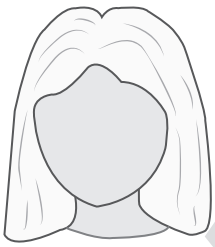
cleft chin

no cleft

widow's peak



straight hairline



straight hair

curly hair

white hair streak

no white streak

shorter second toe

longer second toe

red hair

non-red hair

1. Count the number of people in your class with each characteristic and complete the appropriate columns in the following table:

Characteristic	Number	Characteristic	Number	Dominant trait (prediction)	Dominant trait (actual)
Tongue roller		Non-roller			
Attached ear lobe		Free ear lobe			
Cleft chin		No cleft			
Widow's peak		Straight hairline			
Straight hair		Curly hair			
White hair streak		No white streak			
Shorter second toe		Longer second toe			
Red hair		Non-red hair			

2. Predict which trait in each pair is the dominant one and complete the appropriate column in the table. What did you base your decision on?

_____

3. (a) Use the Internet to find out which traits actually *are* dominant and complete the last column in the table. Were your predictions correct?

_____

_____

(b) Which result/s surprised you the most? Why?

_____

_____

4. (a) Are dominant traits necessarily more common amongst populations? Search the Internet to find at least three examples of dominant traits that are less common than recessive ones.

_____

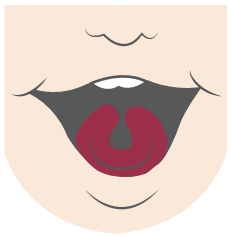
_____

(b) For each of the traits you listed, what is the *incidence* of the dominant one?

_____

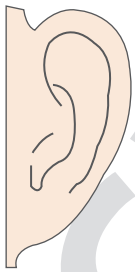
_____

HUMAN VARIATION
(answers)

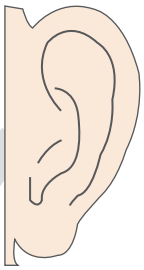


tongue roller

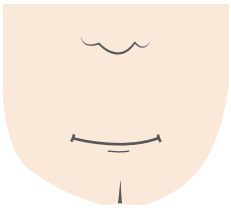
non-roller



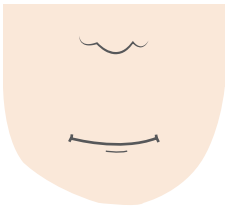
attached ear lobe



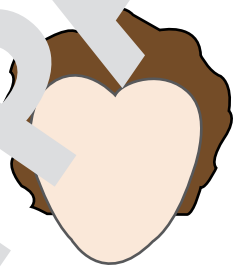
free ear lobe



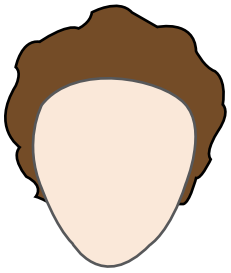
cleft chin



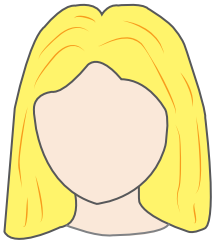
no cleft



widow's peak

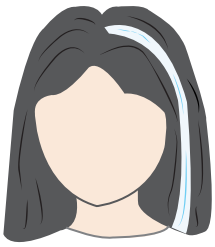


straight hairline

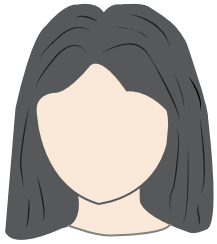


straight hair

curly hair



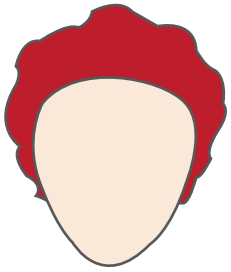
white hair streak



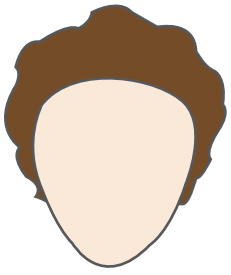
no white streak

shorter second toe

longer second toe



red hair



non-red hair

1. Student answers will depend on numbers of persons in class with the characteristic.

Characteristic	Number	Characteristic	Number	Dominant trait (prediction)	Dominant trait (actual)
Tongue roller		Non-roller			Tongue rolling
Attached ear lobe		Free ear lobe			Free ear lobe
Cleft chin		No cleft			Cleft chin
Widow's peak		Straight hairline			Widow's peak
Straight hair		Curly hair			Curly hair
White hair streak		No white streak			White hair streak
Shorter second toe		Longer second toe			Longer second toe
Red hair		Non-red hair			Non-red hair

2. Student answers will vary. Commonly, students base their predictions on the numbers obtained for each characteristic, believing that a trait is more likely to be dominant if it is more common. Some predictions may also be based on the student's general knowledge; many already know, for example, that red hair is due to a recessive gene.

3. (a) See above table. Student answers will vary in terms of the accuracy of their predictions.

   (b) Student answers will vary.

4. (a) Student answers will vary. Some examples of dominant traits that are less common than recessive ones include: achondroplasia (dwarfism), polydactyly (having extra fingers and/or toes), tone deafness and having webbed fingers or toes (so dominant traits are *not* necessarily more common in populations).

   (b) Student answers will vary. For the traits listed in 4 (a), the incidences are:
   Achondroplasia - 1 in 20,000 - 30,000 births.
   Polydactyly - 1 in 1000 births.
   Tone deafness - 4% of the population.
   Webbed fingers or toes - 1 in 2,000 - 3,000 births.