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B4 Homeostasis – Foundation Workbook answers

1	a	Homeostasis means keeping conditions inside your body the same/constant.												
	b	One example from: water level, salt level, blood glucose level, level of oxygen, level of carbon dioxide												
2	a	<ul style="list-style-type: none"> In: oxygen, digested food (e.g. glucose), water Out: carbon dioxide, urea, water 												
	b	<ul style="list-style-type: none"> Red: urea, carbon dioxide Blue: oxygen, glucose Green: digested food, water 												
3	a	<p>Stimulus – air temperature inside and outside the incubator changes</p> <p>Receptor – sensors detect temperature of air and baby</p> <p>Processing centre – computer coordinates information from sensors and controls heaters</p> <p>Effector – heater</p> <p>Response – air is warmed up when heater is switched on</p>												
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4	a	Heat gain = heat loss												
	b	<ul style="list-style-type: none"> Man in sauna: Heat from the sauna is transferred to the man's body. His body temperature rises. His body responds by sweating more. (Sweat evaporates off his body, removing some heat energy from the skin.) Basketball player: Running around makes his body heat up. His body responds by sweating more. Girl sitting in snow: The air temperature is colder than the girl's body temperature. She loses heat to the air. Her body responds by shivering. (When she shivers her muscles work. The muscle cells do more respiration to move. Respiration gives out some heat energy, which warms her up.) 												
5	a	Colours used to fill in the key												

Further guidance

	b	<ul style="list-style-type: none"> Stimulus – ‘changes in the temperature of the air around you’; ‘changes in the temperature of your blood’; ‘body temperature rises’; ‘body temperature becomes too low’ Receptor – ‘Receptors in your skin’; ‘Receptors in your brain’ Processing centre – ‘the temperature control centre in the brain’ Effector – ‘sweat glands’; ‘muscles’ Responses – ‘increase production of sweat’; ‘sweat production is reduced’; ‘ muscles contract rapidly, causing shivering’
	c	<ul style="list-style-type: none"> Producing more sweat: Sweat evaporates from the surface of the skin. This takes heat energy from the body, so the body temperature is lowered. Shivering: Muscles work harder, so respiration in muscle cells increases. Respiration releases some heat energy. This raises the body temperature.
6	a	Proteins
	b	In the yeast cells
	c	It speeds up the breakdown/reaction.
7		<ul style="list-style-type: none"> Drawing on the left to show the black shape (molecule) fitted into the enzyme (grey shape) like two pieces of a jigsaw. Missing words on the right: speeds, different, shapes, enzyme, again
8		Missing words: shape, fit, molecules, lock and key, one
9		<ul style="list-style-type: none"> Top right: ...the molecules have more energy and move faster, so there are more collisions of molecules and more successful reactions. Bottom left: ...the molecules have less energy and move slower, so there are fewer collisions and fewer successful reactions. Bottom right: ...the enzyme molecules have been denatured by the high temperature, so the molecules they catalyse will no longer fit into the active site, and the rate of reaction slows down.
10	b	<ul style="list-style-type: none"> The cordial molecules were at high concentration where they were poured into the top of the drink. The cordial molecules moved and collided with water molecules. They changed direction as they collided. The cordial molecules moved from their high concentration at the top of the drink to regions of lower concentration. The cordial molecules were spread out evenly through the drink.
	c	Three examples, e.g. oxygen, carbon dioxide, urea, (water)
11		✓✓xx x
12	a	A semi-permeable membrane lets some molecules through but not others.
	b	Missing words: diffusion, high, low, semi
	c	Longer arrow drawn from outside bag (solution B) to inside bag (solution A). Shorter arrow drawn in the opposite direction.

Further guidance

13	a	Gains: drinking, eating, respiration Loses: urine, sweat, faeces, exhaled air (3 out of 4).																				
	b	Input = 3500 cm^3 so output = 3500 cm^3 $3500 - 400 - 700 - 300 = 2100 \text{ cm}^3$ sweat																				
14		<table border="1"> <thead> <tr> <th>Conditions</th> <th>Concentration of blood</th> <th>Level of water in urine</th> <th>Concentration of urine</th> </tr> </thead> <tbody> <tr> <td>cold day, staying inside</td> <td>low</td> <td>high</td> <td>dilute</td> </tr> <tr> <td>hot day, playing sport outside</td> <td>high</td> <td>low</td> <td>high</td> </tr> <tr> <td>eating lots of salty food</td> <td>high</td> <td>low</td> <td>high</td> </tr> <tr> <td>drinking lots of liquids</td> <td>low</td> <td>high</td> <td>low</td> </tr> </tbody> </table>	Conditions	Concentration of blood	Level of water in urine	Concentration of urine	cold day, staying inside	low	high	dilute	hot day, playing sport outside	high	low	high	eating lots of salty food	high	low	high	drinking lots of liquids	low	high	low
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15	a	From top left: kidney, tubules, urine																				
	b	2, 3, 1, 4																				
16	a	Temperature, water, oxygen, salt (other appropriate answers)																				
	b	Labels from top to bottom: <ul style="list-style-type: none"> • upper limit of survival, 43.5 (Note: not 47 - printing error) • range of normal body core temperature, 37.5, 36 • lower limit of survival, 27 																				
17		Red: trunk and brain Blue: hands, feet, top of head, shoulders and other extremities																				
18	a	Missing words: up, increases, low, dehydrated, decrease, rise, core																				
	b	For example: Body temperature goes down, the person shivers to release heat energy from respiration. If this is insufficient body temperature continues to decrease. Person feels confused and drowsy, their speech is slurred and they lose coordination. They are suffering from hypothermia. Eventually they fall into a coma and breathing stops.																				
	c	For example: Body temperature rises, sweating increases, body water levels decrease. If the person doesn't drink water, then symptoms of heat stroke (as above).																				
19		<ul style="list-style-type: none"> • Alcohol causes greater volume of dilute urine to be produced. • Ecstasy results in a smaller volume of less dilute urine. 																				
20	a	Heatstroke is a life-threatening rise in body temperature where the body temperature control system fails.																				

Further guidance

	<p>b People may suffer heatstroke as a result of:</p> <ul style="list-style-type: none"> • over exposure to sun/hot climate • strenuous exercise, fever <p>Symptoms:</p> <ul style="list-style-type: none"> • hot, dry skin • rapid pulse rate • dizziness and confusion <p>Cool the patient by:</p> <ul style="list-style-type: none"> • sponging them with water • wrapping them in wet towels • using a fan to cool them • putting ice in their armpits and groin
21	<p>a Hypothermia is when the core body temperature falls below 35°C. Body heat cannot be replaced as fast as it is being lost.</p>
	<p>b People on mountains may become chilled as a result of:</p> <ul style="list-style-type: none"> • very low external temperatures (also wind chill, rain/sleet/snow) • inadequate clothing (also if unable to keep active) <p>Symptoms:</p> <ul style="list-style-type: none"> • shivering • confusion • drowsiness • slurred speech/lack of coordination <p>Warm the patient by:</p> <ul style="list-style-type: none"> • insulating them, especially head, neck, armpits and groin • handling them gently (to avoid increasing circulation to limbs) • warming them gently with warm towels/blankets • giving them warm drinks (not alcohol) <p>Hot water bottles:</p> <ul style="list-style-type: none"> • increase blood flow to the skin, which leads to further heat loss <p>Do not give food or alcohol because:</p> <ul style="list-style-type: none"> • blood will be diverted away from major organs (i.e. to digestive system in case of food)

B4 Homeostasis – Higher Workbook answers

1	a	<ul style="list-style-type: none"> In: oxygen, digested food (e.g. glucose), water Out: carbon dioxide, urea, water
	b	<ul style="list-style-type: none"> Red: urea, carbon dioxide Blue: oxygen, glucose Green: digested food, water
2	a	<p>Stimulus – air temperature inside and outside the incubator changes</p> <p>Receptor – sensors detect temperature of air and baby</p> <p>Processing centre – computer coordinates information from sensors and controls heaters</p> <p>Effector – heater</p> <p>Response – air is warmed up when heater is switched on</p>
	b	Homeostasis means keeping conditions inside your body the same/constant.
	c	One example from: water level, salt level, blood glucose level, level of oxygen, level of carbon dioxide
3	a	Negative feedback is when a change in a system results in an action that will reverse that change, bringing the system back to its normal state.
	b	When the temperature in an incubator drops too low a heater is switched on to warm it up. When the temperature in the incubator has risen sufficiently, the heater is switched off. This is negative feedback – if the heater was not switched off, the incubator would become too warm.
4	a	If you get too hot your body has effectors to cool you down (e.g. sweat glands). Your body also has effectors to warm you up if you get too cold (e.g. muscles shivering). These effectors have opposite or 'antagonistic' effects on body temperature.
	b	Having antagonistic effectors mean that a body's responses to temperature are more sensitive, so your body can stay as close as possible to an optimum temperature.
5		Heat gain = heat loss
6	a	Colours used for key
	b	<ul style="list-style-type: none"> Stimulus – 'changes in the temperature of the air around you'; 'changes in the temperature of your blood'; 'body temperature rises'; 'body temperature becomes too low' Receptor – 'Receptors in your skin'; 'Receptors in your brain' Processing centre – 'the temperature control centre in the brain – called the hypothalamus' Effector – 'sweat glands'; 'muscles in blood vessels', 'skeletal muscles' Responses – 'increase production of sweat'; 'sweat production is reduced'; 'muscles in blood vessels supplying the skin relax'; 'muscles in blood vessels supplying the skin contract'; 'skeletal muscles contract rapidly, causing shivering'
	c	<ul style="list-style-type: none"> Producing more sweat: Sweat evaporates from the surface of the skin. This takes heat energy from the body, so the body temperature is lowered. Shivering: Muscles work harder, so respiration in muscle cells increases. Respiration releases some heat energy. This raises the body temperature.

Further guidance

	d	<ul style="list-style-type: none"> • Vasodilation – Muscles in the walls of blood vessels near the skin relax. The blood vessels become wider, so blood fills the vessels. Heat from the blood is lost through the skin to the air, cooling down the body. • Vasoconstriction – Muscles in the walls of blood vessels near the skin contract. The blood vessels become narrower, so less blood can flow through them near the skin surface. Less heat is lost from the blood to the air, and so the body stays warm.
7	a	Proteins
	b	In the yeast cells
	c	It speeds up the breakdown/reaction.
	d	<ul style="list-style-type: none"> • Drawing on the left to show the black shape (molecule) fitted into the enzyme (grey shape) like two pieces of a jigsaw. • Missing words on the right: speeds, different, shapes, enzyme, again
	e	Each type of enzyme has an active site specific to one substrate. Only molecules with a certain shape fit into the active site, like a lock and key.
8		<ul style="list-style-type: none"> • Top right: ...the molecules have more energy and move faster, so there are more collisions of molecules and more successful reactions. • Bottom left: ...the molecules have less energy and move slower, so there are fewer collisions and fewer successful reactions. • Bottom right: ...the enzyme molecules have been denatured by the high temperature, so the molecules they catalyse will no longer fit into the active site, and the rate of reaction slows down.
9	b	<ul style="list-style-type: none"> • The cordial molecules were at high concentration where they were poured into the top of the drink. • The cordial molecules moved and collided with water molecules. They changed direction as they collided. • The cordial molecules moved from their high concentration at the top of the drink to regions of lower concentration. • The cordial molecules were spread out evenly through the drink.
	c	Three examples, e.g. oxygen, carbon dioxide, urea, (water)
10	a	The diffusion of water molecules across a partially permeable membrane, from their high to low concentration.
	b	Longer arrow drawn from outside bag (solution B) to inside bag (solution A). Shorter arrow drawn in the opposite direction.
	c	<ul style="list-style-type: none"> • The sugar solution was more concentrated than the contents of the cell. • There was a higher concentration of dissolved sugar molecules in the solution than in the cell. • Water left the cell by osmosis, so it shrivelled up.
11	a	Missing words: energy, passive, high, low, active transport
	b	Diagram coloured to match words

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15	a	<p>Top half of diagram:</p> <ul style="list-style-type: none"> • Increase in blood salt levels caused by: eating salty foods, excess sweating, not drinking enough water • Receptors in the hypothalamus are stimulated • Processing centre – hypothalamus in the brain • Name of effector – pituitary gland Action of effector – secretes more ADH • Result of effector action – kidney walls become more permeable to water, so more water is reabsorbed into the blood and less passes out in the urine (urine is more concentrated) <p>Bottom half of diagram:</p> <ul style="list-style-type: none"> • Decrease in blood salt levels caused by: drinking lots of water, not sweating, eating very little salty foods • Receptors in the hypothalamus are not stimulated • Processing centre – hypothalamus in the brain • Name of effector – pituitary gland Action of effector – secretes less ADH • Result of effector action – walls of kidney become less permeable to water, so less is reabsorbed into the blood and more is passed out in the urine (urine is dilute) 																				
	b	The effector (pituitary gland) responds to a rise in blood salt levels by producing more ADH. This causes the blood salt level to fall. If it drops below normal, the hypothalamus causes the pituitary to produce less ADH, so the blood salt level rises back again to normal.																				
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Comment [A1]: Don't want them to think that you need to eat lots of salt – many of them will be eating too much already

Further guidance

	c	Trunk and brain
	d	Hands, feet
	e	Missing words: up, increases, low, dehydrated, decrease, rise, core
	f	For example: Body temperature goes down, the person shivers to release heat energy from respiration. If this is insufficient body temperature continues to decrease. Person feels confused and drowsy, their speech is slurred and they lose coordination. They are suffering from hypothermia. Eventually they fall into a coma and breathing stops.
	g	<ul style="list-style-type: none"> • Mountaineering – Homeostasis demands: Cold weather, wind chill and getting wet from rain, sleet or snow will all lead to the body losing heat energy to the environment and putting the climber at risk of hypothermia if not wearing appropriate clothing. Reduced atmospheric oxygen at altitude affects breathing rates. Increased breathing rate causes increased water loss (the climber needs to drink more fluid) and also lowers carbon dioxide levels and increases pH in the blood, which affects breathing control systems in the hypothalamus. • Scuba diving – Homeostasis demands: Cold water will lead to the body losing heat energy to the water and putting the diver at risk of hypothermia if not wearing an adequate wetsuit. Diving at depth results in the diver having to breathe in high-pressure air from a tank. This forces nitrogen to dissolve in the bloodstream. If the diver comes up too quickly, the water pressure changes rapidly and nitrogen bubbles out of the blood (like bubbles in a fizzy drink), causing a painful condition known as 'the bends'.
17	a	Heatstroke is a life-threatening rise in body temperature where the body temperature control system fails.
	b	<p>People may suffer heatstroke as a result of:</p> <ul style="list-style-type: none"> • over exposure to sun/hot climate • strenuous exercise, fever <p>Symptoms:</p> <ul style="list-style-type: none"> • hot, dry skin • rapid pulse rate • dizziness and confusion <p>Cool the patient by:</p> <ul style="list-style-type: none"> • sponging them with water • wrapping them in wet towels • using a fan to cool them <p>putting ice in their armpits and groin</p>
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Ecstasy	increased	more water is reabsorbed, so less urine, more concentrated than normal	May cause overhydration										
	<p>c A person who takes Ecstasy sweats more because Ecstasy increases body temperature. Excessive sweating can lead to dehydration, which causes sweat production to fall, and the person can suffer symptoms of severe heatstroke – their body temperature rises uncontrollably. This is more likely to happen in a hot place, like a club, where someone is dancing, as this will also increase body temperature.</p> <p>(Note: Because of the effect of Ecstasy on ADH production there is also the risk of overhydration if, for example, several pints of liquid are drunk quickly. Regular sipping of water or other non-alcoholic drink, one pint per hour, is recommended to users of Ecstasy (see http://www.talktofrank.com.)</p>												