

4 Coordination and control

Practical activities

Question	Mark scheme	Marks
1 a)	• 34	1
b) i)	<ul style="list-style-type: none"> • variable / no clear pattern • about equal between moist and dry for 3 minutes / eq • later / after 3 / 4 minutes, more (woodlice) in moist half / fewer in dry half / eq 	2
ii)	<ul style="list-style-type: none"> • allow woodlice time to settle down / eq • data from table quoted to support answer / eq • repetition (of observations) increases reliability / eq 	2
iii)	<ul style="list-style-type: none"> • woodlice show preference for moist atmosphere / eq • compared with dry atmosphere / eq 	2
c) i)	<ul style="list-style-type: none"> • cover one half / certain sectors / eq of choice chamber with dark material / paint / tape / eq • base filled with damp cotton wool or left empty • keep other conditions constant (e.g. temperature / light intensity / eq) • practical detail (e.g. number of woodlice used, number of observations made / eq) 	3
ii)	<ul style="list-style-type: none"> • woodlice prefer dark (compared with light) / eq • related to habitat (under logs / stones, given in line 1 of question) / eq 	2
Total		12

Question	Mark scheme	Marks
2 a) i)	<ul style="list-style-type: none"> • A = 1.5, 1.6, 0.9 • B = 1.0, 1.0, 0.7 • C = 1.0, 0.6, 0.5 • E = 0.9, 0.65, 0.7 <i>(1 mark per correct row, but allow some tolerance for variation in measurements)</i>	4
ii)	<ul style="list-style-type: none"> • use suitable method for measuring (e.g. transparent ruler marked in mm / eq) • choose same 'top' and 'bottom' levels for each seedling (e.g. in dip where seed leaves separate and top of soil) • eq 	2
iii)	<ul style="list-style-type: none"> • A = seedlings yellow, growth upright • C = seedlings green, one grows towards light, others grow upright • E = seedlings green, growth towards light 	3
b)	<ul style="list-style-type: none"> • seedlings die / growth slows down / eq • no light so no photosynthesis / no synthesis of food materials / eq 	2
c)	<ul style="list-style-type: none"> • shoots show positive phototropism • growth faster on side away from light / growth slower on side receiving light / eq 	2
d)	<ul style="list-style-type: none"> • increase number of tubes with each light treatment / more cress seeds per tube / eq 	1
Total		14

Question	Mark scheme	Marks
3 a) i)	<ul style="list-style-type: none"> • table / columns / rows / eq • suitable headings (e.g. reaction time in seconds) + columns / rows for student A and student B / eq • data for student A inserted into correct position • data for student B inserted into correct position 	3
ii)	<ul style="list-style-type: none"> • 0.26 in student A's results 	1
iii)	<ul style="list-style-type: none"> • $0.11 + 0.13 + 0.14 + 0.12 + 0.18 + 0.15 + 0.13 + 0.15 + 0.16 + 0.15 = 1.42$ • $(1.42) \div 10$ • $= 0.14$ <p><i>(correct answer with no working = 2 marks)</i></p>	2
b)	<ul style="list-style-type: none"> • receptor / eye / retina sees / detects stimulus • (impulse along) sensory neurone • to CNS / eq • intermediate / relay neurone • (impulse along) motor neurone • to effector / muscle (in finger) / eq 	4
c)	<ul style="list-style-type: none"> • same method details described (e.g. 10 times / student being tested can't see what is happening) / eq • both students in turn for both situations / eq • choose same music for both / eq • other factors constant (e.g. room temperature / light or dark / anything eaten or drunk) / eq 	3
Total		13

Question	Mark scheme	Marks
4 a) i)	<ul style="list-style-type: none"> • shoot / plumule correctly labelled • root / radicle correctly labelled <p><i>(label lines should touch ONCE to get both marks, so not penalised twice if they don't touch)</i></p>	2
ii)	<ul style="list-style-type: none"> • positive / eq • geotropism / gravitropism 	2
b)	<ul style="list-style-type: none"> • roots grow horizontally / out from vertical disc / continue to grow in straight line in whatever orientation they started / eq • shoots grow horizontally / out from vertical disc / continue to grow in straight line in whatever orientation they started / eq 	2
c) i)	<ul style="list-style-type: none"> • practical details (e.g. pin germinating seeds to cork disc) / eq • use several seeds on each disc / eq • one disc with light from one side only + one disc with light all round / eq • other factors equal (e.g. moisture on cotton wool, temperature) / eq • same time / time quoted (3 days) / eq • method of observing / recording results / description of growth / eq 	3
ii)	<ul style="list-style-type: none"> • (diagram shows) shoots with one-sided light grow / bend towards light / eq • (diagram shows) shoots with light all round grow upwards / straight / eq <p><i>(accept description of both for 1 mark [diagram requested])</i></p>	2
Total		11

Understanding structure, function and processes

Question	Mark scheme	Marks
1 a) i)	<ul style="list-style-type: none"> renal 	1
ii)	<ul style="list-style-type: none"> increases blood pressure ultrafiltration greater surface area for filtration / eq (therefore) molecules / substances move <i>rapidly</i> from capillaries / into capsule / eq 	2
b) i)	<ul style="list-style-type: none"> protein in A but no protein in B or C protein molecules too large to pass into the capsule / from A to B / eq 	2
ii)	<ul style="list-style-type: none"> glucose present in same concentration in A and B, but none in C (molecules small so can pass from A to B / glomerulus to capsule / eq) <i>[only award once in b)ii) or b)iii)]</i> glucose is reabsorbed into the blood (before C / eq) 	2
iii)	<ul style="list-style-type: none"> urea present in A, B and C / eq but is at higher concentration in C (molecules small so can pass from A to B / glomerulus to capsule / eq) <i>[only award once in b)ii) or b)iii)]</i> water reabsorbed before C / in C / eq 	2
c) i)	<ul style="list-style-type: none"> (liquid in C) more urea from more / eq amino acids / protein / eq 	2
ii)	<ul style="list-style-type: none"> (liquid in C) more dilute / contains more water / eq less water lost in sweating / eq so more lost in urine 	2
Total		13

Question	Mark scheme	Marks
2 a)	<ul style="list-style-type: none"> B E C A D <i>(all correct, 4 marks, 3 or 4 correct, 3 marks, 2 correct, 2 marks, 1 correct, 1 mark)</i>	4
b) i)	<ul style="list-style-type: none"> line drawn to touch the place where the optic nerve passes through the retina 	1
ii)	<ul style="list-style-type: none"> no light receptors / no retina / eq no nerve impulses can be produced / eq 	2
c)	<ul style="list-style-type: none"> in C / ciliary body, muscles contract tension on (suspensory) ligaments reduced / eq lens / A becomes thicker / fatter / more convex light rays (from watch) refracted / bent more 	3
Total		10

Question	Mark scheme	Marks
3 a)	<ul style="list-style-type: none"> (name) insulin (effect) reduces glucose level in the blood / causes conversion of glucose to glycogen / increases uptake of glucose by liver / muscle (name) testosterone (organ) testes (organ) ovary / corpus luteum (effect) maintains thick uterus lining / eq 	2 2 2 2
b)	<ul style="list-style-type: none"> electrical / nerve impulse transmitted along nerve fibres / axons / neurones / nerve cells / eq 	2
Total		8

Question	Mark scheme	Marks
4 a)	• removal of waste products of metabolism from the body / eq	1
b) i)	<ul style="list-style-type: none"> • E • A • B • C 	4
ii)	• urethra	1
c)	• line drawn to touch top part of a kidney or just above kidney	1
d)	<p><i>any two pairs from the following:</i></p> <ul style="list-style-type: none"> • increases heart rate • so more oxygen / glucose to muscles / for respiration / eq • dilates / widens blood vessels inside muscles • so more oxygen / glucose to muscles • increases breakdown of glycogen to glucose • so more glucose available for respiration / eq • restricts blood supply to digestive system • diverts blood / oxygen to muscles / eq • increases breathing rate / eq • so increased oxygenation of blood / eq • increases rate of breakdown of stored fat / eq • so (breakdown products) respired / eq • eq • eq <p><i>(credit may be given for other effects of adrenaline, not listed here)</i></p>	4
Total		11

Question	Mark scheme	Marks
5 a) i)	<ul style="list-style-type: none"> • A = Bowman's capsule • B = proximal convoluted tubule / eq • C = collecting duct 	3
ii)	<ul style="list-style-type: none"> • filtration of blood under increased pressure • small molecules in plasma / named example, pass (through capillary walls) • into Bowman's capsule 	2
iii)	<p><i>glomerular filtrate:</i></p> <ul style="list-style-type: none"> • has no large molecules • no red blood cells • no protein • eq 	2
b)	<ul style="list-style-type: none"> • (glucose) reabsorbed • into blood • by active transport / requires energy • no glucose left (in the filtrate) / all glucose reabsorbed / eq 	3
c)	<ul style="list-style-type: none"> • collects liquid / eq from many nephrons • carries liquid / eq to ureter / eq • water reabsorbed (in collecting duct / eq) • concentration of urine / eq, controlled by action of ADH (in collecting duct) / eq 	2
Total		12

Applying principles

Question	Mark scheme	Marks
1 a)	<ul style="list-style-type: none"> • homeostasis 	1
b)	<ul style="list-style-type: none"> • (generate heat) respiration / other metabolic reactions / shivering / muscular action / eq • (gain heat from outside) heat from sun / from heater / fire / hot water / hot drink / hot food / eq 	2
c) 1	<ul style="list-style-type: none"> • arterioles (bringing blood to skin) dilate / widen / vasodilation / eq • (skin red colour because) more blood flows in capillaries near to skin / eq • allows loss of heat from skin (by radiation) 	8
2	<ul style="list-style-type: none"> • layers of clothing trap air • (air) acts as <u>insulator</u> • less heat reaches body from outside air / eq • white reflects heat / does not absorb heat (compared with black) / eq 	
3	<ul style="list-style-type: none"> • water in clothes evaporates rapidly (in wind) / eq • (evaporation) results in cooling / heat drawn from body • reference wind chill / wind blows warm air away from body surface / eq • with dry clothing (much) less loss of heat in wind 	
4	<ul style="list-style-type: none"> • evaporation (of sweat) results in cooling / takes heat away from body / ref latent heat • so more sweating on hot day / eq • on humid day sweat does not evaporate / evaporates only slowly • (less cooling so) person feels uncomfortable / eq 	
Total		11

Question	Mark scheme	Marks
2 a)	<ul style="list-style-type: none"> • sweat gland extracts water • from blood (capillaries) in skin / eq • sweat on skin surface evaporates / eq • evaporation of sweat takes heat from skin / latent heat / eq • results in cooling of skin / heat drawn from blood / eq 	3
b) i)	<ul style="list-style-type: none"> • at 7% dehydration, sweating rate lower than at 0% / converse / eq • quote figures (e.g. at 7%, sweating rate = 160 units, at 0% = 330 units) / rate at 7% approx. half that at 0% / difference is 170 units / eq 	2
ii)	<ul style="list-style-type: none"> • if water level low (in body), less water available for evaporation as sweat / less water in blood / eq • osmoregulation / eq • need to keep level of water constant in blood / homeostasis / eq 	2
c)	<ul style="list-style-type: none"> • (increase in dehydration / decrease in sweating rate) shows increase in rectal temperature • quote figures (e.g. 3% dehydration has sweating rate 300 units and rectal temperature of 37.6°C whereas 5% dehydration has sweating rate of 260 units and rectal temperature of 37.8°C) / eq • eq 	2
d)	<ul style="list-style-type: none"> • less water eliminated in urine (when dehydrated) / eq • more water reabsorbed in kidney tubule by loop of Henlé / distal tubule / collecting duct / eq • ref ADH secretion • need to keep level of water constant in blood / homeostasis / eq 	2
Total		11

Question	Mark scheme	Marks
3 a)	<ul style="list-style-type: none"> • (left hand side) $C_6H_{12}O_6 + (6)O_2 (=)$ • (right hand side) $(=) (6)CO_2 + (6)H_2O$ • balanced (i.e. figures as given in brackets) • (correct word equation = 1 mark) 	3
b) i)	<ul style="list-style-type: none"> • $13.5 \div 60$ • 22.5(%) • (correct percentage figure with no working gets 2 marks) 	2
ii)	<ul style="list-style-type: none"> • loop of Henlé / distal coiled tube / collecting duct / eq 	1
iii)	<ul style="list-style-type: none"> • kangaroo rat has very concentrated urine / eq • less water lost in excretion / urine (compared with human) / eq • conserves water / eq 	2
c) i)	<ul style="list-style-type: none"> • large intestine / rectum 	1
ii)	<ul style="list-style-type: none"> • low water content in feces of kangaroo rat (compared with other non-desert rat) / eq • reference to figures (e.g. feces of other rat contains more than 5 times more water than kangaroo rat) / eq • less water lost in feces (of kangaroo rat) compared with non-desert rat / conserves water / eq • eq 	2
d)	<ul style="list-style-type: none"> • exhaled air contains water (from respiration) / eq • moist surface in lungs / alveoli helps gas exchange / eq • moisture in bronchioles / bronchi / trachea for mucus layer / action of cilia / eq • eq 	2
Total		13

Question	Mark scheme	Marks
4 a) i)	<ul style="list-style-type: none"> • (1) 80 mg per 100 cm³ • (2) 150 mg per 100 cm³ • at 1 hour • (3) 3 hours 	3
ii)	<ul style="list-style-type: none"> • higher than normal blood glucose / over 150 mg per 100 cm³ • max blood glucose content higher / 370 mg per 100 cm³ • (max) reached later / at 2 hours • slower to return to normal level / still above normal level at 5 hours / graph results record 200 mg per 100 cm³ at 5 hours but not yet returned to normal level / eq • eq 	3
b)	<ul style="list-style-type: none"> • digested glucose / sugars absorbed into the blood over longer period / eq • allows more continuous supply of glucose / less fluctuation in glucose level / eq • helps maintain (steady) level of glucose in blood / eq • person with diabetes less able to store glucose as glycogen / eq • eq 	2
Total		8

Extended writing

Question	Mark scheme	Marks
1	<ul style="list-style-type: none"> • (pain/heat/stimulus) generates electrical/nerve impulses/eq • in receptor • (impulse) along sensory neurone • (impulse) along axon/nerve fibre* • (impulse) across synapse* • (impulse) to relay/intermediate neurone • in spinal cord/CNS/eq • (impulse) to motor neurone • (impulse) to effector/muscle • (muscle) contracts (to move fingers) <p>(*points marked with an asterisk may be mentioned in different parts of the sequence but may only be credited once)</p>	6
Total		6

Question	Mark scheme	Marks
2	<ul style="list-style-type: none"> • (heat energy generated) by respiration in muscles/eq • (heat energy generated) by contraction in muscles • sweat glands secrete more sweat/eq • sweat contains water • (sweat) evaporates from skin surface • (evaporation) takes heat from the body • vasodilation • arterioles in skin widen/eq • <u>more</u> blood to skin surface/eq • <u>more</u> heat lost • by radiation/eq 	6
Total		6

Question	Mark scheme	Marks
3	<ul style="list-style-type: none"> • blood from renal artery • to glomerulus • knot of capillaries (in Bowman's capsule) • blood vessel into glomerulus wider than vessel taking blood out/eq • blood under high pressure • small molecules from plasma pass out (of capillaries) • <i>one example from:</i> glucose, urea, salts, water, amino acids/eq • into Bowman's capsule • large molecules/red blood cells/proteins/eq, remain (in capillaries) • (liquid is) glomerular filtrate 	6
Total		6

Question	Mark scheme	Marks
4	<ul style="list-style-type: none"> • water lost due to sweating/exhalation/urination/eq • less water in blood/increase in concentration of blood, detected by (osmo)receptors/eq • (receptors) in brain/eq • ADH secreted • by pituitary gland • carried in blood to kidney • acts on the collecting duct/eq • more water reabsorbed into the blood • less water lost in the urine/urine more concentrated • (an example of) homeostasis/osmoregulation 	6
Total		6