

1. (a) (i) (p)CO₂/blood pressure/H⁺/pH/stretch; I O₂ 1
- (ii) Medulla; 1
- (iii) Sympathetic system cardiac accelerator nerve / links CNS to SA node/pacemaker stimulated/increase rate of impulses; noradrenaline released/stimulating SA node; A RA or change 2
- (iv) Receptors detect CO₂ too high/blood pressure too low; (CNS) increases heart rate to decrease/increase pCO₂/blood pressure; cancels stimulus/receptor ceases to be stimulated; 2
- (b) (i) Reduced/more O₂ unloaded; 1
- (ii) Exercise lowers pO₂ / eq; to zero; decreases saturation of Hb; to zero/unloads all O₂; increase of temperature causes faster increase; max 4
- (c) (i) points (close to or on a line) in correct direction; between 1.5 and 6 litres; 2
- A any vertical separation of points
- A all points on the line
- A points starting on bottom of Y axis
- R obvious curves
- R line with no curves
- R line with no point
- Ignore the line – look at the points
- (ii) Surface area of respiratory lining proportional to vital capacity/more alveoli; 1
- (d) Increase of adrenaline; R. urine adrenaline increase available glucose; and energetic drive/eq; increase of blood to muscles/away from skin; 3
- (e) (i) Required for synthesis of creatine phosphate/ C + ATP → CP + ADP; in muscles; provides ATP quickly/ in explosive sports; max. 2
- (ii) Creatine found in meat/low (A none) concentration in vegetables; 1
2. (a) correct position of AVN; (at the top of Purkyne tissue) 1
- (b) (i) pressure in ventricles increasing (so ventricle contracting); QRS occurs before pressure increase/ventricle contraction/ contracts after S / 0.14s; 2
- (ii) corresponds to time when heart is relaxed/filling with blood/ diastole / not contracting; 1

[20]

	(c)	(i)	0.2s ;	1	
		(ii)	line below left ventricle; in phase with left ventricle;	2	[7]
3.	(a)	(i)	more (nerve) impulses; along sympathetic neurones /pathway; to SAN;		
		(ii)	more nerve impulses;(award once only) along parasympathetic neurones /pathway; to SAN;(award once only)	max 4	
	(b)	(i)	$70 \times 72 = 5040$ plus method shown for calculating percentage; 756cm^3 ;	2	
		(ii)	(increase in size of heart) increasing amount of blood pumped out / Increasing stroke volume;	1	[7]
4.	(i)		(cardiac) muscle is myogenic; sinoatrial node/SAN; wave of depolarisation/impulses/electrical activity (across atria); initiates contraction of atria atrioventricular node/AVN; bundle of His/purkyne tissue spreads impulse across ventricles; ventricles contract after atria/time delay enables ventricles to fill;	5 max	
	(ii)		pressure receptors; in aorta/carotid artery/sinus; send impulses (<i>award once only</i>); to medulla; send impulses (<i>award once only</i>); along parasympathetic / vagus pathway; slows heart rate;	5 max	[10]
5.	(a)	(i)	Sympathetic; Parasympathetic/ vagus;	2	
		(ii)	Medulla / cardiovascular centre	1	

- (b) (i) One to accelerate, one to decelerate heartbeat/ excite v inhibit 1
- (ii) (Sympathetic) releases (nor)adrenalin/ norepinephrine to accelerate;
(Parasympathetic) releases acetylcholine to decelerate; max 2
- [6]**
6. (a) (i) Several rod cells to each neurone/bipolar cell;
additive effect of light striking several rod cells;
- (ii) Each cone is connected to a specific neurone;
light striking cone cells generating separate action potentials; max 3
- (b) Objects viewed directly are focused on fovea;
mainly cones not rods in fovea/most rods lie outside fovea
dim objects will not stimulate cones; max 2
- [5]**
7. (a) (Pressure) deforms / opens (sodium) channels; *reject any other ion*
Sodium ions enter;
Causing depolarisation;
Increased pressure opens more channels / greater sodium entry; 2 max
- (b) (i) Arrow (labelled K) pointing out of node; 1
- (ii) Same amplitude of action potentials as in medium pressure graph
but of a greater frequency; 1
- (c) (i) Answer between 0.7 and 0.9(ms); 1
- (ii) Correct answer based on candidate's response to (c) (i)
(i.e. 80 divided by answer to previous question)
Accept correct working shown with no final answer 1
- (d) (i) Action potential / impulse unable to "jump" from node to node /
no saltatory conduction / action pd / impulse must pass through
a greater amount of membrane;
Slows / prevents impulse; 2 max
- (ii) Greater entry of sodium ions / greater exit of K^+ in
de-myelinated neurone;
Ref. to active transport / ref. to ion pumps; 2

- (e) (i) Kinesis; *ignore prefix* 1
(ii) Response is non-directional / related to intensity of the stimulus; 1

[12]

8. (a) Hot receptors in skin;
nervous impulse;
to hypothalamus;
blood temperature monitored;
heat loss centre involved;
vasodilation / dilation of arterioles;
more blood to surface / heat lost by radiation;
piloerector muscles relax;
hairs flatten on skin surface;
less insulation;
sweating initiated / increased;
panting / licking;
evaporation removes latent heat;
drop in metabolic rate / use less brown fat;
accept long term changes such as less fat deposition;
thinner fur;
migration;
accept one behavioural process; max. 8

- (b) Rapid / slow;
direct / broadcast;
short lived/ long term;
mainly electrical ; chemical;
delivery via nerves / blood vessels;
cause depolarisation of target cell membrane /
receptors in membrane of target cell; max. 4

[12]

9. (a) Rapid response to a stimulus;
involuntary/invariable/innate;(any 2) 3

- (b) Three neurones, one in ventral root, one in grey matter of spinal cord, one
in dorsal root;
Names of all three neurones correct;
Sensory in dorsal root, motor in ventral root; 3

[6]

10. (a) (touch / pressure) receptors in mouth stimulated;
impulses in nerves / neurones to;
coordinator / brain; (*not just c.n.s.; via spinal cord disqualifies*)
salivary glands as effector / effector secretes saliva. 4
- (b) chemical, (not electrical);
slower (to take effect / transmission);
longer-lasting;
delivered by blood, (not nerves);
broader targeting. 3
- [7]**
11. (a) In the light (accept converse for dark)
1. Faster/further (slower/ shorter distance)/ larger area;
2. Less turns (more turns); 2
(*Reject straighter lines*)
- (b) (i) Kinesis; 1
- (ii) Allows woodlouse to stay in/ to find favourable environment;
Avoids predators; prevent desiccation/keeps gas exchange surface moist;
near food source; 2
- [5]**
12. (a) (i) arc shows 3 neurones;
(*3 distinct neurones, one of which is in the grey matter, with
correct route through dorsal and ventral roots and indication
of synapses. Ignore position of cell bodies.*) 1
- (ii) neurones labelled sensory, relay/intermediate, motor; 1
- (iii) muscle labelled as effector; 1
- (b) impulses to brain;
(*reject signal, message, information*)
sensory areas (in brain);
(in) cerebral hemispheres;
interpretation/processing by association area; 3 max
- [6]**