1 **(a)**	central (nervous system) **;** peripheral (nervous system) **;** spinal cord **;**	[3]	**R** spine
(b) (i)	sensory neurone **;**	[1]	**A** afferent neurone **R** sensory nerve
(ii)	simple reflex / reflex **;**	[1]	**A** reflex arc
(iii)	slower / takes more time **;** needs thought / uses (higher centres of) the brain / conscious control **;** learnt / not inherited / not innate / needs training / AW **;** not automatic **;** response is not always the same to the stimulus **;**	[max 2]	

Question		**Mark**	**Guidance**
(c) (i)	*either* **pot P** – (uniform) light AND **pot Q** – no light / dark / covered (up) **;** *or* **pot P** – (uniform) with / plus, magnesium AND **pot Q** – no magnesium **;**	[1]	**A** pot P has all nutrients
(ii)	positive **;** (photo)tropism / (photo)tropic **;**	[2]	**R** (photo)trophic / geotropic / gravitropic
(iii)	*idea that* leaves / seedlings / plants / chloroplasts, get more light **;** more (light) energy, absorbed / trapped / AW **;** more photosynthesis **;** more, growth / biomass / glucose / starch / AW **;**	[max 2]	'more' is only required once
(iv)	(auxins) made / produced, in (shoot), tip / apex **;** pass / move / diffuse / spread (down the stem) **;** auxins collect in the side, in the dark / away from light **;** greater (cell) elongation on side in the dark **;** AVP **;** e.g. absorption of water (by osmosis) / stretching of cell walls / phototropin(s) / plants detect *or* sense light / ref to turgor pressure	[max 4]	**I** 'found, in / on' **A** 'dark / shaded, side' **I** comments about roots
		[Total: 16]	

2 **(a)**	<table><tr><th>name of part</th><th>letter from Fig. 3.1</th></tr><tr><td>hair</td><td>**R** ;</td></tr><tr><td>blood vessel / arteriole / small artery</td><td>**S** ;</td></tr><tr><td>sweat gland</td><td>**U** ;</td></tr></table>	[3]	1 mark per correct row **R** artery, capillary
(b)	(involuntary responses are) automatic / no conscious decision / does not involve thought / decision making / innate / reflex ; (higher centres of) brain not involved ; faster / immediate / rapid ; response always the same / response specific to stimulus ; may involve glands ; they are protective / linked to survival / AW ; AVP ;	max [3]	**A** reverse argument written in favour of voluntary responses if this is clearly stated
(c)	(change in) temperature / hot / cold is stimulus ; temperature receptors (in skin) / V ; (electric) impulse ; travels through sensory neurone ; to brain ; relay / connector / intermediate neurone ; motor neurone ; to effector ; example of effector (arteriole / erector, muscle) ;	max [4]	**R** messages points need to be in the correct sequence **A** 'muscle' unqualified.
(d)	change in temperature, is detected / acts as a stimulus ; to keep temperature, constant / at 37 °C / within limits / near set point / at the norm / AW ; corrective / opposite, action by the body ; return to normal temperature ; correct ref to homeostasis ;	max [3]	
		[Total: 13]	

3 **(a)**	hepatic portal vein ;	[1]	
(b)	(semi lunar) valves ; prevent backflow ; large, lumen ; low, pressure / resistance to blood flow ; thin / less elastic / less muscular, walls (than arteries) ; low blood pressure ; allows vein to be squeezed by (surrounding skeletal) muscles ;	2 + 2 max [4]	in each case the explanation must be linked to a correct feature
(c)	= (181 – 135) ÷ 135 (× 100) ; = 34 (%) ;;	max [2]	
(d) (i)	(liver) responds to insulin (from pancreas) ; increased, uptake / respiration, of glucose ; glucose converted to glycogen ; by enzymes ; glycogen is, insoluble / stored ; negative feedback ;	max [2]	**A** glycogenesis **R** hormones carrying out conversions directly **ignore** homeostasis
(ii)	temperature ; water ; AVP ; e.g. pH / ions / urea / carbon dioxide	max [1]	

3 **(e)**	deamination ; (part of excess) amino acids converted to urea ; (part of) amino acid converted to ammonia ; ammonia converted to urea ; ammonia is harmful ; (rest of) amino acid molecule, releases energy / converted to glucose / glycogen / respired ; (some amino acids) used to make proteins e.g. fibrinogen ; AVP ; e.g. transamination	max [3]	**A** description of amino group removal **ignore** protein converted to urea
(f)	bile production / AW ; breakdown / remove, hormones / red blood cells / toxins / alcohol / drugs ; storage of, iron / vitamin A / vitamin D ; AVP ; e.g. cholesterol, synthesis / AW	m [1]	**R** homeostasis, deamination, protein synthesis, transamination
		[Total: 14]	

4	**(a) (i)**	eaten / absorbed, a (sugary / high carbohydrate) meal / AW **;** (secretion / effect, of) adrenaline **;** (secretion / effect, of) <u>glucagon</u> **;** dehydration / loss of water **;**		max [1]	
	(ii)	used in <u>respiration</u> **;** (named) exercise / physical activity **;** hungry / fasting / starvation **;** (secretion / effect, of) insulin **;**		max [1]	
	(iii)	liver **;** muscle **;** kidney **;** testes **;**		max [2]	
	(b)	**1**	pancreas / islets of Langerhans, detects increase in glucose concentration **;**	max [3]	
		2	(pancreas / islets) secretes / produces, insulin **;**		
		3	transported in, blood / plasma **;**		
		4	liver / muscle / cells, convert glucose to <u>glycogen</u> **;**		
		5	ref to, enzymes (converting glucose to <u>glycogen</u>) **;**		
		6	<u>homeostasis</u> / <u>negative feedback</u> **;**		
	(c)	water, diffuses out of (red blood cells) **;** through, partially permeable membrane **;** by osmosis **;** down water potential gradient / from high water potential to low water potential **;** (red cells) decrease in volume / shrink / crenated / AW **;**		max [3]	