

Question	Answer	Marks	Guidance
2 (a) (i)	<p><i>product</i> urea ;</p> <p><i>organ transported to</i> kidney ;</p>	2	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p><b>ACCEPT</b> bladder</p>
2 (a) (ii)	<p>1 hepatocytes can tolerate , lactate / low pH (which would otherwise be toxic) ;</p> <p>2 hepatocytes have / (other) cells do not have , enzymes to , metabolise lactate / catalyse this reaction ;</p> <p>3 (conversion of lactate) requires oxygen and , muscle cells do not have enough oxygen / O<sub>2</sub> is not available during anaerobic respiration / O<sub>2</sub> is sufficient in hepatocytes ;</p>	1 max	<p>2 <b>ACCEPT</b> ref to hepatocytes having the , correct / necessary , enzyme(s)</p>

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2	<p>1 blood glucose (concentration) would fall, too low / below normal level ;</p> <p>2 <i>idea that</i> glucose would continue to be taken up by, cells / liver / muscle (results in low blood glucose) or <i>idea that</i> glucose is continually converted into glycogen / would store too much glucose as glycogen ;</p> <p>3 (mitochondria eventually) cannot, release enough energy / generate enough ATP (as less available glucose in blood) ;</p> <p>4 coma / death ;</p> <p>5 AVP ;</p>	2 max	<p>1 <b>CREDIT</b> causes <u>hypoglycaemia</u></p> <p>2 Needs to convey the idea of <b>continued / too much</b> uptake rather than 'more'. <b>IGNORE</b> 'glucose taken up by cells' / 'glucose converted to glycogen' unless suitably qualified <b>ACCEPT</b> 'too much glucose is taken up by cells'</p> <p>3 <b>CREDIT</b> ref to use of alternative respiratory substrate</p> <p>4 <b>IGNORE</b> fatigue / tiredness / fainting</p> <p>5 e.g. ● receptor (on hepatocyte) becomes desensitised ● triggering of glucagon release</p>

Question	Answer	Mark	Guidance
2 (c) (i)	<p>1 build-up of lactate / prevention of pathway S, poisons / kills, (liver) cells ;</p> <p>2 disruption of enzymes as a result of low pH ;</p> <p>3 <i>idea that</i> lack of substrate / fatty acids not available, for respiration ;</p> <p>4 lack of (oxidised) NAD for (metabolic) reactions ;</p> <p>5 (some) deamination / ornithine cycle / pathway P / breakdown of (named) hormones / pathway R, cannot occur ;</p> <p>6 build-up of fatty acids / more fatty acids present, resulting in, fat deposits in (liver) cells / fatty liver / cirrhosis ;</p>	2 max	<p>1 <b>IGNORE</b> ref to ethanal</p> <p>2 <b>IGNORE</b> 'affects enzymes' without qualification</p> <p>4 e.g. • 'less NAD is available for oxidation of fatty acids' • 'lack of NAD for respiration' when referring to conversion of lactate to pyruvate the emphasis must be on the lack of available NAD to accept hydrogen from the lactate (and so inhibiting the conversion of lactate to pyruvate)</p> <p>6 <b>IGNORE</b> 'fatty acids build up in liver' without qualification <b>IGNORE</b> repetition of bulleted statements without ref to build up <b>IGNORE</b> ref to fat deposited around the liver</p>
2 (c) (ii)	<p>crista(e) / inner mitochondrial membrane ;</p>	1	<p><b>Mark the first answer.</b> if the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b></p> <p><b>ACCEPT</b> (at) electron transport chain <b>DO NOT CREDIT</b> inter mitochondrial membrane</p>
	<b>Total</b>	<b>8</b>	

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4 (a) (i)	acetylcholine ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p><b>CREDIT</b> other correct examples e.g. dopamine / noradrenaline / norepinephrine</p> <p><b>ACCEPT</b> ACh</p>
4 (a) (ii)	<p><b>either</b></p> <p>post-synaptic membrane ; (TRPA1) prevents attachment of (named) neurotransmitter to its receptor ;</p> <p><b>or</b></p> <p>pre-synaptic membrane / (pre)synaptic knob / axon terminal / bouton / synaptic bulb ; (TRPA1) prevents , release of (named) neurotransmitter / influx of calcium ions ;</p>	2	<p>Explanation must match correct location for 2 marks. If no location stated then explanation can be awarded independently for 1 mark.</p> <p><b>Incorrect location = 0 marks.</b></p> <p><b>IGNORE</b> 'interferes' (as in Q)</p> <p><b>IGNORE</b> ref to dendrites / cell bodies / neurone(s) / synapse(s)</p> <p><b>CREDIT</b> causes hyperpolarisation</p> <p><b>DO NOT CREDIT</b> idea that TRPA1 is a free protein that will enter the ACh receptor and block it (rather like a competitive inhibitor occupying the active site of an enzyme)</p> <p><b>ACCEPT</b> Ca<sup>2+</sup></p>

Question	Answer	Mark	Guidance
4 (b) (i)	<p>A sinusoid ;</p> <p>B (branch of) bile duct ;</p> <p>C (branch of) hepatic portal <u>vein</u> ;</p> <p>D (branch of) hepatic artery / arteriole ;</p> <p>E (branch of) hepatic / central , <u>vein</u> ;</p>	5	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>B DO NOT CREDIT canalculus</p> <p>C IGNORE inter lobular <b>but</b> DO NOT CREDIT intra lobular</p> <p>D IGNORE inter lobular <b>but</b> DO NOT CREDIT intra lobular</p> <p>E IGNORE intra lobular <b>but</b> DO NOT CREDIT inter lobular</p>
4 (b) (ii)	<p>1 because there is not enough <u>glutathione</u> / <u>glutathione</u> has run out ;</p> <p>2 enzyme catalysing glutathione reaction is, working at <math>V_{max}</math> / inhibited / in short supply ;</p> <p>3 the NAPQI cannot, cross the cell (surface) membrane / leave the cell / leave (named) organelle ;</p>	1 max	<p>2 DO NOT CREDIT in context of P450 system</p> <p>3 IGNORE ref to excretion</p>
4 (b) (iii)	<p>hepatocytes</p> <p><b>and</b></p> <p><u>mitosis</u> / <u>mitotic</u> (division) ;</p>	1	<p>CREDIT (liver) stem cells / hepatic cells</p> <p>IGNORE liver cells unqualified</p> <p>DO NOT CREDIT Kupffer cells</p> <p>ONLY CREDIT correct spelling for mitosis / mitotic</p>
	<b>Total</b>	<b>10</b>	

Question	Expected Answer	Mark	Additional Guidance
2 (a) (i)	vein / venule ;	1	<p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE further qualification (e.g. central / hepatic) but</p> <p>DO NOT CREDIT inappropriate name (e.g. renal vein / hepatic portal vein)</p>
2 (a) (ii)	hepatocyte(s) / hepatic cells ;	1	<p>IGNORE 'liver cells' (as given in Q) and 'sinusoid cells'</p> <p>A list must include 'hepatocytes' or 'hepatic cells' and not include an incorrect cell            e.g. hepatocytes and Kupffer cells = 1            hepatocytes and <math>\alpha</math> cells = 0            liver cells and Kupffer cells = 0</p>
2 (b)	<u>deamination</u> ; carbon dioxide / $\text{CO}_2$ ; urea / $\text{CO}(\text{NH}_2)_2$ ; water / $\text{H}_2\text{O}$ ;	4	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>If a formula is given for compounds D, E and F then the formula given must be correct in order to be awarded the mark            e.g. E 'urea (<math>\text{CONH}_2</math>)' = 0 as the formula is incorrect</p>

Question	Expected Answer	Mark	Additional Guidance
2	<p>(c) (i) <i>This is a QWC question</i></p> <p>1 (testing for) human chorionic gonadotrophin / hCG ;</p> <p>2 hormone small so can pass from blood into filtrate (at Bowman's capsule) ;</p> <p>3 monoclonal / immobilised , antibodies / immunoglobulin , on stick ; antibodies attached to , marker / dye ;</p> <p>4 hormone , binds / complementary , to antibody ;</p> <p>5 (triggers) appearance of colour / line becomes visible ;</p> <p>6 AVP ;</p> <p>7 QWC - technical terms used appropriately and spelt correctly ;</p>	<p>3 max</p> <p>1</p>	<p>Max 2 (instead of 3) for content if use the term , receptor / antigen / enzyme , <i>throughout</i> instead of antibody</p> <p>1 ACCEPT HCG This mark can be awarded for hCG but the name must be given in full for QWC</p> <p>3 ALLOW 'strip' instead of stick</p> <p>5 IGNORE specificity</p> <p>7 e.g. • reference to the second line to validate test • different antibody for second line • 2 coloured lines = pregnant</p> <p>Use of three terms from: human chorionic gonadotrophin, filtrate, immobilised, complementary, monoclonal, antibody(ies),</p>

Question	Expected Answer	Mark	Additional Guidance
2 (c) (ii)	<p>1 fairness / giving unfair advantage / does not give an 'even playing field' ;</p> <p>2 <i>idea of</i> health risks / dangerous / unhealthy / fatal / side effects ;</p> <p>3 specified health risk ;</p> <p>4 <i>idea of</i> distrust of 'outstanding' performances / does not reflect athlete's natural talent / sport should reflect athlete's natural talent ;</p> <p>5 <i>idea of</i> pressure to keep up with rival competitors ;</p> <p>6 <i>idea that</i> can train for longer (without tiring) / can respire longer (without tiring) / can recover from injury quicker / can build up muscle mass ;</p> <p>7 AVP ;</p>	3 max	<p>IGNORE enhances performance (as given in Q)</p> <p>1 <b>ACCEPT</b> comment about cheating <b>IGNORE</b> idea of should be available to all</p> <p>2 <b>IGNORE</b> 'has an effect on health' as must imply negative effect</p> <p>3 e.g. <ul style="list-style-type: none"> <li>• depression</li> <li>• aggression</li> <li>• liver , damage / failure</li> <li>• heart attack</li> <li>• masculinisation of female athletes</li> <li>• feminisation of male athletes</li> <li>• infertility</li> </ul> </p> <p>7 e.g. <ul style="list-style-type: none"> <li>• up to the individual to decide</li> <li>• idea that athletes should be role models</li> </ul> </p>
	<b>Total</b>	<b>[13]</b>	