

# F214 Communication, Homeostasis & Energy

Question		Expected Answers		Marks	Additional Guidance									
1	(a)	1	<table border="1"> <thead> <tr> <th></th> <th><i>excretion</i></th> <th><i>secretion</i></th> </tr> </thead> <tbody> <tr> <td><i>one difference</i></td> <td>(metabolic) waste <b>or</b> toxin / harmful <b>or</b> substance is to be removed from body <b>or</b> does not use vesicles</td> <td>useful product <b>or</b> used in cell communication (e.g. to target tissues) <b>or</b> released from glands (ducts or ductless) <b>or</b> uses vesicles <b>or</b> remain in body</td> </tr> <tr> <td><i>one example of a product</i></td> <td>urea / carbon dioxide / water / bile pigment / named example</td> <td>hormone / enzyme / antibodies / mucus / bile salts / neurotransmitter / named example</td> </tr> </tbody> </table>		<i>excretion</i>	<i>secretion</i>	<i>one difference</i>	(metabolic) waste <b>or</b> toxin / harmful <b>or</b> substance is to be removed from body <b>or</b> does not use vesicles	useful product <b>or</b> used in cell communication (e.g. to target tissues) <b>or</b> released from glands (ducts or ductless) <b>or</b> uses vesicles <b>or</b> remain in body	<i>one example of a product</i>	urea / carbon dioxide / water / bile pigment / named example	hormone / enzyme / antibodies / mucus / bile salts / neurotransmitter / named example	;	<p>One mark per row.</p> <p><b>CREDIT</b> converse statements on either side or unmatched statements for each</p> <p><b>1 IGNORE</b> name or type of product without qualification</p> <p><b>DO NOT CREDIT</b> any ref to egestion in 'excretion'</p>
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<i>one example of a product</i>	urea / carbon dioxide / water / bile pigment / named example	hormone / enzyme / antibodies / mucus / bile salts / neurotransmitter / named example												
2	2	IGNORE	sweat / urine / bile / saliva / salt / (named) digestive juice											

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			3	<p><i>one similarity</i></p> <p>requires ATP  <b>or</b>                      (involved in) homeostasis  <b>or</b>                      (compounds)                      produced by cell(s) /                      produced by metabolism /                      need to cross membrane /                      need to move through membrane /                      need to leave cell /                      (may be) transported in blood</p>	;	3	<p><b>CREDIT</b> method of leaving cell e.g. exocytosis  <b>IGNORE</b> going into cells                      (as some excretory products do)</p>
					3		

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1	(b)		<p><b>S1</b> glucose is not the only substrate / there are other substrates ;</p> <p><b>E1</b> named alternative substrate ;</p> <p><b>or</b></p> <p><b>S2</b> ATP is produced / energy is released ;</p> <p><b>E2</b> (by) substrate level / oxidative, phosphorylation ;</p> <p><b>or</b></p> <p><b>S3</b> ATP / energy, required ;</p> <p><b>E3</b> (for) phosphorylation / glycolysis ;</p> <p><b>or</b></p> <p><b>S4</b> is not a single step reaction / other steps involved / other products / other intermediates ;</p> <p><b>E4</b> named stage(s) / named intermediate compound(s) ;</p> <p><b>or</b></p> <p><b>S5</b> enzymes are involved ;</p> <p><b>E5</b> dehydrogenation / decarboxylation / oxidative phosphorylation / named (respiratory) enzyme ;</p> <p><b>or</b></p> <p><b>S6</b> coenzymes / NAD, involved ;</p> <p><b>E6</b> oxidative phosphorylation / link reaction / Krebs cycle / glycolysis ;</p> <p><b>or</b></p> <p><b>S7</b> glucose does not, combine / react , (directly) with oxygen ;</p> <p><b>E7</b> (oxygen) used in oxidative phosphorylation / is final electron acceptor / is final hydrogen acceptor ;</p>	<p><b>S &amp; C</b></p>	<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>CREDIT one statement and a suitable explanation related to that (first) given statement</b> (e.g. S3 + E3 but not S4 + E1)</p> <p><b>DO NOT AWARD 2 marks for 2 statements or 2 explanations</b></p> <p><b>1</b> 'fats can (also) be respired' = E1 'fats can be respired as well as glucose' = S1 + E1</p> <p><b>S2 DO NOT CREDIT energy</b> produced / made / created</p> <p><b>4</b> Krebs cycle / ETC , happens = E4 'other stages such as link reaction are involved' = S4 +</p> <p><b>E4</b> E4 e.g. pyruvate / acetyl CoA / acetate <b>IGNORE</b> NAD(H) / FAD(H) / ATP</p> <p><b>S6 DO NOT CREDIT</b> NADP</p>
				<b>2</b>	

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1	(c)	(i)	<p><b>1</b> unable to produce (enough) insulin / do not secrete insulin / produces ineffective insulin ;</p> <p><b>2</b> insulin-producing cells / beta cells / islets of Langerhans, not functioning (correctly) / damaged / destroyed / attacked ;</p> <p><b>3</b> by (body's own) immune system / by (body's own) antibodies / auto-immune disease ;</p> <p><b>4</b> (idea of) family history / genetic / hereditary ;</p> <p><b>5</b> (condition can be) triggered by , virus / environmental factor ;</p>	<p><b>2 max</b></p>	<p><b>Max 1 if referring to insulin receptors</b></p> <p><b>1 DO NOT CREDIT</b> 'excrete' as incorrect</p> <p><b>2 ALLOW</b> lack of beta cells / ref to b cells <b>DO NOT CREDIT</b> alpha cells / B cells (if lymphocytes implied)</p> <p><b>3 CREDIT</b> description</p> <p><b>5</b> e.g. <ul style="list-style-type: none"> <li>• shock</li> <li>• drugs side effect</li> <li>• (pancreatic) cancer</li> <li>• infection / disease</li> </ul> </p>
1	(c)	(ii)	<p><b>1</b> increasing age / older / ageing / more prevalent over 40 ;</p> <p><b>2</b> (idea of) family history / genetic / hereditary ;</p> <p><b>3</b> (more common in) males ;</p> <p><b>4</b> (more common in) some ethnic groups / African / Afro-Caribbean / Asian / Hispanic / Oceanic ;</p> <p><b>5</b> obese / overweight / fat around abdomen ;</p> <p><b>6</b> high / frequent, intake of , sugar / highly processed food / high GI food ;</p> <p><b>7</b> lack of physical activity / sedentary lifestyle ;</p> <p><b>8</b> high blood pressure ;</p> <p><b>9</b> excessive alcohol intake ;</p>	<p><b>3 max</b></p>	<p><b>Mark the first 3 responses only</b></p> <p><b>1 DO NOT CREDIT</b> age without 'older' implication</p> <p><b>5 CREDIT</b> 'apple shaped'</p> <p><b>6 IGNORE</b> 'poor diet' / 'bad diet' / 'unhealthy diet' <b>IGNORE</b> fat / carbohydrate , in diet</p> <p><b>8 CREDIT</b> history of , heart attack / stroke</p> <p><b>9</b> idea of <i>too much</i> is needed</p>
			<b>Total</b>	<b>10</b>	

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2	(a)	(i)	glycolysis / glycolytic pathway ;	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>CREDIT</b> phonetic spelling but must have 'glycol...'</p>
2	(a)	(ii)	cytoplasm ;	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>CREDIT</b> cytosol <b>DO NOT CREDIT</b> cytoplasm, in / of, mitochondrion</p>
2	(a)	(iii)	<p><b>D</b> ATP ;</p> <p><b>E</b> NAD ;</p> <p><b>F</b> pyruvate ;</p>	3	<p><b>Mark the first answer for each letter.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 mark</b></p> <p><b>E ALLOW</b> oxidised NAD <b>DO NOT CREDIT</b> NADP / reduced NAD</p> <p><b>F ACCEPT</b> pyruvic acid</p>

Question		Expected Answers	Marks	Additional Guidance
2	(b)	<p>1 (pyruvate / F) converted to lactate ;</p> <p>2 F / pyruvate , accepts hydrogen (atoms) ;</p> <p>3 hydrogen from , <b>reduced</b> NAD / <b>reduced E</b> ;</p> <p>4 (catalysed by) <u>lactate</u> dehydrogenase ;</p> <p>5 no, oxygen / O<sub>2</sub> , to act as (final), hydrogen / electron, acceptor ;</p> <p>6 (so) link reaction / Krebs cycle / ETC, cannot take place ;</p> <p>7 NAD / E, regenerated / recycled / able to be re-used ;</p> <p>8 allows glycolysis to continue / pyruvate continues to be made ;</p> <p>9 limited / small amount of / some, ATP can be produced ;</p>	5 max	<p><b>Award marks from labelled / annotated diagrams – but ensure that mp 2 only awarded if H clearly shown to be accepted by pyruvate</b></p> <p>1 <b>ACCEPT</b> lactic acid <b>DO NOT CREDIT</b> if pyruvate → ethanol in the animal is indicated/implied <b>DO NOT CREDIT</b> wrong reaction type (e.g. oxidation)</p> <p>2 <b>ACCEPT</b> pyruvic acid <b>DO NOT CREDIT</b> hydrogen <b>ions</b> (unless also e<sup>-</sup>) / molecules</p> <p>3 <b>ACCEPT</b> NADH / NADH<sub>2</sub> / NADH + H<sup>+</sup></p> <p>4 for pyruvate → lactate <b>ACCEPT</b> LDH</p> <p>6 Needs a clear statement of <b>not</b> taking place <b>CREDIT</b> no , electron transport chain / electron carrier chain / chemiosmosis / oxidative phosphorylation</p> <p>7 <b>IGNORE</b> reduced NAD , oxidised / reoxidised (as this does not give the idea of reusing it)</p> <p>8 Needs a clear statement</p> <p>9 <b>CREDIT</b> 1 ATP (per pyruvate) / 2 ATP (rather than 28-38 per glucose) / only substrate level phosphorylation <b>IGNORE</b> 'enough ATP for ...'</p>

Question		Expected Answers	Marks	Additional Guidance
2	(c)	<p>1 <i>physical (probably from diagrams)</i> large nostrils (open) to take in air ;</p> <p>2 (when submerged) nostrils close / nose closes , to , keep air in / stop air from escaping ;</p> <p>3 lungs / airways , have high (vital) capacity ;</p> <p><i>links to respiration</i></p> <p>4 <i>idea that</i> seal , has low(er) metabolic rate / has low(er) respiratory rate / has low(er) energy requirements / uses (relatively) little ATP ;</p> <p>5 able to respire anaerobically for a long time / more glycolysis ;</p> <p>6 large supplies of NAD (to accept H) ;</p> <p>7 (this) prevents , build-up of lactate / lowering of pH ;</p> <p>8 <i>idea that</i> (seal) tolerates lactate / removes lactate quickly ;</p> <p>9 <i>idea that</i> (seal) tolerates high CO<sub>2</sub> concentration ;</p> <p>10 <i>idea that</i> (seal) tolerates low pH / has <b>more</b> pH buffers ; <i>synoptic / inference</i></p> <p>11 <i>idea that</i> blood diverted from certain regions / certain regions have reduced metabolic activity ;</p> <p>12 <i>idea that</i> has plenty of , haemoglobin / red blood cells / myoglobin (as oxygen source) ;</p> <p>13 <i>idea that</i> haemoglobin has a higher affinity for oxygen / dissociates less readily / dissociation curve shifted to <b>left</b> ;</p>	S & C	<p>1 <b>ACCEPT</b> oxygen</p> <p>2 <b>ACCEPT</b> oxygen <b>IGNORE</b> ref to keeping water out</p> <p>3 <b>ACCEPT</b> deep / barrel / large , chest <b>IGNORE</b> big lungs <b>CREDIT</b> large lung <u>volume</u> / takes in large <u>volume</u> of oxygen / larger numbers of alveoli / larger (exchange) surface area / increased number of capillaries</p> <p>4 e.g. • (streamlined, less resistance so) uses less energy • (insulated so retain heat so) uses less energy • (buoyant so) less energy required • (small flippers so less surface area of extremity so loses less heat so) uses less energy</p> <p>5 'anaerobic' needs time ref</p> <p>7 <b>ACCEPT</b> lactic acid</p> <p>8 <b>ACCEPT</b> lactic acid</p> <p>11 <b>DO NOT CREDIT</b> zero respiration rate</p>
		<b>Total</b>	<b>3 max</b>	<b>13</b>

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3	(a)	1	myelin / myelinated / lipid / fatty (sheath) ;	2 max	1 <b>DO NOT CREDIT</b> fatty acids  3 must be in the context of structure rather than function (as many refer to it in context of saltatory conduction)																												
		2	(Schwann) <u>cell</u> , wrapped around / surrounds / AW, <u>axon</u> ;																														
		3	except at nodes of Ranvier / (sheath) not continuous / presence of gaps (in the sheath) ;																														
3	(b)	(i)	1 (myelination produces) <u>greater</u> speeds ; 2 unmyelinated needs larger diameter to produce same speed ; 3 comparative figs, <b>all</b> with units, to support either the general trend or the exception to the trend with the mollusc ;	2 max	1 <b>IGNORE</b> ref to axon diameter for this mp  3 1 speed for myelinated (25 / 30 / 35 , $\text{m s}^{-1}$ ) <b>and</b> 1 speed for unmyelinated (3 / 30 , $\text{m s}^{-1}$ ) (allow m/s) <b>or</b> calculated difference in speed between myelinated and unmyelinated ( <b>with units unless</b> a multiple e.g. approx. x12)																												
3	(b)	(ii)	1 larger axon diameter produces <u>greater</u> speeds ; <b>ora</b> 2 comparative figs, <b>all</b> with units, to support ;	2 max	1 needs to be a general statement 2 2 diameters & speeds ( <b>both with units</b> ) for <b>myelinated</b> <b>or</b> calculated difference in diameter for 2 stated speeds ( <b>both with units unless</b> diameter is a multiple e.g. around x 1.4 / around 140%) <table border="1"> <thead> <tr> <th>type of neurone</th> <th>diameter (<math>\mu\text{m}</math>)</th> <th>speed (<math>\text{m s}^{-1}</math>)</th> <th>animal taxon</th> </tr> </thead> <tbody> <tr> <td>myelinated</td> <td>4</td> <td>25</td> <td>mammal</td> </tr> <tr> <td>myelinated</td> <td>10</td> <td>30</td> <td>amphibian</td> </tr> <tr> <td>myelinated</td> <td>14</td> <td>35</td> <td>amphibian</td> </tr> </tbody> </table> <b>or</b> 2 diameters & speeds ( <b>both with units</b> ) for <b>unmyelinated</b> <b>or</b> calculated difference in diameter for 2 stated speeds ( <b>both with units unless</b> diameter is a multiple e.g. about x10) <table border="1"> <thead> <tr> <th>type of neurone</th> <th>diameter (<math>\mu\text{m}</math>)</th> <th>speed (<math>\text{m s}^{-1}</math>)</th> <th>animal taxon</th> </tr> </thead> <tbody> <tr> <td>unmyelinated</td> <td>15</td> <td>3</td> <td>mammal</td> </tr> <tr> <td>unmyelinated</td> <td>1 000</td> <td>30</td> <td>mollusc</td> </tr> </tbody> </table>	type of neurone	diameter ( $\mu\text{m}$ )	speed ( $\text{m s}^{-1}$ )	animal taxon	myelinated	4	25	mammal	myelinated	10	30	amphibian	myelinated	14	35	amphibian	type of neurone	diameter ( $\mu\text{m}$ )	speed ( $\text{m s}^{-1}$ )	animal taxon	unmyelinated	15	3	mammal	unmyelinated	1 000	30	mollusc
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3	(c)	(i)	<p>1 increased <u>kinetic energy</u> / <u>KE</u> so,</p> <ul style="list-style-type: none"> <li>ions <u>diffuse</u>, across (axon) membrane / into neurone / into cell / between nodes / along neurone, more quickly</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>faster movement of (neurotransmitter) vesicles / exocytosis (of neurotransmitter)</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>neurotransmitter diffuses more quickly across, synapse / synaptic cleft</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>neurotransmitter (ACh) broken down by enzyme (acetylcholinesterase) more quickly ;</li> </ul> <p>2 faster <u>diffusion</u> of ions leads to,</p> <ul style="list-style-type: none"> <li>faster depolarisation</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>shorter duration of action potential</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>shorter refractory period</li> </ul> <p><i>or</i></p> <ul style="list-style-type: none"> <li>faster repolarisation ;</li> </ul>	<p><b>S &amp; C</b></p> <p><b>1 max</b></p>	<p>description of ion movement must be correct (e.g. Na<sup>+</sup> in for depolarisation / Ca<sup>2+</sup> into presynaptic knob)</p>
3	(c)	(ii)	<p>1 ion, channels / pumps, disrupted / denatured / no longer function ;</p> <p>2 fluidity of, membrane / phospholipid / bilayer, disrupted ;</p> <p>3 (named) synaptic enzymes denatured ;</p>	<p><b>1 max</b></p>	<p><b>DO NOT CREDIT</b> general denaturation of proteins / enzymes</p> <p><b>2 IGNORE</b> leaky membrane unless qualified</p>

Question		Expected Answers	Marks	Additional Guidance
3	(d)	<p>1 calcium <b>channels</b> open ;</p> <p>2 <math>\text{Ca}^{2+}</math> / <math>\text{Ca}^{++}</math> / calcium ions , enter / diffuse into,</p> <p>3 acetylcholine / ACh / <b>neurotransmitter</b>, in <b>vesicle(s)</b> ;</p> <p>4 (synaptic) vesicles move towards <b>presynaptic</b> membrane ;</p> <p>5 vesicles fuse with membrane ;</p> <p>6 release acetylcholine, by <b>exocytosis</b> , into synaptic <b>cleft</b> ;</p>	3 max	<p><b>IGNORE</b> ref to influx of <math>\text{Na}^+</math> and events when action potential arrives at the synaptic knob – start when the <math>\text{Ca}^{2+}</math> channels open</p> <p>2 <b>DO NOT CREDIT</b> ‘calcium’ alone  <b>DO NOT CREDIT</b> <math>\text{Ca}^+</math>  <b>DO NOT CREDIT</b> ‘enter membrane’ – must cross it</p> <p>4 <b>CREDIT pre-synaptic</b></p> <p>5 <b>DO NOT CREDIT</b> attach / bind / join</p> <p>‘vesicles move and fuse with presynaptic membrane’ = mps 4 &amp; 5  ‘vesicles move and fuse with membrane’ = mp 5 only</p>
		<p><b>QWC</b> – technical terms used appropriately and spelt correctly ;</p>		1
<b>Total</b>			<b>12</b>	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	<u>ultrafiltration</u> ;	1	<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>  This term required but <b>ACCEPT</b> phonetic spelling
4	(a)	(ii)	17.9 ; ;	2	<b>Correct answer = 2 marks</b> If answer incorrect, not rounded or incorrectly rounded then allow 1 mark for working $125 \div 700$ <b>or</b> an unrounded answer e.g. 17.857412
4	(b)	(i)	(cuboidal) epithelium / epithelial ;	1	<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>  <b>DO NOT CREDIT</b> 'epithelium <b>cells</b> ' / 'ciliated epithelium' / 'squamous epithelium' / endothelium <b>ALLOW</b> columnar epithelium
4	(b)	(ii)	<u>microvilli</u> / <u>microvillus</u> ;	1	<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>  <b>ACCEPT</b> 'brush border' <b>DO NOT CREDIT</b> cilia

Question			Expected Answers	Marks	Additional Guidance
4	(b)	(iii)	<i>This is a QWC question</i>		
		1	selective <b>reabsorption</b> ;	<b>S &amp; C</b>	<b>2 DO NOT CREDIT</b> if glucose & amino acids <b>&amp; proteins</b> <b>3 ACCEPT</b> direct uptake , of glucose / amino acids, by active transport
		2	of glucose <b>and</b> amino acids ;		
3	<b>co-transport / facilitated diffusion</b> / uptake described ;				
4		water follows by <b>osmosis</b> so concentration of, ions / nitrogenous waste / urea / remaining substances , increases ;			<b>5</b> e.g. <ul style="list-style-type: none"> <li>• microvilli provide large surface area for uptake</li> <li>• many mitochondria provide energy for uptake</li> <li>• many brush border enzymes (ATPase) for active uptake</li> <li>• active secretion of nitrogenous waste into lumen</li> </ul>
5	AVP ;				
		<b>QWC</b> - technical terms used appropriately and spelt correctly ;		<b>3 max</b>	
				<b>1</b>	Use of <b>three</b> terms from: <b>reabsorption</b> (or derived term), <b>co-transport</b> (or derived term), <b>facilitated diffusion, osmosis</b>

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4	(c)	(i)	L artery / shunt / vein (at arterial end of shunt) <b>AND</b> M vein ;	1	<b>IGNORE</b> names of artery / vein (e.g. renal) <b>DO NOT CREDIT</b> aorta and vena cava
4	(c)	(ii)	so that clots don't form, while in the (dialysis) machine / during dialysis ;	1	<b>ALLOW</b> congeal instead of clot <b>IGNORE</b> prevents clotting in the body <b>IGNORE</b> clumping
4	(c)	(iii)	<i>idea of allowing blood to clot normally after treatment ;</i>	1	<b>CREDIT</b> preventing low blood pressure (as low viscosity)
4	(c)	(iv)	(simple) <u>diffusion</u> ;	1	<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> <b>IGNORE</b> dialysis <b>DO NOT CREDIT</b> facilitated diffusion
4	(c)	(v)	<i>idea that it, maintains diffusion gradient / maintains concentration gradient / maximises diffusion gradient / maximises concentration gradient / allows maximum removal of waste / allows maximum rate of diffusion / AW ;</i>	1	<b>IGNORE</b> unqualified ref to countercurrent  e.g. <ul style="list-style-type: none"> <li>• solutions in contact over greater distance</li> <li>• provides maximum contact for exchange</li> <li>• allows exchange over longer distance</li> </ul> <b>IGNORE</b> ref to surface area
<b>Total</b>				<b>14</b>	

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5	(a)	(i)	control ;	1	<p><b>CREDIT</b> a description e.g.</p> <ul style="list-style-type: none"> <li>• comparison</li> <li>• to compare results with</li> <li>• to show that (wavelengths of) light is producing the effect</li> <li>• to show the result produced without light</li> <li>• create baseline</li> <li>• create set point</li> <li>• validity</li> </ul> <p><b>IGNORE</b> 'fair test' <b>DO NOT CREDIT</b> 'control variable' / 'controlled variable'</p>