

Question number	Answer	Marks	Guidance
1 (a) (i)	Addition of (inorganic) phosphate	1	
1 (a) (ii)	<i>Similarities</i> ATP produced; phosphate group transferred; <i>differences</i> OP requires oxygen; electron transport chain involved in OP; SLP occurs during, glycolysis / Krebs cycle;	3 max	
1 (b) (i)	NADH 10/4; FADH 6/4; = 1.5 NADH = 2.5 and FADH = 1.5;	3	
1 (b) (ii)	12 NADH (glycolysis 2, link reaction 2, Krebs cycle 8) + 2 FADH (Krebs cycle 2); (12 × 10) + (2 × 6) = 132; 132/4 = 33;	3	
2 (a) (i)	glycolysis / glycolytic pathway;	1	
2 (a) (ii)	cytoplasm;	1	
2 (a) (iii)	ATP; NAD; pyruvate;	3	
2 (b)	(pyruvate / F) converted to lactate; F / pyruvate , accepts hydrogen (atoms); hydrogen from , reduced NAD / reduced E; (catalysed by) lactate dehydrogenase; no, oxygen / O <sub>2</sub> , to act as (final), hydrogen / electron, acceptor; (so) link reaction / Krebs cycle / ETC, cannot take place; NAD / E, regenerated / recycled / able to be re-used; allows glycolysis to continue / pyruvate continues to be made; limited / small amount of / some, ATP can be produced;		
2 (c)	physical (probably from diagrams) 1 large nostrils (open) to take in air; 2 (when submerged) nostrils close / nose closes , to , keep air in / stop air from escaping; 3 lungs / airways , have high (vital) capacity; <i>links to respiration</i> 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; 5 able to respire anaerobically for a long time / more glycolysis; 6 large supplies of NAD (to accept H); 7 (this) prevents , build-up of lactate / lowering of pH; 8 <i>idea that</i> (seal) tolerates lactate / removes lactate quickly; 9 <i>idea that</i> (seal) tolerates high CO <sub>2</sub> concentration; 10 <i>idea that</i> (seal) tolerates low pH / has more pH buffers; synoptic / inference 11 <i>idea that</i> blood diverted from certain regions	3 max	1 ACCEPT oxygen 2ACCEPT oxygen IGNORE ref to keeping water out 3 ACCEPT deep / barrel / large , chest IGNORE big lungs CREDIT large lung volume / takes in large volume of oxygen / larger numbers of alveoli / larger (exchange) surface area / increased number of capillaries 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 5 'anaerobic' needs time ref 7 ACCEPT lactic acid 8 ACCEPT lactic acid

	/ certain regions have reduced metabolic activity; 12 <i>idea that</i> has plenty of , haemoglobin / red blood cells / myoglobin (as oxygen source); 13 <i>idea that</i> haemoglobin has a higher affinity for oxygen / dissociates less readily /dissociation curve shifted to left;		11 DO NOT CREDIT zero respiration rate
3 (a) (i)	X adenine; Y ribose; Z (tri / 3) phosphate(s);	3	
3 (a) (ii)	transfers energy / energy 'currency' / releases energy / universal energy molecule / energy intermediate / (immediate) source of energy; phosphate(s) can be removed by hydrolysis; to , release / provide , 30 kJ (mol <sup>-1</sup> ) energy; (energy released for) metabolism / appropriate named reaction / appropriate reaction described; ADP can attach a phosphate (forming ATP) during , respiration / photosynthesis; energy released in , small 'packets' (to prevent cell damage) / suitable quantity;	3	
3 (b) (i)	crista;	1	
3 (b) (ii)	chemiosmosis / oxidative phosphorylation;	1	
3 (c)	substrate respired changes over time; initially respire (mostly) , glucose / carbohydrate; lower / decrease in / 0.75 , RQ indicates (more) , fat / lipid , as substrate <i>or</i> as time goes by (more) lipid is respired; glucose / carbohydrate , used up / decreases (over time); protein not likely to be used as substrate / protein only used as a last resort;	3 max	