12. Energy and Respiration

12.1 Energy

Paper 4

Marking Scheme

Q1.

(b)(i)	*any **four** from:* **1** (RQ =) ratio of carbon dioxide (exhaled) to oxygen (inhaled) ; **2** air flow meter measures oxygen inhaled ; **3** carbon dioxide sensor measures concentration of CO_2 exhaled ; **4** carbohydrate RQ = 1 ; **5** lipid RQ = 0.7 ;	**4**
(b)(ii)	*any **three** from:* **1** lipid has higher energy (value) **OR** carbohydrate 15–17 kJ g^{-1} and lipid 37–40 kJ g^{-1} ; **2** more, hydrogen (atoms) / C-H bonds, in lipid ; **3** more reduced, NAD / FAD ; **4** greater proton gradient / more protons in intermembrane space / more protons pass through ATP synth(et)ase ;	**3**

Q2.

(a)	**highest**: malic acid ; **lowest**: oleic acid ;	**2**

Q3.

(a)	anabolic / condensation / polymerisation ;	**1**

(c)	cytoplasm **and** mitochondrial matrix ;	**1**

Q4.

(a)(i)	*any **two** from:* **1** *ref. to* muscle fibre / sarcomere, contraction ; **2** active transport of (named), ion / molecule **or** active transport (of substance) against concentration gradient ; **3** movement of, vesicles / organelles, through cytoplasm / described ; **4** exocytosis of named substance ; **5** endocytosis / phagocytosis ; **6** spindle fibre / chromosome / chromatid, (movement) during, mitosis / meiosis ; **7** cilia / flagella, wafting / beating / AW ; **I** movement	**2**

(a)(ii)	correct working ; e.g. $\frac{150}{0.2} = 750$ then $\frac{750}{24}$ **or** $\frac{150}{24} = 6.25$ then $\frac{6.25}{0.2}$ **or** $\frac{149.8}{0.2} = 749$ then $\frac{749}{24}$ 31 ;	**2**
(a)(iii)	(respiration) oxidative phosphorylation ; (photosynthesis) photophosphorylation / light dependent stage ;	**2**

Q5.

(a)(i)	*any **four** from:* 1 water soluble ; 2 (so) easily transported around the cell ; 3 (ATP) loses, P_i / phosphate group ; 4 hydrolysed by ATPase / (ATP is) stable molecule ; 5 to release energy, immediately / in small packets **or** *ref. to* 30.5 kJ (mol^{-1}) ; 6 can be, recycled / regenerated **or** ATP ⇄ ADP + P_i ;	**4**
(a)(ii)	*any **two** from:* 1 unwinding DNA ; 2 activating (RNA) nucleotides ; 3 *ref. to* mRNA synthesis ; 4 peptide bond formation / joining amino acids ; 5 AVP ; e.g. post translation modification / amino acid activation / moving ribosomes along mRNA / movement of mRNA from nucleus	**2**

Q6.

(a)	volume of carbon dioxide produced ÷ volume of oxygen consumed ; per unit time ;	**2**
(b)(i)	25 ; 18 ;	**2**
(b)(ii)	0.72 ;	**1**
(b)(iii)	lipid / fatty acid ;	**1**

Q7.

(b)(i)	volume of carbon dioxide produced ÷ volume of oxygen consumed ; per unit time ;	**2**
(b)(ii)	lipids / fatty acids, metabolised (not having fed) ; sugar / carbohydrates, metabolised (after feeding) ;	**2**

(b)(iii)	$\frac{95}{32}$ *or* 95 ÷ 32 ; 2.97 ;	**2**
(b)(iv)	*any* ***two*** *from:* 1 substrate immediately available to muscle cells ; 2 no need to break down, glycogen / energy stores ; 3 glycogen still available as substrate between feeds ; 4 AVP ; e.g. cannot carry stores as need to be light to fly	**2**