

- M1.(a)**
1. Calcium ions diffuse into myofibrils from (sarcoplasmic) reticulum;
  2. (Calcium ions) cause movement of tropomyosin (on actin);
  3. (This movement causes) exposure of the binding sites on the actin;
  4. Myosin heads attach to binding sites on actin;
  5. Hydrolysis of ATP (on myosin heads) causes myosin heads to bend;
  6. (Bending) pulling actin molecules;
  7. Attachment of a new ATP molecule to each myosin head causes myosin heads to detach (from actin sites).

5 max

- (b)
1. Releases relatively small amount of energy / little energy lost as heat;  
*Key concept is that little danger of thermal death of cells*
  2. Releases energy instantaneously;  
*Key concept is that energy is readily available*
  3. Phosphorylates other compounds, making them more reactive;
  4. Can be rapidly re-synthesised;
  5. Is not lost from / does not leave cells.

2 max

[7]

**M2.(a)**

	Photosynthesis	Anaerobic respiration	Aerobic respiration
ATP produced	✓	✓	✓
Occurs in organelles	✓		✓
Electron transport chain involved	✓		✓

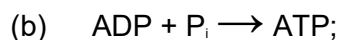
*1 mark per column*

*Mark ticks only. Ignore anything else if different symbols such as crosses are used as well.*

*If crosses are used instead of ticks allow cross as equivalent to a tick.*

*Reject tick with a line through*

3



*Both sides correct, but allow other recognised symbols or words for phosphate ion. Reject P unless in a circle.*

*Accept = as equivalent to arrow*

*Accept reversible arrow*

*Ignore any reference to kJ / water*

1

(c) 1. Energy released in small / suitable amounts;

2. Soluble;

3. Involves a single / simple reaction;

*1. In context of release, not storage. Ignore producing energy / manageable amounts.*

*2. Reject "broken down easily / readily". Reject "quickly / easily resynthesised".*

2 max

(d) 1. ATP cannot be stored / is an immediate source of energy;

2. ATP only releases a small amount of energy at a time;

2

[8]

**M3.** (a) Electrons transferred down electron transport chain;

Provide energy to take protons /  $\text{H}^+$  into space between membranes;

Protons /  $\text{H}^+$  pass back, through membrane / into matrix / through ATPase;

Energy used to combine ADP and phosphate / to produce ATP;

*Accept: alternatives for electron transport chain.*

3 max

(b) (i) Prevent damage to mitochondria caused by water / osmosis / differences in water potential;  
*Accept: other terms that imply damage e.g. shrink / burst*

1

(ii) Glucose is used / broken down during glycolysis in cytoplasm / not in mitochondria;  
*Accept: 'glucose is converted to pyruvate' for description of breakdown*

Glucose cannot cross mitochondrial membrane / does not enter mitochondria;  
*Accept: only pyruvate can*

2

(iii) Terminal / final acceptor (in electron transport chain) / used to make water;  
*Could be shown by symbols*

1

[7]

**M4.** (a) (i) 2 (molecules)

1

(ii) Cannot pass out of cell;  
Quickly / easily broken down (hydrolysed) / broken down in a on-step reaction / immediate source of energy;  
Stores / releases small amounts of energy;  
*Do not credit "producing energy"*

max 2

(b) Formed when reduced NAD used to reduce / donate H ions to pyruvate / convert pyruvate to ethanol;

1

[4]

**M5.** (a) (more cristae / larger surface area) for electron transport chain / more enzymes for ATP production / oxidative phosphorylation; muscle cells use more ATP (than skin cells)(not just more respiration); 2

(b) (i) pyruvate; 1

(ii) carbon dioxide formed / decarboxylation; hydrogen released / reduced NAD formed; acetyl coenzyme A produced; 2 max

(c) NAD / FAD reduced / hydrogen attached to NAD / FAD; H<sup>+</sup> ions / electrons transferred from coenzyme to coenzyme / carrier to carrier / series of redox reactions; energy made available as electrons passed on; energy used to synthesise ATP from ADP and phosphate / using ATPase; H<sup>+</sup> / protons passed into intermembrane space; H<sup>+</sup> / protons flow back through stalked particles / enzyme; 3 max

[8]

**M6.** (a) (i) 29.47(29.5); (2 marks for correct answer) 40% / 0.4 of 2800 / 38; 2

(ii) released as heat; 1

(b) (i) glucose only partly broken down / only broken down to lactate; 1

(ii) lactate / lactic acid has built up / been produced; oxygen used to break down lactate / convert it back to pyruvate / glucose / glycogen; 2

[6]

**M7.** (a) ATP

1

(b) (i) 2.57:1/2.6:1/18:7; Correct answer however derived scores two marks  
72:28 scores one mark Correct working from wrong figures scores 1 mark

*Accept*

*0.4 / 0.39 / 0.389 / 0.3889*

2 max

(ii) Low intensity; At low intensity/below 40% mainly fat used / at high intensity/  
above 40% mainly carbohydrate used; Long duration exercise; Percentage fat  
used increases with time / percentage  
carbohydrate used decreases with time;

3

[6]