CHEMISTRY ONLINE
TUITION

Phone: +442081445350

www.chemistryonlinetuition.com

Email:asherrana@chemistryonlinetuition.com

BIOLOGY

ORGANISMS RESPOND TO CHANGES IN ENVIRONMENT

Level & Board	AQA (A-LEVEL)
TOPIC:	CONTRACTION OF SKELETAL MUSCLES
PAPER TYPE:	SOLUTION - 1
TOTAL QUESTIONS	7
TOTAL MARKS	48

Contraction of Skeletal Muscles - 1

1.

(a)

Light/I band only actin

H zone/band only myosin

Darkest/overlapping region actin and myosin

2.

(a)

Lower force of contraction in mouse below 29 degrees

Higher force of contraction in mouse above 29 degrees

Only used mouse and rabbit

NO STATS TEST TO SEE IF DIFFERENCE IS SIGNIFICANT

(b)

Less tropomyosin moved from binding site

Fewer actinomyosin bridges formed

Myosin head does not move

(c) This reaction involves a transfer of hydrogen from NADH to pyruvate to produce lactate and NAD^+. In order for glycolysis to continue to produce ATP for the cell to use, NAD^+ is required and the recycling of NADH back to NAD^+ by lactate dehydrogenase facilitates this.

OR

Regenerates NAD, so glycolysis can continue

3.

(a) SDH is an enzyme that plays a key role in the Krebs cycle, which is responsible for generating energy in cells. One reason for the difference in staining between the muscle fibers of control mice and trained mice could be the adaptation of the trained mice's muscles to endurance exercise.

OR

Increase in aerobic respiration

(b)

More aerobic respiration produces more ATP

Anaerobic respiration delayed

Less or no lactate

(c) Area = πr^2

1.25mm2/0.39788 = 0.6307

d= r x 2= 1.2616mm

1.2616mm

1.2616 = 0.0841

0.0841 x 1000 = 84.1 micrometers

(d)

Young fibres range 14/15 - 47/48 μm and

adult fibres 17/18 - 86/87/88 μm **OR**

Young fibres range 32/33/34 and adult fibres range 68/69/70/71

i.e.

Adult fibres greater range/spread/variation of diameters

4.

(a)

C = M line / M disc / myosin filament

D = mitochondrion

E = myofibril

(b) Sarcomere

(c) 1.14 –1.18

(d) Glycogen is a store of glucose and when hydrolysed, glycogen is released to provide ATP for respiration

(e) The change causes a change in the shape of ion receptors. means that less calcium binds to tropomyosin and fewer move away to reveal actin binding sites. fewer cross bridges from as a result.

5.

(a) Calcium binds to troponin C, causing the conformational shift in tropomyosin that reveals myosin-binding sites on actin.

ATP then binds to myosin.

ATP is then hydrolyzed.

A cross-bridge forms and myosin binds to a new position on actin.

OR

- Calcium ions diffuse into myofibrils from sarcoplasmic reticulum
- Calcium ions cause movement of tropomyosin on actin
- This movement causes exposure of the binding sites on the actin
- Myosin heads attach to binding sites on actin
- Hydrolysis of ATP on myosin heads causes myosin heads to bend
- Bending pulling actin molecules
- Attachment of a new ATP molecule to each myosin head causes myosin heads to detach from actin sites.

(b) ATP is a suitable energy source because it is soluble which allows it to diffuse freely throughout the cell so that it can move within the various organelles to power the reactions which occur within them. Furthermore, in order to obtain the energy only a single reaction, known as hydrolysis is needed.

OR

Releases relatively small amount of energy / little energy lost as heat

Releases energy instantaneously

Phosphorylates other compounds, making them more reactive;

Can be rapidly re-synthesized

Is not lost from / does not leave cells.

6.

(a) ATP is responsible for cocking pulling back the myosin head, ready for another cycle. When it binds to the myosin head, it causes the cross bridge between actin and myosin to detach. ATP then provides the energy to pull the myosin back, by hydrolyzing to ADP + Pi.

OR

Reaction with ATP breaks/allows binding of myosin to actin/ actinomyosin bridge

Provides energy to move myosin head

7.

(a) 1.299-0.399/1.299 x 100 = 69.28%

(b) Mutant mice can't make phosphocreatine so less phosphate is available to make ATP

So less ATP available for contraction

(c)

Heterozygous mice have one dominant for creatine production.

This leads to production of enough of creatine

DR. ASHAR RANA

M.B.B.S / MS. CHEMISTRY

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Phone: +442081445350
www.chemistryonlinetuition.com
Email: asherrana@chemistryonlinetuition.com

- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students in UK and worldwide since 2008
- CIE & EDEXCEL Examiner since 2015
- Chemistry, Physics, Math's and Biology Tutor

CONTACT INFORMATION FOR **CHEMISTRY ONLINE TUITION**

- UK Contact: 02081445350
- International Phone/WhatsApp: 00442081445350
- Website: www.chemistryonlinetuition.com
- Email: asherrana@chemistryonlinetuition.com

Address: 210-Old Brompton Road, London SW5 OBS, UK