11.2 Movement

Mark Schemes

Course	DP IB Biology
Section	11. Animal Physiology (HL Only)
Topic	11.2 Movement
Difficulty	Medium

To be used by all students preparing for DP IB Biology HL
Students of other boards may also find this useful

1

The correct answer is **B**

Load is the weight of the person acting downwards, the fulcrum is the pivot point around the ball of the foot and the effort is the contracting force from the muscle.

2

The correct answer is **D**

The flexor muscle is on the underside of the leg and the extensor is on the upper side. Remember extensor - extends! Muscles can only pull and not push, so in order to move the leg outward as shown in the diagram, the extensor muscle must contract to pull on the top of the exoskeleton and the flexor must relax.

3

The correct answer is **D**

D is not a movement demonstrated by simple synovial joints such as the knee or elbow as inversions are complex movements made by joints in the foot.

4

The correct answer is **D**

The distance between the two Z lines is the same as the length of a sarcomere; when the muscle contracts, this length decreases as the actin slides across the myosin filaments to increase the overlap between the two fibres. This reduces the visible size of the light band. The length of the dark band does not change because it spans the length of the myosin filaments which do not change in length when contraction occurs.

5

The correct answer is **B**

One myosin powerstroke requires hydrolysis of one molecule of ATP and moves one actin filament 20 nm.

How many ATP molecules would be required to move a single actin filament 0.3 μm when the sarcomere contracts?

1. Convert 0.3μm into nm → 0.3 × 1000 = 300nm (1000nm in 1μm)
2. Calculate how many powerstrokes have occurred to move the actin 300nm → 300 ÷ 20 = 15 powerstrokes
3. Multiply by the number of ATP produced per power stroke → 15 × 1 = 15 ATP

6

The correct answer is **C**

Calcium binds to troponin which changes shape causing a change in the position of the tropomyosin. This exposes the binding sites on the actin where myosin can bind to form cross bridges. Calcium doesn't bind to tropomyosin and is not involved in the hydrolysis of ATP or the cocking of the myosin head so options A and D are incorrect.

7

The correct answer is **D**

Although **A** mentions active transport (which does require ATP) it is not correct because calcium ions **diffuse** in through voltage gated channels.

Calcium is responsible for exposing the myosin binding sites (as seen in the last question).

Crossbridge formation occurs as a result of the exposure of binding sites caused by calcium.

8

The correct answer is **B**

Don't be put off by having not heard of phosphocreatine before; the key to answering this is in the question thread. Phosphocreatine provides a source of phosphate. This means that the increased force of contraction shown in the graph can be attributed to a higher availability of phosphate to make ATP for muscle contraction: ADP + Pi = ATP. The information is not enough to say whether mice run faster as a result of the phosphocreatine (**A**) and answers **C** and **D** are incorrect.

9

The correct answer is **A** because calcium sensitive aequorins are used in studies of muscle contraction.

This is a question which fits into the Nature of Science (NOS) element of the course. You should ensure that you are familiar with how fluorescence has been used in the study of muscle contraction.

10

The correct answer is **A**

The transverse section shows the two different fibres, actin and myosin, represented by the thick and thin dots and A is in the dark band of the micrograph, where the myosin and actin overlap.

B is a light band made up of actin only.

C is in the very centre of the sarcomere; this region will contain only myosin filaments.

D is the same as **B**.