2.1 Movement Analysis: Levers, Planes and Axes: 30-minute Pack

AQA 8582 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A gymnast performs a straight-arm lateral raise, lifting both arms sideways from resting by the body to shoulder height. Identify the plane of movement and the axis of rotation.

(Total for Question 1 is 2 marks)

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2 A diver performs a forward pike dive, bending sharply at the hips to bring the head towards the legs before straightening out and entering the water. Identify the plane of movement and the axis of rotation.

(Total for Question 2 is 2 marks)

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3 A figure skater performs an axel jump, taking off, rotating one and a half times while airborne, then landing. Identify the axis of rotation and the plane of movement.

(Total for Question 3 is 2 marks)

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4 Explain one limitation of the human body having mostly third class levers when it comes to lifting very heavy loads.

(Total for Question 4 is 2 marks)

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5 Every lever system in the body is made up of three key components.

(a) State what is meant by the 'fulcrum' of a lever. **(1)**

(b) State what is meant by the 'effort' in a lever system. **(1)**

(c) State what is meant by the 'load' (or resistance) in a lever system. **(1)**

(Total for Question 5 is 3 marks)

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6 In a first class lever, the fulcrum is positioned between the effort and the load. Extension of the elbow using the triceps brachii, for example during the push/release phase of a shot put, is an example of a first class lever.

(a) Identify the fulcrum in this example. **(1)**

(b) Identify the effort in this example. **(1)**

(c) Identify the load in this example. **(1)**

(d) Using the terms 'effort arm' and 'load arm', explain why this lever arrangement is well suited to a fast, powerful action such as putting a shot. **(2)**

(Total for Question 6 is 5 marks)

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7 Table 1 describes the arrangement of fulcrum (F), load (L) and effort (E) for each class of lever.

Table 1

Part	Description
(a)	Fulcrum is positioned between the effort and the load
(b)	Load is positioned between the fulcrum and the effort
(c)	Effort is positioned between the fulcrum and the load
(d)	Which class of lever is used when the hamstrings flex the knee to bring the heel up towards the buttocks during the recovery phase of a sprint stride?

(a) Name the class of lever described in row (a) of Table 1. **(1)**

(b) Name the class of lever described in row (b) of Table 1. **(1)**

(c) Name the class of lever described in row (c) of Table 1. **(1)**

(d) Answer the question given in row (d) of Table 1. **(1)**

(Total for Question 7 is 4 marks)

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8 A gymnast's floor routine uses movements in all three planes of movement.

(a) Describe the sagittal plane, and give one example of a gymnastics movement that takes place within it. **(2)**

(b) Describe the frontal plane, and give one example of a gymnastics movement that takes place within it. **(2)**

(c) Describe the transverse plane, and give one example of a gymnastics movement that takes place within it. **(2)**

(Total for Question 8 is 6 marks)

9 Movement in each plane happens as the body rotates about a corresponding axis.

(a) Name the axis about which rotation occurs when a gymnast performs a forward somersault (a movement in the sagittal plane), and describe its orientation through the body. **(2)**

(b) Name the axis about which rotation occurs when a gymnast performs a cartwheel (a movement in the frontal plane), and describe its orientation through the body. **(2)**

(c) Name the axis about which rotation occurs when an ice skater performs a spin/pirouette (a movement in the transverse plane), and describe its orientation through the body. **(2)**

(Total for Question 9 is 6 marks)

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Mark scheme · 2.1 Movement Analysis: Levers, Planes and Axes: 30-minute Pack

Question 1

frontal plane **B1**

sagittal axis **B1**

Answer: Frontal plane, rotating about the sagittal axis.

Question 2

sagittal plane **B1**

transverse (frontal) axis **B1**

Answer: Sagittal plane, rotating about the transverse (frontal) axis.

Question 3

longitudinal axis **B1**

transverse plane **B1**

Answer: Rotating about the longitudinal axis, in the transverse plane.

Question 4

third class levers have a mechanical advantage below 1 (effort arm shorter than load arm), oe **B1**

this means the muscle must produce more force than the size of the load itself, so lifting a very heavy load places a large strain on the muscle (and the joint), limiting the maximum load that can be safely lifted, oe **B1**

Answer: Because third class levers have a mechanical advantage below 1, the muscle has to produce more force than the load itself, which places a large strain on the muscle and joint and limits how heavy a load can safely be lifted this way.

Question 5

(a) the fixed point/pivot around which the lever rotates (the joint), oe **B1**

(a) Answer: The fixed pivot point around which the lever rotates; in the body, this is the joint.

(b) the force applied to move the load, generated by a muscle contracting and pulling on the bone via a tendon, oe **B1**

(b) Answer: The force that moves the load; in the body, this is generated by a muscle contracting and pulling on a bone via a tendon.

(c) the weight or resistance being moved, e.g. the weight of a body part or an object being held, oe **B1**

(c) Answer: The weight or resistance being moved, such as the weight of a body part or an object being held.

Question 6

(a) the elbow joint **B1**

(a) Answer: The elbow joint.

(b) the triceps brachii, pulling on the ulna (olecranon process) behind the elbow joint, oe **B1**

(b) Answer: The triceps brachii, pulling on the ulna just behind the elbow joint.

(c) the weight of the forearm and hand, plus the shot being held, oe **B1**

(c) Answer: The weight of the forearm and hand, plus the shot being held.

(d) the triceps inserts close to the elbow joint, so the effort arm (fulcrum to triceps insertion) is short, oe **B1**

(d) the load arm (fulcrum to hand) is much longer, so a small, fast contraction of the triceps close to the joint produces a much larger, faster movement of the hand at the end of the lever, ideal for driving the shot forward, oe **B1**

(d) Answer: Because the triceps inserts very close to the elbow (a short effort arm) while the hand is far from the elbow (a long load arm), a small, fast muscle contraction produces a large, fast movement of the hand, which suits the powerful, fast release needed in a shot put.

Question 7

(a) first class lever **B1**

(a) Answer: First class lever

(b) second class lever **B1**

(b) Answer: Second class lever

(c) third class lever **B1**

(c) Answer: Third class lever

(d) third class lever **B1**

(d) Answer: Third class lever

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Question 8

(a) the sagittal plane divides the body into left and right sides, oe **B1**

(a) movements such as flexion and extension occur within it, e.g. a forward roll, a backward roll, a tucked somersault, oe **B1**

(a) Answer: The sagittal plane divides the body into left and right sides; flexion and extension movements happen within it, for example a forward roll in gymnastics.

(b) the frontal plane divides the body into front and back halves, oe **B1**

(b) movements such as abduction and adduction occur within it, e.g. a cartwheel, a star jump, a straddle jump, oe **B1**

(b) Answer: The frontal plane divides the body into front and back halves; abduction and adduction movements happen within it, for example a cartwheel.

(c) the transverse plane divides the body into upper and lower halves, oe **B1**

(c) rotational movements occur within it, e.g. a pirouette (full turn on one foot), a full-twisting jump, oe **B1**

(c) Answer: The transverse plane divides the body into upper and lower halves; rotational movements happen within it, for example a pirouette (a full turn on one foot) in gymnastics.

Question 9

(a) the transverse axis (also called the frontal axis) **B1**

(a) a horizontal line running from side to side (left to right) through the body's centre of mass, oe **B1**

(a) Answer: The transverse axis (also called the frontal axis): a horizontal line running from left to right through the body's centre of mass.

(b) the sagittal axis **B1**

(b) a horizontal line running from front to back through the body's centre of mass, oe **B1**

(b) Answer: The sagittal axis: a horizontal line running from front to back through the body's centre of mass.

(c) the longitudinal axis **B1**

(c) a vertical line running from the head to the toes through the centre of the body, oe **B1**

(c) Answer: The longitudinal axis: a vertical line running from the head to the toes through the centre of the body.

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