PE.AP1 Musculoskeletal System: Bones, Joints and Muscles

Total Marks

AQA 8582 · Calculators not allowed · about 50 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Which type of joint is found at the knee?

- ☐ A) Ball and socket
- ☐ B) Hinge
- ☐ C) Pivot
- ☐ D) Condyloid

(Total for Question 1 is 1 mark)

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2 The skeleton performs several important functions in the body.

(a) State one function of the skeleton related to the body's shape and posture. **(1)**

(b) State one function of the skeleton related to keeping internal organs safe from damage. **(1)**

(c) State one function of the skeleton that allows the body to move. **(1)**

(d) State one function of the skeleton related to making new blood cells. **(1)**

(Total for Question 2 is 4 marks)

3 Bones can be classified by shape.

(a) State the class of bone that the femur belongs to. **(1)**

(b) State the class of bone that the cranium belongs to. **(1)**

(Total for Question 3 is 2 marks)

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4 Explain why the shape of a flat bone such as the cranium is suited to its function of protection.

(Total for Question 4 is 2 marks)

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5 Joints allow different types and ranges of movement depending on their shape.

(a) Name the type of joint found at the hip. **(1)**

(b) Name the type of joint found at the elbow. **(1)**

(Total for Question 5 is 2 marks)

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6 State one movement that is possible at a ball and socket joint but is NOT possible at a hinge joint.

(Total for Question 6 is 1 mark)

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7 Explain how the skeletal system and the muscular system work together to produce movement at a joint.

(Total for Question 7 is 3 marks)

8 Table 1 gives descriptions of different types of movement possible at joints, with the movement name missing.

Table 1

Part	Description of movement
(a)	Decreasing the angle at a joint
(b)	Increasing the angle at a joint
(c)	Moving a body part away from the midline of the body
(d)	Moving a body part towards the midline of the body
(e)	Moving a body part in a continuous circular motion
(f)	Turning a body part around its own long axis
(g)	Pointing the toes downward, away from the shin
(h)	Pulling the toes upward, towards the shin

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

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

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

(d) Name the movement described in row (d) of Table 1. **(1)**

(e) Name the movement described in row (e) of Table 1. **(1)**

(f) Name the movement described in row (f) of Table 1. **(1)**

(g) Name the movement described in row (g) of Table 1. **(1)**

(h) Name the movement described in row (h) of Table 1. **(1)**

(Total for Question 8 is 8 marks)

9 A sprinter drives out of the starting blocks at the start of a 100 m race. As the rear leg extends powerfully, the hip, knee and ankle all straighten.

(a) Name the joint action taking place at the knee as the leg straightens. **(1)**

(Total for Question 9 is 1 mark)

10 Using the same sprint start described in Question 9, name the agonist (prime mover) muscle group responsible for extending the knee, and state its antagonist.

(Total for Question 10 is 2 marks)

11 Explain, using the term 'antagonistic muscle action', how the quadriceps and hamstrings work together to produce and control the knee extension described in Question 9.

(Total for Question 11 is 2 marks)

12 During the upward (lifting) phase of a bicep curl, the elbow joint bends.

(a) Name the joint action occurring at the elbow during this phase. **(1)**

(b) Name the agonist muscle responsible for this phase. **(1)**

(Total for Question 12 is 2 marks)

13 Name the antagonist muscle at the elbow during the upward phase of the bicep curl described in Question 12, and explain what happens to it.

(Total for Question 13 is 2 marks)

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14 A footballer points their toes downward to strike a ball (plantarflexion of the ankle). Name the agonist muscle responsible for this movement.

(Total for Question 14 is 1 mark)

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15 Explain the antagonistic pair of muscles at the ankle joint, naming both muscles and the movement each one produces.

(Total for Question 15 is 2 marks)

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16 During the recovery phase of a sprint stride, a runner's leg is driven forward and upward at the hip.

(a) Name the joint action taking place at the hip as the leg is driven forward and upward. **(1)**

(Total for Question 16 is 1 mark)

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17 Name the agonist muscle for the hip flexion described in Question 16, and its antagonist for hip extension, briefly explaining the role of each.

(Total for Question 17 is 2 marks)

18 Using named examples from at least two different joints, explain the role of antagonistic muscle action in producing controlled movement during sporting performance.

(Total for Question 18 is 6 marks)

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19 Vertebrae are irregular bones that make up the spinal column.

(a) State one function of the vertebrae. **(1)**

(b) Explain how the shape of irregular bones, such as the vertebrae, allows them to perform their functions. **(2)**

(Total for Question 19 is 3 marks)

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20 A gymnast performs a handstand, supporting their entire body weight through both wrists.

(a) Name the type of joint found at the wrist, and describe the movements it allows. **(2)**

(Total for Question 20 is 2 marks)

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21 Explain why bones classified as 'short bones', such as the carpals found in the wrist, are suited to supporting body weight in a position such as a handstand.

(Total for Question 21 is 2 marks)

22 A weightlifter performs a shoulder press, pushing a barbell from shoulder height to a fully extended overhead position, then slowly lowers it back down under control.

(a) Name the joint action occurring at the shoulder as the barbell is pushed overhead. **(1)**

(b) Name the agonist muscle primarily responsible for this shoulder flexion. **(1)**

(c) Name the antagonist muscle at the shoulder joint, and explain what it does as the barbell is lowered back down under control. **(2)**

(Total for Question 22 is 4 marks)

Mark scheme · PE.AP1 Musculoskeletal System: Bones, Joints and Muscles

Question 1

- **B1** B (hinge)
- **Answer: B (hinge)**

Question 2

- (a) **B1** support (maintains the body's shape and holds it upright), oe
- **(a) Answer: Support**
- (b) **B1** protection (e.g. the cranium protects the brain, the ribs protect the heart and lungs), oe
- **(b) Answer: Protection**
- (c) **B1** movement (bones act as levers and provide attachment points for muscles at joints), oe
- **(c) Answer: Movement**
- (d) **B1** production of blood cells (red bone marrow produces red blood cells, white blood cells and platelets), oe
- **(d) Answer: Production of blood cells**

Question 3

- (a) **B1** long bone
- **(a) Answer: Long bone**
- (b) **B1** flat bone
- **(b) Answer: Flat bone**

Question 4

- **B1** a flat bone has a broad, wide surface area, oe
- **B1** this spreads out/absorbs an impact force over a large area (rather than concentrating it at one point), helping to protect the organ underneath (e.g. the brain), oe
- **Answer: A flat bone has a broad surface area, which spreads an impact force out over a wide area rather than concentrating it at one point, helping to protect the organ underneath.**

Question 5

- (a) **B1** ball and socket joint
- **(a) Answer: Ball and socket joint**
- (b) **B1** hinge joint
- **(b) Answer: Hinge joint**

Question 6

- **B1** any one of: rotation / abduction / adduction / circumduction
- **Answer: For example, rotation.**

Question 7

- **B1** bones act as rigid levers, oe
- **B1** a joint is the point where two bones meet, allowing movement between them, oe
- **B1** muscles are attached to bones (via tendons) either side of the joint, and pull on the bone (by contracting) to move it around the joint, oe
- **Answer: Bones act as rigid levers, joints are the points where bones meet and allow movement, and muscles attach to the bones via tendons and pull on them to move the bones around the joint.**

Question 8

- (a) **B1** flexion
- **(a) Answer: Flexion**
- (b) **B1** extension
- **(b) Answer: Extension**
- (c) **B1** abduction
- **(c) Answer: Abduction**
- (d) **B1** adduction
- **(d) Answer: Adduction**
- (e) **B1** circumduction
- **(e) Answer: Circumduction**
- (f) **B1** rotation
- **(f) Answer: Rotation**
- (g) **B1** plantarflexion
- **(g) Answer: Plantarflexion**
- (h) **B1** dorsiflexion
- **(h) Answer: Dorsiflexion**

Question 9

- (a) **B1** extension
- **(a) Answer: Extension**

Question 10

- **B1** agonist: quadriceps
- **B1** antagonist: hamstrings
- **Answer: Agonist: quadriceps. Antagonist: hamstrings.**

Question 11

- **B1** the agonist (quadriceps) contracts to produce the knee extension, oe
- **B1** at the same time the antagonist (hamstrings) relaxes/lengthens to allow the movement to happen smoothly, oe
- **Answer: The quadriceps (agonist) contracts to extend the knee, while the hamstrings (antagonist) relax and lengthen at the same time to allow the movement to happen smoothly.**

Question 12

- (a) **B1** flexion
- **(a) Answer: Flexion**
- (b) **B1** biceps brachii (biceps)
- **(b) Answer: Biceps brachii**

Question 13

- **B1** antagonist: triceps brachii (triceps)
- **B1** the triceps relaxes/lengthens to allow the elbow to flex, oe
- **Answer: The antagonist is the triceps brachii, which relaxes and lengthens to allow the elbow to flex.**

Question 14

- **B1** gastrocnemius (calf muscle)
- **Answer: Gastrocnemius**

Question 15

- **B1** gastrocnemius produces plantarflexion (pointing the toes down), oe
- **B1** tibialis anterior produces dorsiflexion (pulling the toes up towards the shin), oe
- **Answer: The gastrocnemius (calf muscle) produces plantarflexion, and the tibialis anterior (shin muscle) produces dorsiflexion; the two work as an antagonistic pair, each relaxing while the other contracts.**

Question 16

- (a) **B1** flexion
- **(a) Answer: Flexion**

Question 17

- **B1** agonist for hip flexion: hip flexors/iliopsoas, which contract to lift the thigh forward and up, oe
- **B1** antagonist: gluteus maximus, which becomes the agonist for hip extension (e.g. driving the leg back down and behind the body), oe
- **Answer: The hip flexors (iliopsoas) are the agonist, contracting to lift the thigh forward and up; the gluteus maximus is the antagonist, and becomes the agonist for the opposite movement, hip extension, when the leg drives back down.**

Question 18

- **B1** definition: one muscle, the agonist (prime mover), contracts to cause a movement, while the antagonist relaxes/lengthens to allow it, oe
- **B1** correct named example 1 with correct roles, e.g. biceps brachii (agonist) and triceps brachii (antagonist) at the elbow during flexion, oe
- **B1** correct named example 2 from a different joint, with correct roles, e.g. quadriceps (agonist) and hamstrings (antagonist) at the knee during extension, oe
- **B1** explanation that muscles can only pull (not push), so a pair of muscles working in opposite roles is needed to produce movement in both directions at a joint, oe
- **B1** the same muscle swaps from agonist to antagonist depending on the direction of movement required, oe
- **B1** link to controlled movement: the antagonist relaxes gradually (rather than suddenly) or can contract eccentrically, controlling the speed/smoothness of the movement rather than letting it happen suddenly or with excess force, oe
- **Answer: Antagonistic muscle action is where the agonist contracts to cause a movement while the antagonist relaxes to allow it, for example the biceps brachii and triceps brachii at the elbow, or the quadriceps and hamstrings at the knee; because muscles can only pull, this paired arrangement (with each muscle able to swap roles) is needed to produce and smoothly control movement in both directions at a joint.**

Question 19

- (a) **B1** any one of: protect the spinal cord / support the head and trunk / allow flexibility of movement in the trunk
- **(a) Answer: For example, protecting the spinal cord.**
- (b) **B1** their complex, non-uniform shape provides several surfaces/projections for muscle and ligament attachment, oe
- (b) **B1** a central hole/canal through each bone allows the spinal cord to pass through and be protected, while the stacked, individually-jointed vertebrae still allow some flexibility of movement along the spine, oe
- **(b) Answer: The complex shape of irregular bones like the vertebrae gives several surfaces for muscle and ligament attachment, and a central canal that protects the spinal cord while the stack of individual bones still allows the spine some flexibility.**

Question 20

- (a) **B1** condyloid joint
- (a) **B1** allows flexion, extension, abduction and adduction, but not rotation, oe
- **(a) Answer: The wrist is a condyloid joint, allowing flexion, extension, abduction and adduction, but not rotation.**

Question 21

- **B1** short bones are roughly cube-shaped and compact, giving them strength, oe
- **B1** several short bones packed closely together (as in the wrist) spread the load across a small area while still allowing some flexibility/shock absorption, oe
- **Answer: Short bones are compact and roughly cube-shaped, which gives them strength; several of them packed closely together, as in the wrist, spread the load of the body weight across a small area while still allowing some flexibility.**

Question 22

- (a) **B1** flexion
- **(a) Answer: Flexion**
- (b) **B1** deltoid (anterior deltoid)
- **(b) Answer: Deltoid**
- (c) **B1** antagonist: latissimus dorsi
- (c) **B1** as the bar is lowered under control, the latissimus dorsi lengthens gradually rather than staying fully relaxed, controlling the speed of the movement rather than letting the arm drop suddenly, oe
- **(c) Answer: The antagonist is the latissimus dorsi, which lengthens gradually as the bar is lowered, controlling the speed of the movement rather than letting the arm drop suddenly.**