

SECTION 1: MULTIPLE CHOICE QUESTIONS (Circle the correct response)

Question 1

Sport Science consists of which of the following branches?

- A Measurement, Diagnosis, Prescription
- B Sports Medicine, Performance Analysis, Exercise Prescription
- C Technical, Tactical, Physical and Mental
- ☒ D Anatomy, Biomechanics, Physiology

Question 2

Which of the following statements best describes Newton's first law of motion?

- A The acceleration of an object is directly proportional to the amount of force applied to it.
- ☒ B An object will remain in a constant state of motion or rest unless acted on by a force.
- C For every action there is an equal and opposite reaction.
- D The acceleration of an object is directly proportional to its momentum.

Question 3

In 2014, Dennis Kimetto broke the marathon world record, in 2 hours, 2 mins and 57 seconds. The main fuel that Dennis would have used throughout his run would have been:

- A Fat
- B Protein
- C Lactic Acid
- ☒ D Carbohydrate

Question 4

The body is made up of different tissue types. The least flexible, or least elastic, of these would be:

- A bones
- B tendons
- ☒ C ligaments
- D muscles

Question 5

Back spin imparted to the ball in table tennis will see the ball most likely do the following in terms of its flight path:

- ☒ A the ball will hold up in the air, lengthening its flight time and distance
- B the ball will dip and drop more quickly, shortening its flight time and distance
- C the ball will deviate to the side during its flight path
- D there will be no change in the balls flight path due to the application of top spin.

Question 6

After we make contact with the ball during a kick in soccer, during the follow through, the joint movement of the kicking leg is:

- ☒ A extension of the knee and flexion of the hip
- B extension of the knee and extension of the hip
- C flexion of the knee and flexion of the hip
- D flexion of the knee and extension of the hip

Question 7

The main purpose of performing a musculo-skeletal screen in sports medicine is to:

- ☒ A reduce the risk of injury by identifying the strength and length of key muscles and joints
- B measure the current level of an athlete by using performance tests
- C identify how talented a performer might be by measuring their strength and power
- D all of the above

Question 8

The main fuel that a discus thrower would use during a competitive throw would be:

- ☒ A Phospho-creatine
- B ATP
- C Lactic Acid
- D Carbohydrate

Question 9

During the analysis of a baseball pitch, we calculate the speed of the ball. This would be an example of:

- A qualitative analysis
- ☒ B quantitative analysis
- C musculo-skeletal screening
- D all of the above

Question 10

In car racing, the cars have a wing (foil or spoiler) on the back to help:

- A increase the speed of the air passing over the car, which decreases drag and increases the speed
- B increase the drag force to allow the car to brake, or slow down, more quickly to help in cornering
- ☒ C increase the lift force downwards to push the car down on to the track to make it more stable
- D increase the upwards lift force to make the car 'lighter' to generate more speed

Question 11

To minimise body rotation and unwanted movement in running, it is vital to have a strong 'core'. The 'core' involves muscles of the:

- A quadriceps, hamstrings and gluteals
- B posterior muscles – gluteals, lower back, upper back
- C leg and back muscles
- ☒ D abdominals, lower back and hips

The following diagram of a 100m sprinter relates to questions 12 to 15.



Question 12

As the sprinter pushes hard against the block, the block doesn't move and exerts an opposite force. This would be an example of:

- A Newton's 1st Law
- B Newton's 2nd Law
- ☒ C Newton's 3rd Law
- D Summation of forces

Question 13

As the leg pushes off the block, the quadriceps:

- ☒ A contract concentrically as the knee extends
- B contract concentrically as the knee flexes
- C contract eccentrically as the knee extends
- D contract eccentrically as the knee flexes

Question 14

The 100m sprinter would likely have a high percentage of which muscle fibre type?

- A Slow twitch fibres
- ☒ B Fast twitch fibres
- C Ballistic fibres
- D Dynamic fibres

Question 15

When the sprinter reaches the finish line in 10 seconds, the predominant energy system at the time of finish would most likely be:

- A Aerobic glycolysis
- ☒ B Anaerobic glycolysis
- C ATP-PC
- D Lipolytic

END OF SECTION

SECTION 2: SHORT ANSWER QUESTIONS (77 marks)

Please complete all your answers in the spaces provided.

Question 1 (12 Marks)

The following questions relate to someone performing a vertical jump for maximal height (see diagram to the right).

(a) What are the joint actions of the following joints:

Ankle: Plantar-flexion

Knee: Extension

Hip: Extension (3marks)



(b) What are the following contraction types of the below muscles:

Gluteus maximus: Concentric

Gastrocnemius: Concentric (2marks)

(c) What would be the dominant energy system and predominant fuel used during this movement?

ATP-CP, Creatine-Phosphate (CP) (2marks)

(d) The record vertical jump at the AFL draft camp (for under 18's) is 88cm by Marvin Baynham in 2014.

(i) Explain the principle of summation of force, in relation to the vertical jump.

- S.O.F. is the combination of many muscle groups contracting in sequence. (1)
- To jump higher, Marvin would need maximal contractions of the lower leg & thigh muscles (eg. gastrocnemius, quadriceps), lower back and finally shoulders. (1)
- The muscles also need to contract in good sequence (timing). (3 marks) (1)

(ii) Is it likely that Marvin would also have one of the highest scores (best times) for the 3km running time trial?

Explain in relation to muscle fibre types.

No. As he can jump high, he is likely to have ^{more} fast-twitch fibres. (1). FT fibres contract at a high speed but fatigue quickly. Therefore, don't suit endurance events eg. 3km. (1)

(2 marks)

Question 2 (12 marks)

The picture to the right shows David Rudisha (Kenya) who broke the 800m world record at the London Olympics (2012), in a time of 1 minute 40.91 seconds.



(a) Explain energy system interplay during his 800m record run.

*6 clear pts required!

- All ES. work together to provide the required amount of ATP.
- At the start, the ATP-CP system would be the dominant provider of ATP as David accelerates.
- The anaerobic glycolysis system would become dominant from about 10 secs.
- It would remain dominant, until around 30 secs (1).
- From there the aerobic system would become dominant
- As intensity increases eg. to pass a runner, fast finish, the anaerobic glycolysis system provides more ATP.

(6 marks)

(b) Explain why it would not be an advantage for David to carbohydrate-load (take in a much higher level of CHO's to normal) in the few days leading up to an 800m event.

- The 800m event takes under 2 mins. Therefore, CHO's would be sufficient. (1) CHO's last 1-2 hours so wouldn't run out. (1)
- Therefore CHO loading would have no advantage → it's likely David would put on weight so would be a disadvantage. (1)

(3 marks)

(c) After his race is completed, he then walks around, does an interview, then sits down to rest. During this 10 minute period, what would be the main energy system and fuel utilised during recovery? Explain.

- Aerobic system. Fats. The energy is not required quickly anymore as at low intensity. Fats produce ATP slowly so would suit low intensity.

(3 marks)

Question 3 (10 marks)

The picture to the right shows Jan Zelezny (Czech Republic). The world record for javelin is 98.48m.



- (a) At the point of release, the 3 main factors that will determine the distance of the throw are:

- speed of release
- height of release
- angle of release

(3 marks)

- (b) Explain why the javelin would not travel as far in the air if it was released at a much steeper angle (eg. more upright), with the same release speed. You may use a diagram to help explain your answer.

- A higher angle of attack, means more surface area.
- Lift would be reduced and drag increased.
- Therefore, javelin would slow more rapidly.



(2 marks)

- (c) In javelin, the men use a 2kg implement. If a competitor swapped to a 1.5kg javelin, explain (using Newton's 2nd law) why it would travel further.

- 2nd law: $F = m \times A$. (1) It is likely the same force would be applied, regardless of the object's mass.
- If mass ↓'d, and the same force applied, the object would accelerate more. (1).
- This would result in a greater speed and distance. (1).

(3 marks)

- (d) In the picture, it shows Jan's hips and shoulders are almost side on to the direction of the throw. Explain how this could help to increase the force of the throw and make it go further?

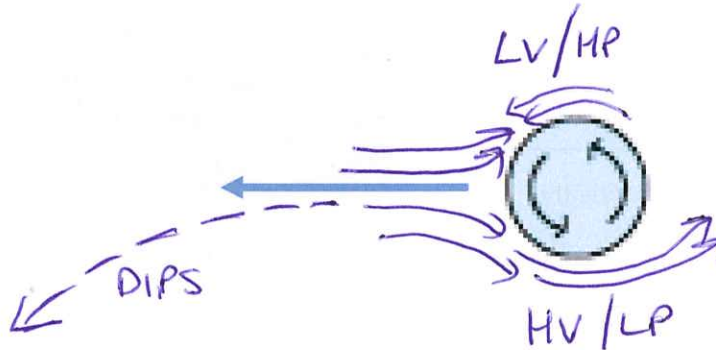
- Higher The total force applied to the javelin, higher its release speed.
- To generate more force, Jan can summate all his muscles in sequence. By turning side on, his legs, lower back & hips can contribute more force. (2 marks)

Question 4 (7 marks)

The picture to the right shows a table tennis player hitting a topspin shot.



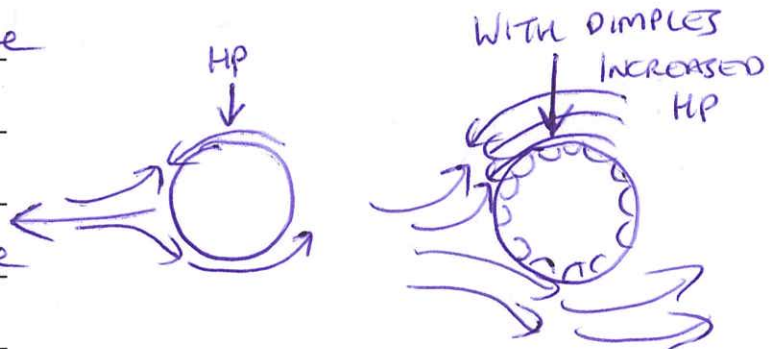
- (a) Show the airflow on the diagram below, and show the ball's flight path, high/low velocity and high/low pressure areas. (3 marks)



- (b) If the ball had dimples (eg. like a golf ball), would you expect it to change/dip its flight path more or less?

Explain (you can use a diagram to help).

- Would expect it to dip more as more air can be trapped around the ball.
- Therefore, there would be even greater pressure.



(2 marks)

- (c) Often a player will use a bat with 'pips' or dimples (see diagram) instead of a smooth surface to make the ball spin more. Explain how 'pips' might help create more spin.



- Pips ↑ friction between bat & ball.
- As the ball hits, it can grip more, and allow the bat to be in contact with the ball for longer.

(2 marks)

Question 5 (16 marks)

Road cycling is a sport that requires a great athlete with excellent technique and physiology AND a great bicycle with advanced technology. The picture to the right shows a triathlete during the cycle leg of their event.



- (a) In the picture, as the cyclist pushes down on the pedal, what are the joint movements of:

Knee: Extension

Hip: Extension

As the cyclist pushes down on the pedal, what would be the:

Agonist muscle group? Quadriceps Antagonist muscle group? Hamstrings

As the cyclist pulls up on the pedal, what would be contraction type of the:

Hamstrings: Concentric Triceps: Isometric (6 marks)

- (b) Explain 2 things in the picture that would help to reduce the drag and allow the cyclist to go faster.

1 mark each, and 1 for explanation. egs.
- Helmet - allows air to pass quickly over it
- Suit -
- Bars/riding position -
- Bike -

(4 marks)

- (c) If the cyclist rode close behind another cyclist (drafting), why would it take them less effort/force to travel at the same speed as the front cyclist?

- Air hits the lead cyclist, splits around him, and leaves an area of low pressure behind him.
- If a cyclist rides within the "drag" or LP area, she has lower drag force acting on him.
- Therefore, they do not need to apply as much force to the pedals to ride at same speed as lead rider. (3 marks)

- (d) The cyclist performs a 500m time trial on the track, which takes her 40 seconds to complete. Explain which energy system would be dominant and which fuel would be most utilised.

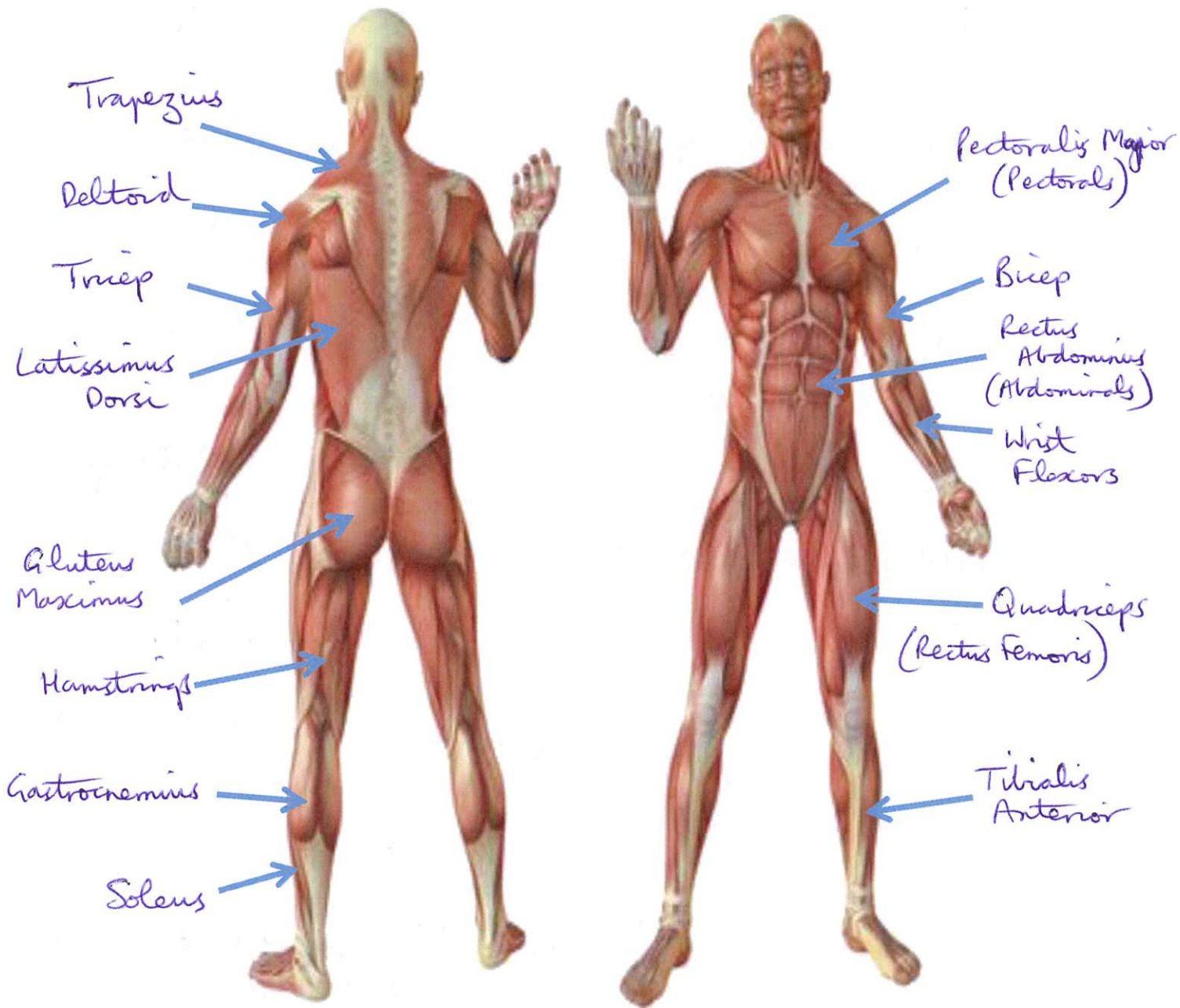
- The anaerobic glycolysis system would provide the most ATP throughout 40s, and CHO's would be utilised most (2)
- ATP-CP would be used up by around 10s, and aerobic system would be producing the most ATP towards the end of the race.

(4 marks)

Question 6 (10 marks)

Label the following muscles on the diagram below, using the correct terminology.

(14 x ½ marks = 7 marks)



Two muscle groups that would extend the hip? Gluteals and Hamstrings
 An example of a body structure containing smooth muscle? Lung, kidney, Stomach, Intestine etc.
 The heart is made up of what type of muscle? Cardiac
 Two main muscles that plantar flex the foot? Gastrocnemius and Soleus

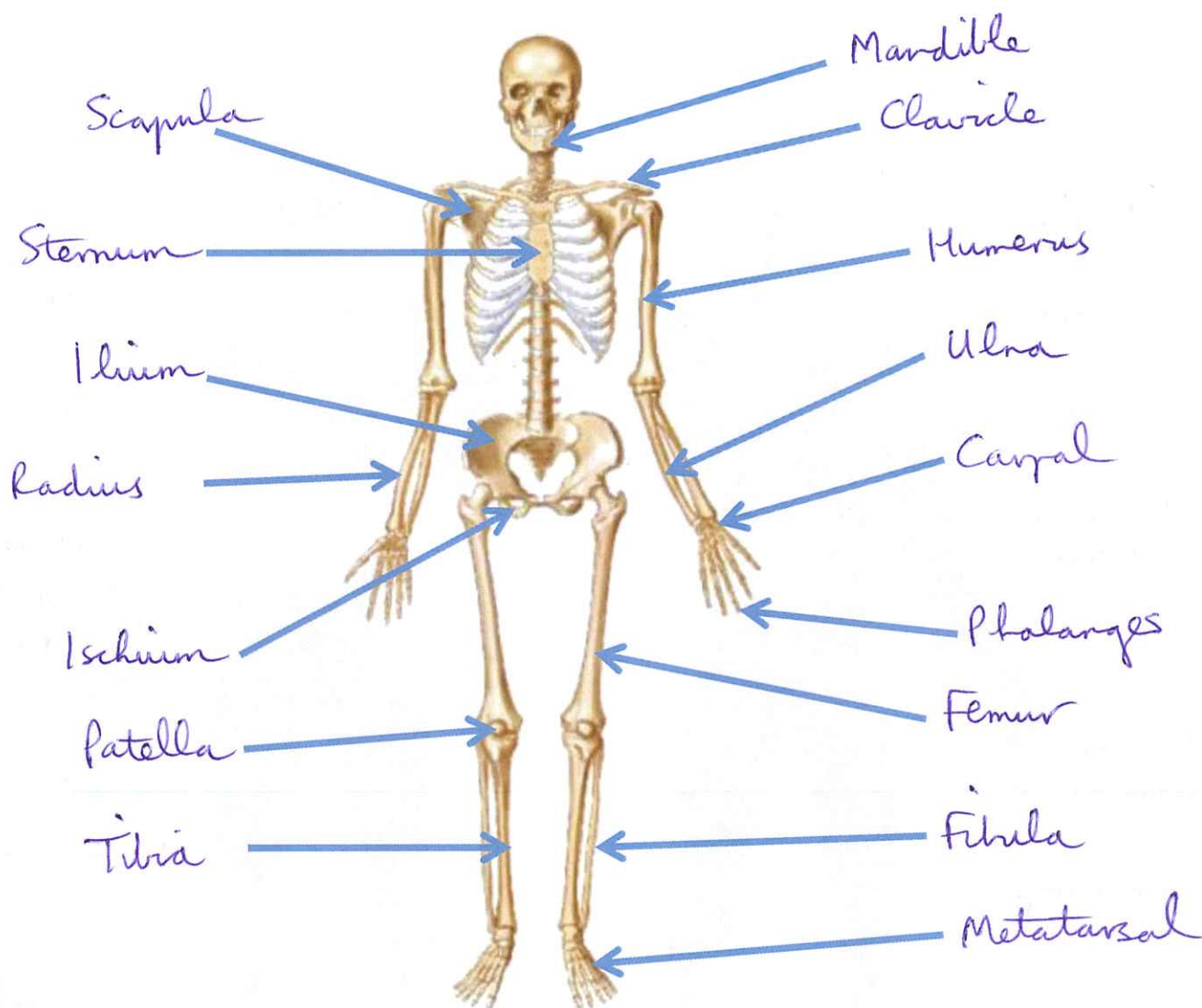
(6 x ½ marks = 3 marks)

(1 of 1)

Question 7 (10 marks)

Label the following bones on the diagram below, using the correct terminology.

(16 x ½ marks = 8 marks)



2 of:

Name 2 bones that protect vital organs? Cranium, Ribs, Ilium, and Vertebrae, Scapula, Sternum

Lifting the arm out to the side would be an example of what movement? Abduction

Turning the palm of the hand to face upwards would be an example of what movement? Supination

(4 x ½ marks = 2 marks)

TOTAL MARKS: 92

END OF TEST