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SPORTS, EXERCISE AND HEALTH SCIENCE
STANDARD LEVEL
PAPER 2

Candidate session number

Thursday 6 November 2014 (morning)

1 hour 15 minutes

Examination code

8	8	1	4	–	6	6	0	2

INSTRUCTIONS TO CANDIDATES

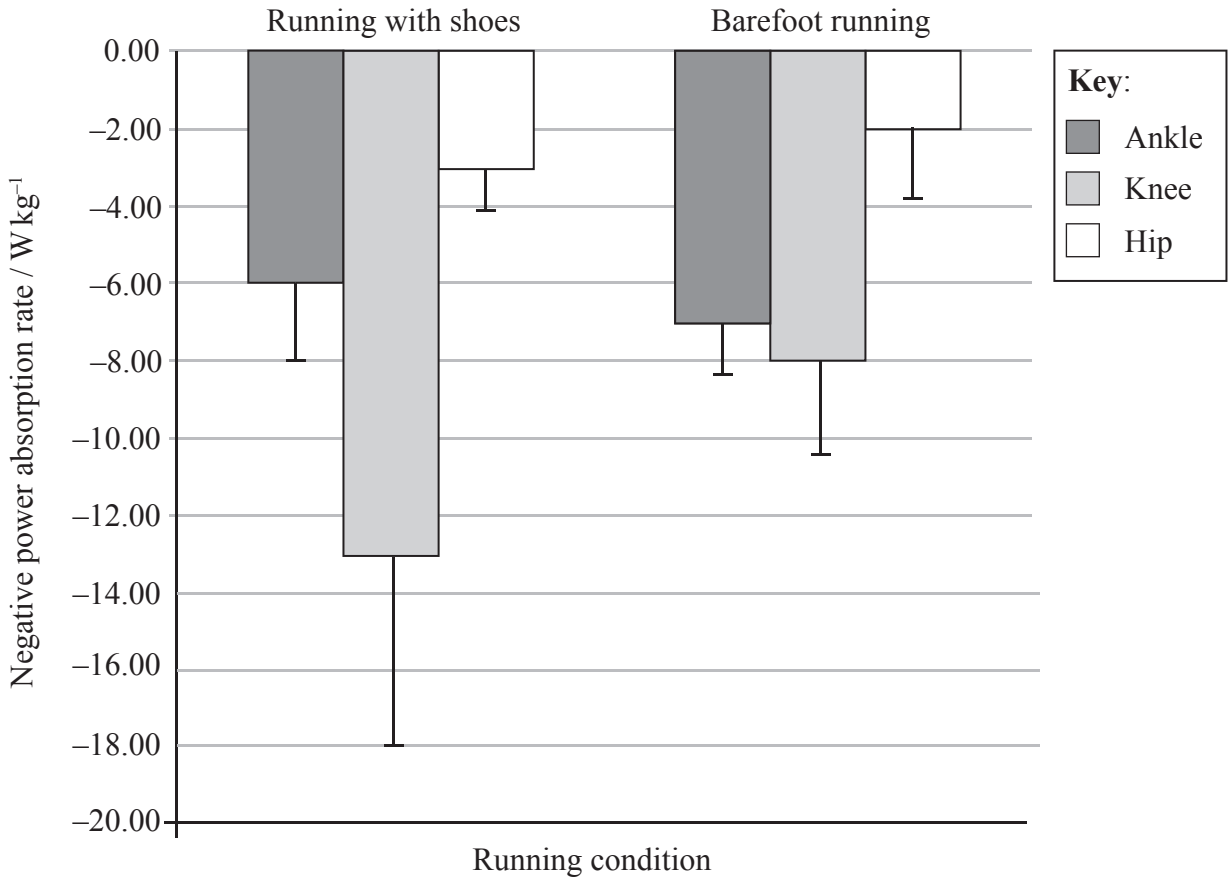
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[50 marks]*.

SECTION A

*Answer **all** questions. Write your answers in the boxes provided.*

1. A study recorded the joint power absorption rates of 20 runners with and without running shoes. The bar chart below shows the negative power absorption rate for the ankle, knee and hip joints under the following running conditions:

- Running with shoes
- Barefoot running (without shoes)



[Source: adapted from D Williams *et al.*, (2012), *The International Journal of Sports Physical Therapy*, **7** (5), page 529]

(a) State which running condition has the highest negative power absorption rate at the hip joint. *[1]*

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(This question continues on the following page)

(Question 1 continued)

(b) Discuss the hypothesis that the negative power absorption rate will be lower in barefoot running compared to running with shoes. *[3]*

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(c) Outline how each of the following are useful for comparing data on joint power absorption rates.

(i) Standard deviation *[1]*

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(ii) Error bars *[1]*

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(Question 1 continued)

Another study measured the effect of two different running surfaces on in-shoe pressure patterns in long-distance runners. The table below shows the mean peak pressure rates and contact time on in-shoe pressure sensors for different parts of the foot.

	Peak pressure / Kpa		**Contact time / ms**	
	Concrete	Grass	Concrete	Grass
Forefoot	242	214	223	230
Rearfoot	349	299	148	151
Midfoot	112	116	194	202

[Source: V Tessutti *et al.*, (2012), *Journal of Sports Sciences*, **30** (14), page 1548]

(d) Calculate, with appropriate units, the mean contact time on grass. *[1]*

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(e) Analyse the peak pressure on different parts of the foot on concrete and grass. *[2]*

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(f) Define Newton's *third law of motion*. *[1]*

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(Question 1 continued)

(g) Using Newton's third law of motion, explain how an athlete accelerates out of the starting blocks in a 100 m sprint. *[2]*

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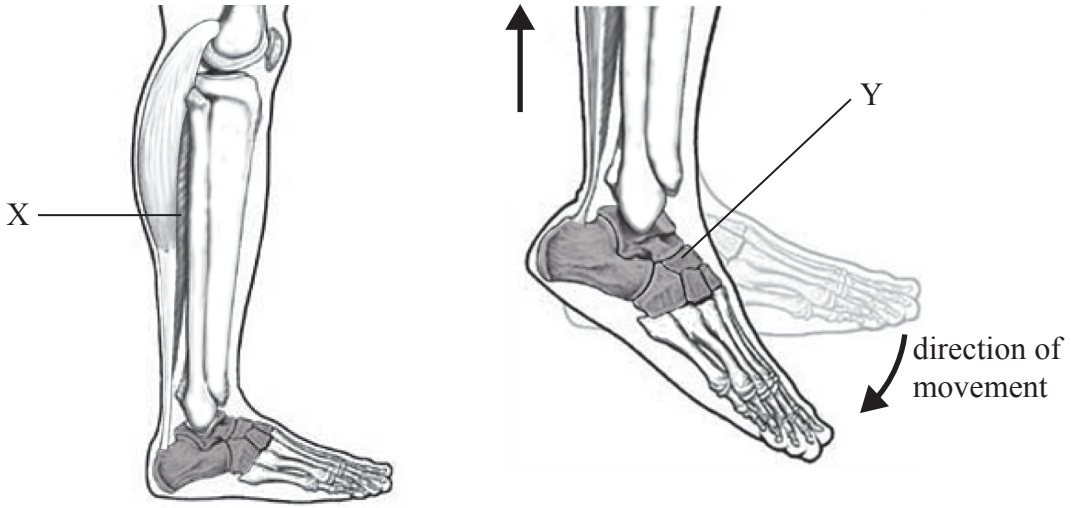
2. In barefoot running, the forces at initial contact are transmitted through the bones and muscles of the lower leg. The bones and muscles of the lower leg are shown below.



[Source: adapted from www.emedicinehealth.com]

(a) State the name of the shaded muscle labelled X and the shaded **bones** labelled Y. *[1]*

X: . . . . . .

Y: . . . . . .

(b) Describe **one** type of lever at the ankle joint with reference to effort, load and fulcrum. *[2]*

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(Question 2 continued)

(c) Explain the role of ATP in energy production when accelerating out of the starting blocks during a short burst of intense exercise. *[3]*

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(d) Compare the recommended energy intake of **two** macronutrients for a marathon runner and a student who takes part in no exercise. *[2]*

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3. (a) List **two** principal structures of the ventilatory system. *[1]*

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(b) Outline the sequence of excitation of the cardiac muscle which results in a heartbeat. *[2]*

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(c) Explain the redistribution of blood throughout the body during exercise. *[2]*

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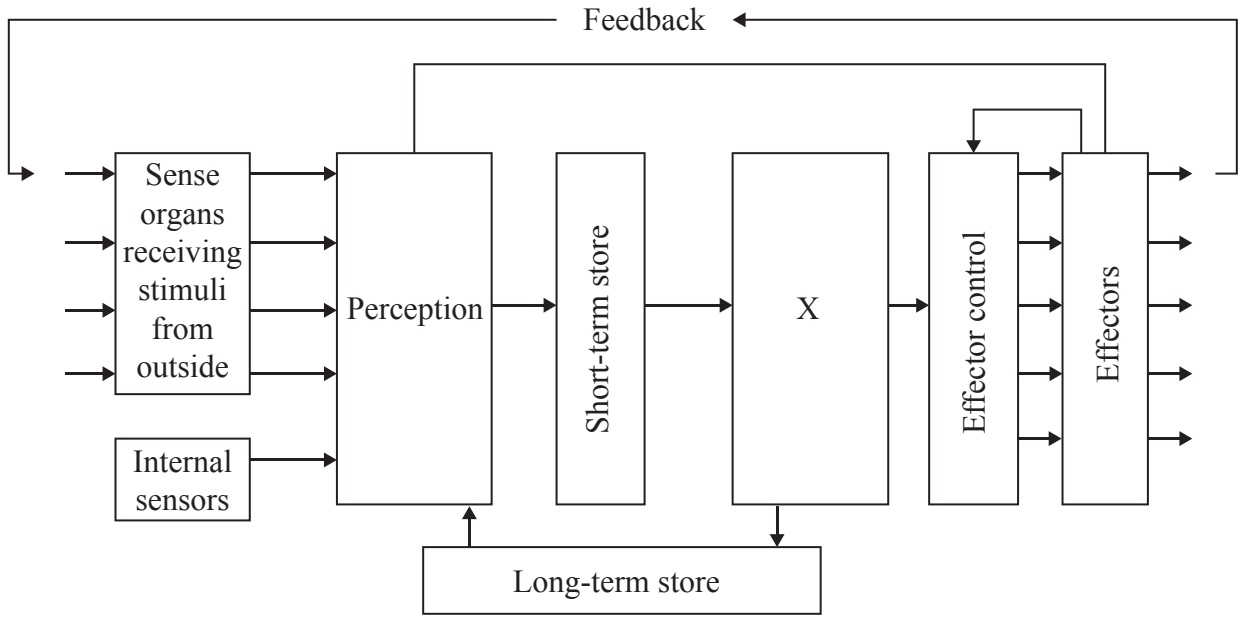
4. The diagram below shows Welford's model of information processing.



[Source: P Beashel *et al.*, (1999), *Advanced Studies in Physical Education and Sport*, page 244]

(a) State the name of component X. *[1]*

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(b) Discuss the relationship between selective attention and memory for a sports player. *[2]*

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(Question 4 continued)

(c) Outline **one** principle of training programme design for a sports player. *[2]*

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SECTION B

*Answer **one** question. Write your answers in the boxes provided.*

5. (a) Explain the process of gaseous exchange between the lungs and pulmonary capillaries. *[4]*

(b) Outline how both the nervous system and the chemical composition of blood control the rate of breathing during exercise. *[5]*

(c) Describe the characteristics associated with the three phases (stages) of learning with reference from novice to skilled performance. *[6]*

(d) Explain how a skilled player could use the psychological refractory period (PRP) to their advantage when playing a sport. *[5]*

6. (a) Outline how the general characteristics of skeletal muscle tissue function during a 200 m sprint. *[5]*

(b) Explain how skeletal muscle contracts once a muscle fibre has been stimulated by a neurotransmitter using the sliding filament theory. *[7]*

(c) Outline the types of movements and muscle contraction at the knee joint when a soccer player kicks a soccer ball. *[4]*

(d) Discuss how maximal oxygen consumption data can vary with different modes of exercise in the same individual. *[4]*

7. (a) Describe the process of anaerobic catabolism of glucose. *[3]*

(b) Outline the function of glucagon and adrenaline when fasting in relation to the breakdown of glycogen. *[3]*

(c) Describe the production of ATP by the aerobic system. *[4]*

(d) Evaluate **one** method of testing maximal oxygen uptake for sports players. *[4]*

(e) Explain the importance of study design to investigate how causality can be demonstrated through experimental results. *[6]*