Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4791/02

W16-4791-02

ADDITIONAL APPLIED SCIENCE

UNIT 1: Science at Work in Applied Contexts
HIGHER TIER

A.M. THURSDAY, 7 January 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**11**	
2.	**13**	
3.	**13**	
4.	**13**	
5.	**10**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **2***(c)* and **5***(b)*.

You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

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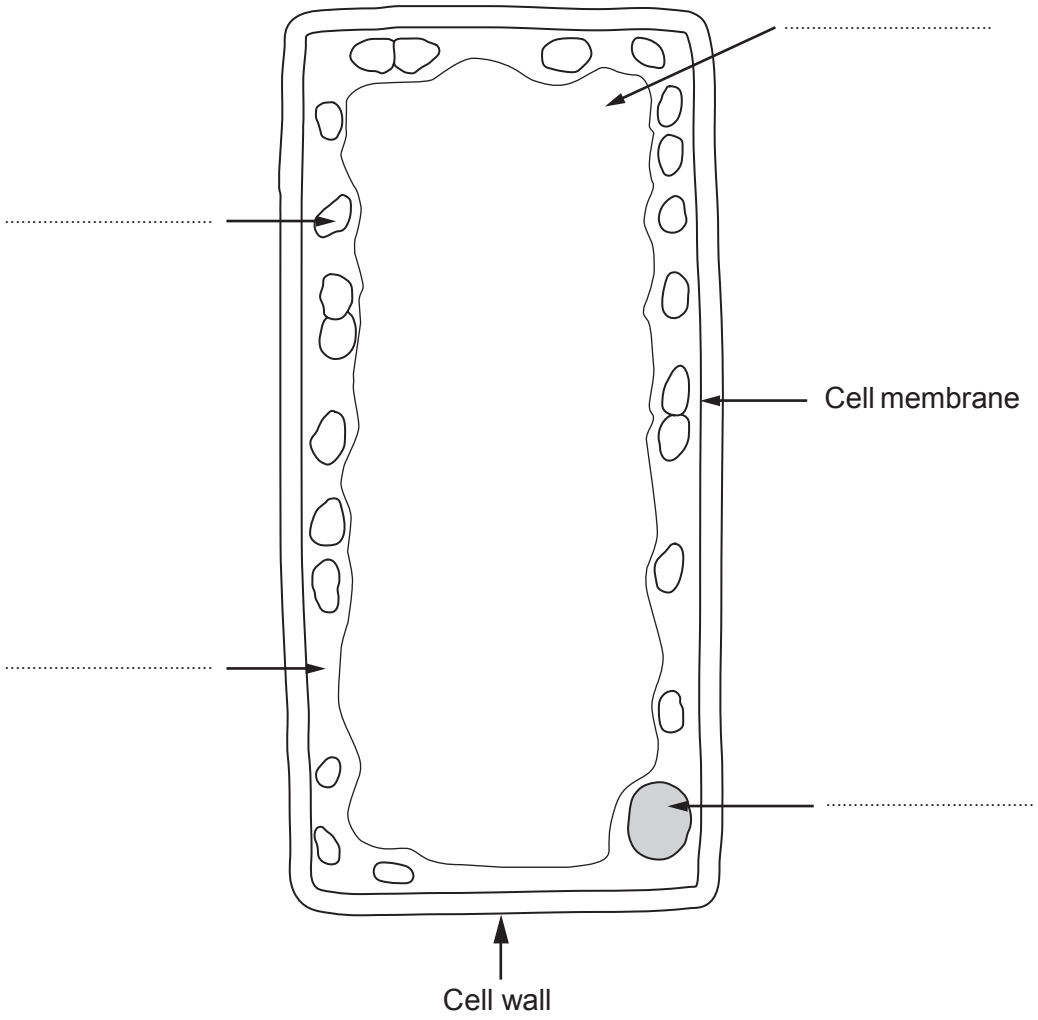
Answer **all** *the questions in the spaces provided.*

1. *(a)* A diagram of a plant cell is shown below.



(i) **Complete** the labelling of the diagram. [4]

(ii) I. State the function of the cell wall. [1]

.....

II. State which part controls all the activities of the cell. ..... [1]

III. State the function of the cell membrane. [1]

.....

(b) Chloroplasts contain a green substance that absorbs light for photosynthesis.

(i) Name this green substance. ..... [1]

(ii) Complete the word equation for photosynthesis. [3]

carbon dioxide + ... ⟶ ..... + ...

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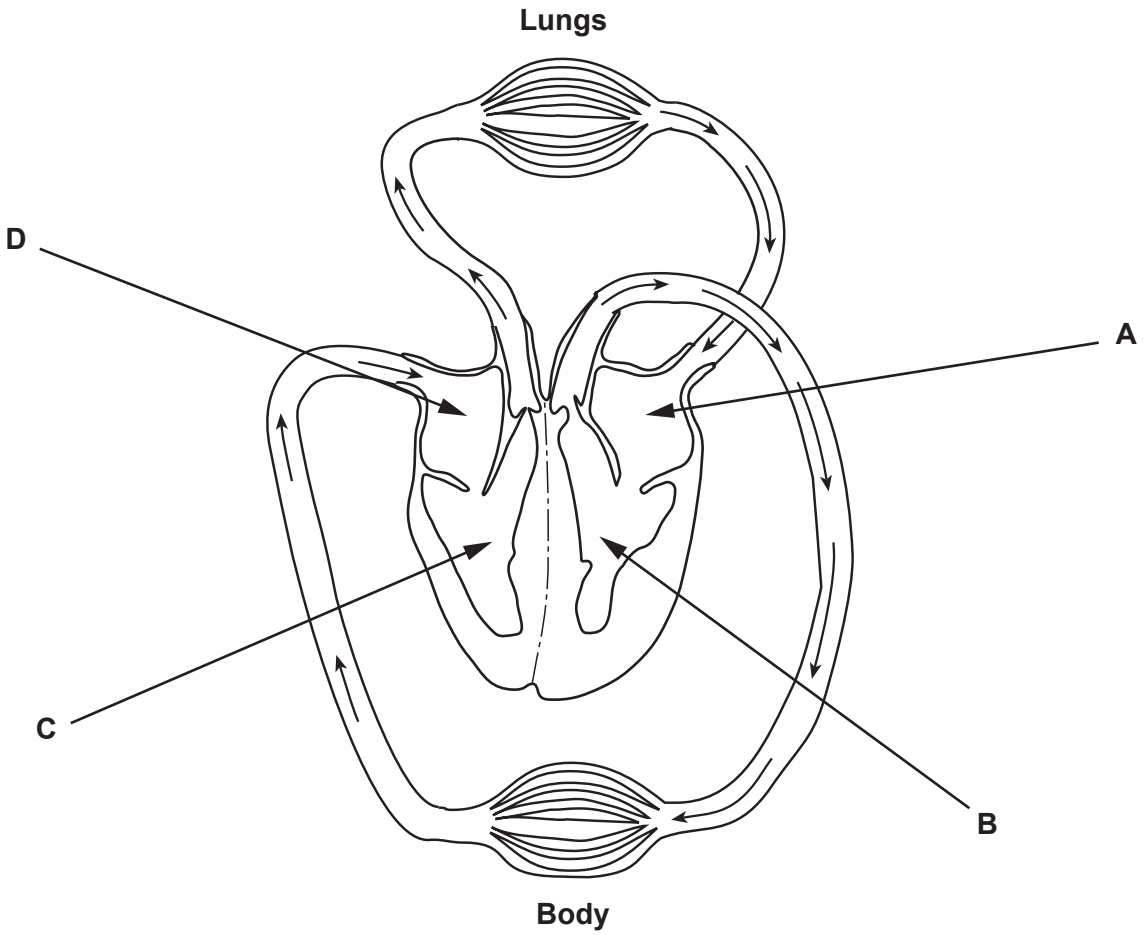
2. A nurse is monitoring the heart of a patient.

(a) Answer the questions using the diagram of the circulatory system below.



(i) Which chamber, **A**, **B**, **C** or **D**, pumps blood to the lungs? .....[1]

(ii) Into which chamber, **A**, **B**, **C** or **D**, does blood return from the body? ..... [1]

(iii) The symptoms of left ventricular failure are tiredness, shortness of breath and irregular heart rate. Which chamber, **A**, **B**, **C** or **D**, is the left ventricle? [1]

.....

(iv) **Add** an arrow labelled **V** to the diagram to show a vein. [1]

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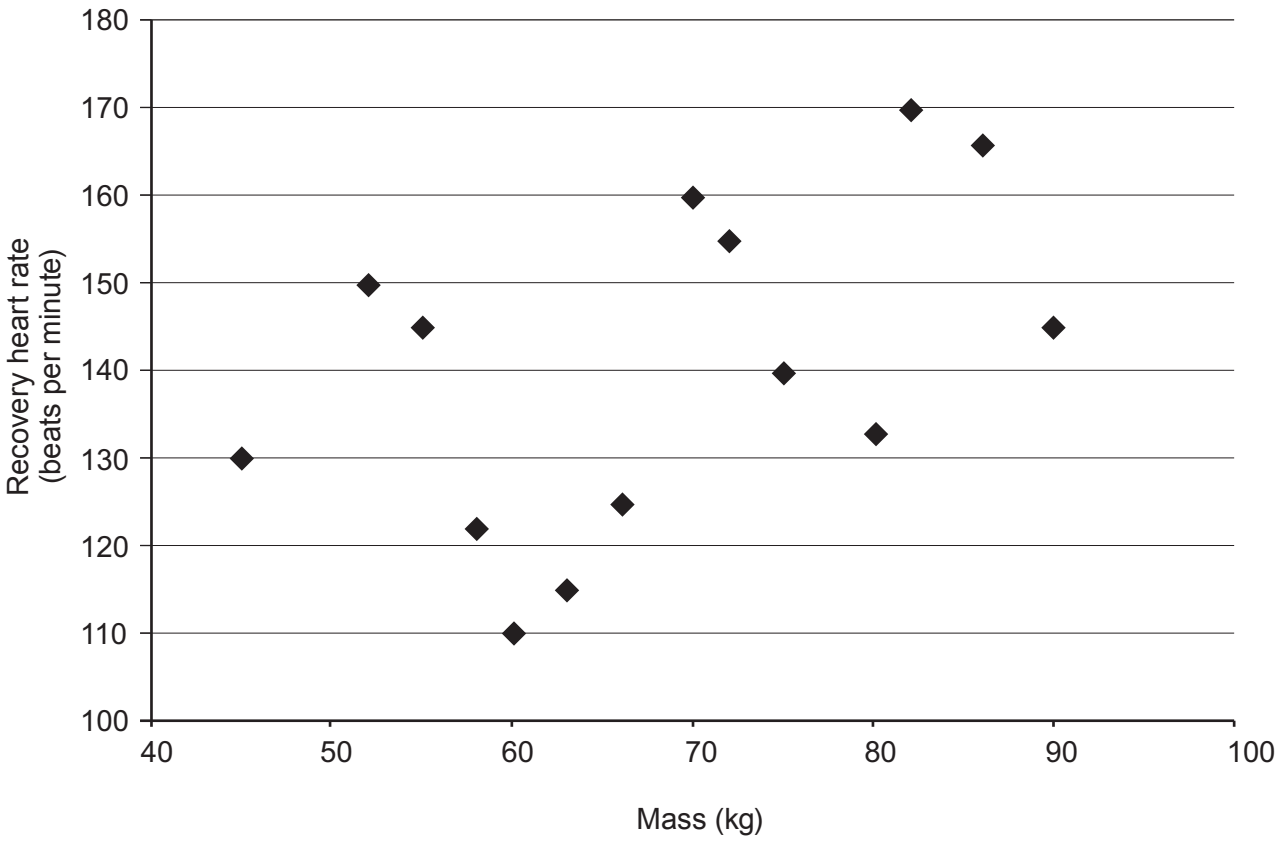
(b) Recovery heart rate is the heart rate measured one minute after exercise. The scatter graph below shows the recovery heart rate for boys of different mass.



Use the information in the scatter graph to answer the following questions.

(i) What is the mass of the fittest student? [1]

..... kg

(ii) Explain whether recovery heart rate depends on body mass. [2]

.....

.....

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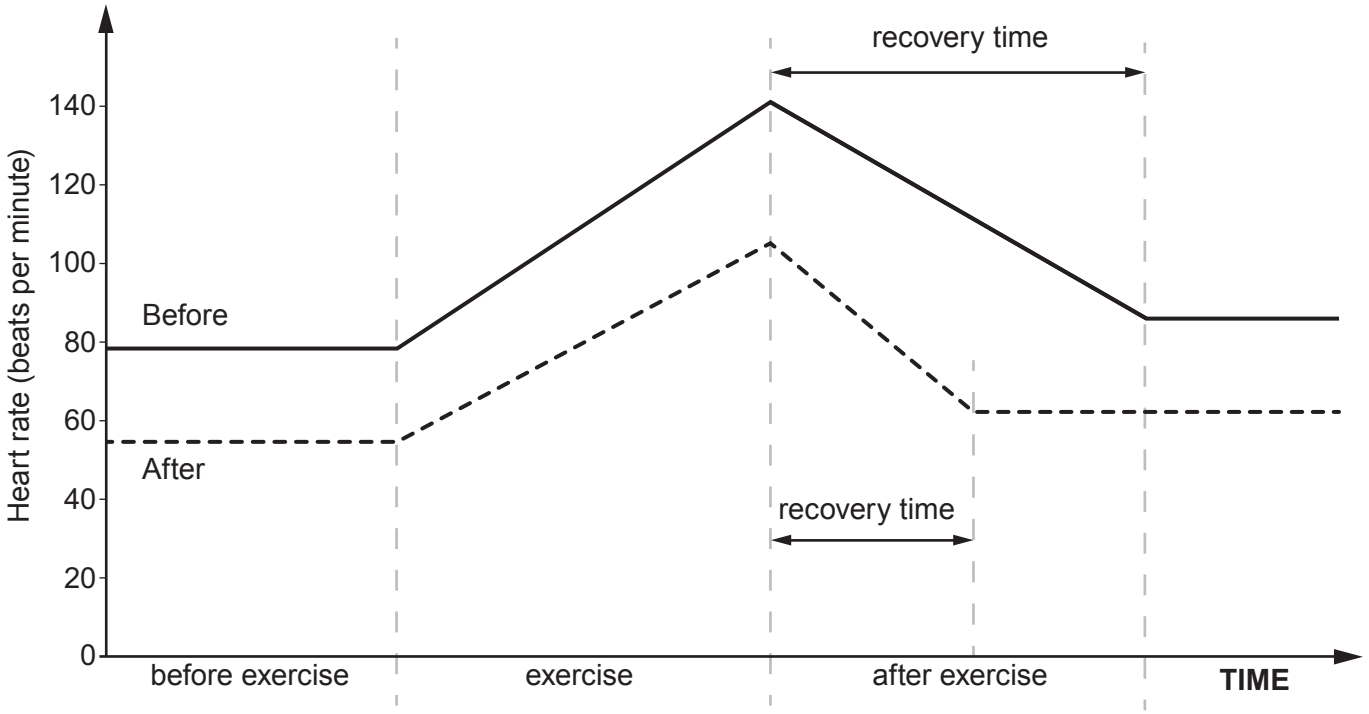
(c) The boys carried out a 6-month training programme.
The graph below shows the effect of the same amount of exercise on one boy's heart rate **before** and **after** the training programme.



Explain the differences between the heart rates **before** and **after** the training programme. [QWC 6]

Your answer should include:
- a description of the differences between both graphs;
- an explanation of why these differences exist.

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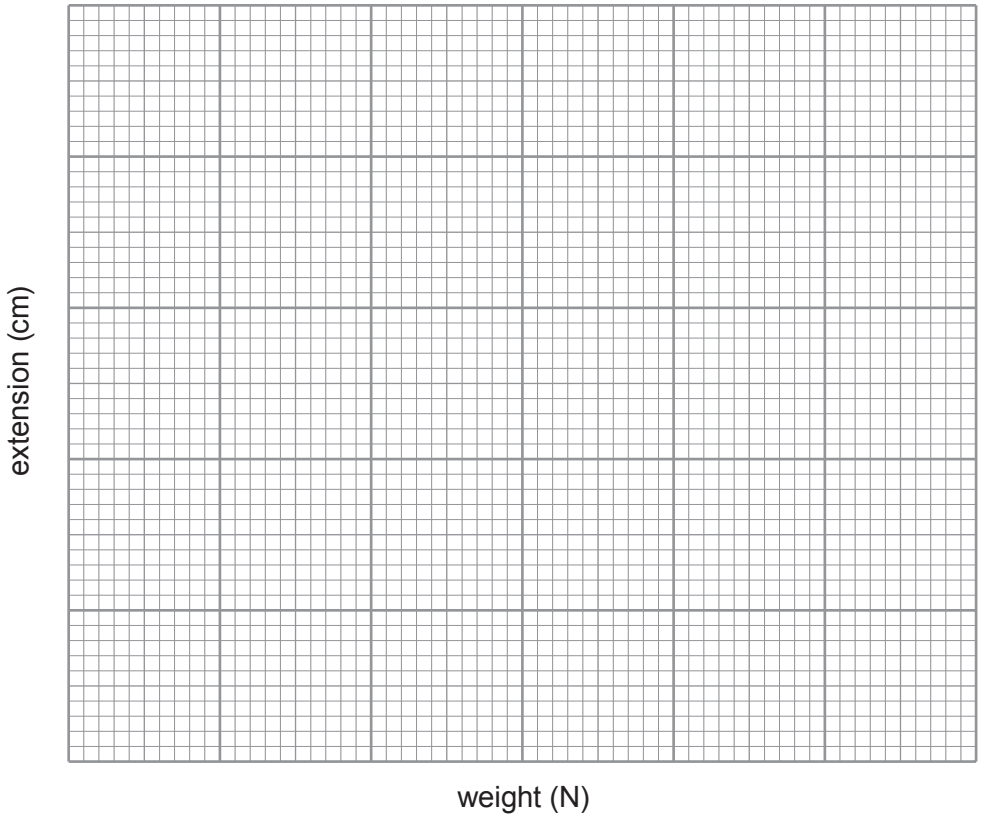
3. The table shows the results of an experiment to measure the stiffness of a spring.

Weight (N)	Position of pointer (cm)	Spring extension (cm)
0.0	24.0	0.0
0.5	24.6	0.6
1.0	25.2	1.2
1.5	25.8	1.8
2.0	26.4	2.4
3.0	27.6	3.6
4.0	28.8	.....

(a) (i) Complete the table. [1]

(ii) Use the results to plot a graph on the grid. [3]



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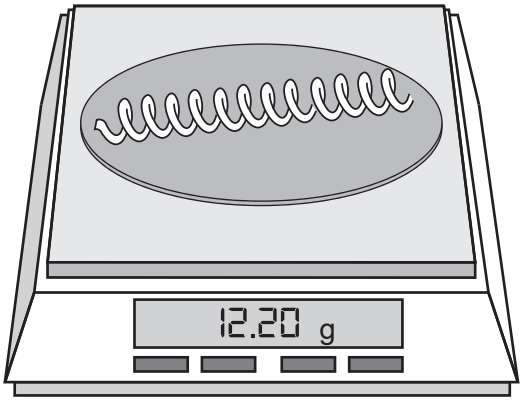
(iii) Use data from the graph to calculate the spring constant using the equation: [2]

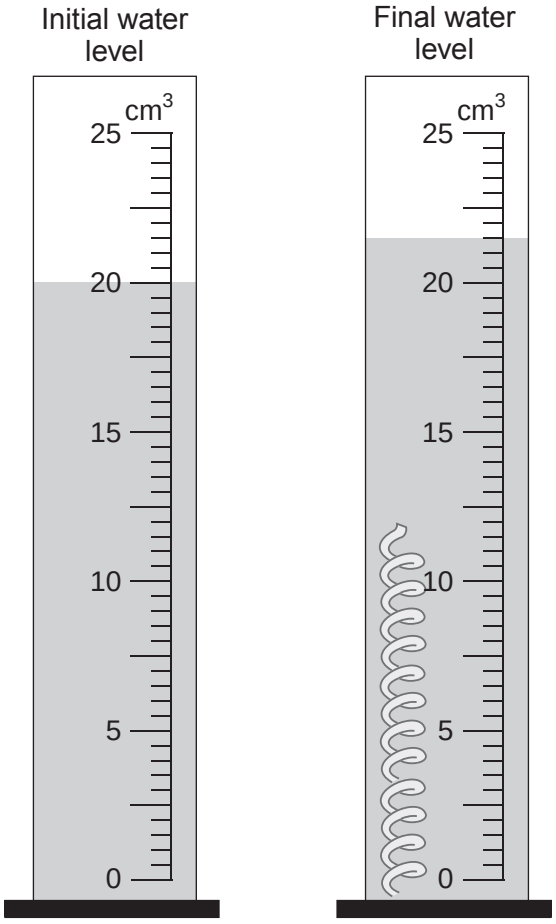
$$\textit{spring constant} = \frac{\textit{force (N)}}{\textit{extension (cm)}}$$

spring constant = ... N/cm

(iv) Add a line to the graph to show the results for a spring with a bigger spring constant. [2]

(b) The mass and volume of the spring are found as shown below.





(i) Calculate the density of the spring, using the data above and the equation: [3]

$$\textit{density} = \frac{\textit{mass}}{\textit{volume}}$$

density = ... g/cm^3

(ii) Explain the limitations of the apparatus used in this method. [2]

.....

.....

.....

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4. The table gives information about the solubility of salts.

Soluble salts	Insoluble salts
all nitrates	no insoluble nitrates
sodium carbonate potassium carbonate	most carbonates
most chlorides most bromides most iodides	silver chloride silver bromide silver iodide lead chloride lead bromide lead iodide
most sulfates	lead sulfate barium sulfate
sodium hydroxide potassium hydroxide	most hydroxides

(a) In a precipitation reaction, two soluble salts make an insoluble salt.

(i) Use the information above to complete the table below if salts **1** and **2** are mixed together. [3]

Salt **1** in water	Salt **2** in water	Example of a precipitation reaction? Yes / No	Insoluble salt produced? Yes / No	Name of insoluble salt if produced
sodium nitrate	barium sulfate	No	No	No insoluble salt produced
sodium sulfate	lead nitrate	.....	.....	.....
potassium nitrate	sodium carbonate	.....	.....	.....
lead bromide	barium hydroxide	.....	.....	.....

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(ii) Silver chloride is used to make photochromic sunglasses and stained glass windows. Complete the word equation below for a precipitation reaction that will produce silver chloride. [3]

..... (soluble) + ... (soluble) chloride ⟶ silver chloride (insoluble) + ... (soluble)

(b) Another example of a precipitation reaction is shown in the equation below.

copper sulfate + sodium hydroxide ⟶ copper hydroxide + sodium sulfate

(i) Complete the balanced symbol equation for this reaction. [3]

..... + ... ⟶ $Cu(OH)_2$ + Na_2SO_4

(ii) I. Use the information in the table below to calculate the relative formula mass of copper hydroxide. [3]

Element	Relative atomic mass
copper	64
oxygen	16
hydrogen	1

Relative formula mass = ...

II. The mass of copper hydroxide produced in a reaction is 24.5 g. Calculate the number of moles of copper hydroxide in this mass. [1]

Number of moles = ...

13

Turn over.

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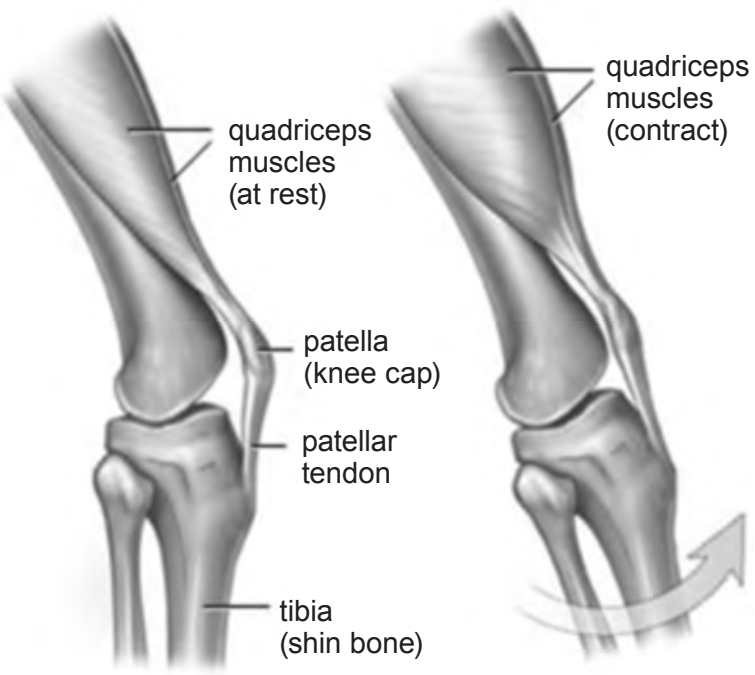
5. Footballers rely on healthy knee joints and having strong muscles connected to the knee.

(a) The diagram below shows how the quadriceps muscles are connected at the knee joint.



Describe the sequence of events that occur in the nervous system when a footballer makes a decision to kick a ball. [4]

.....

.....

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.....

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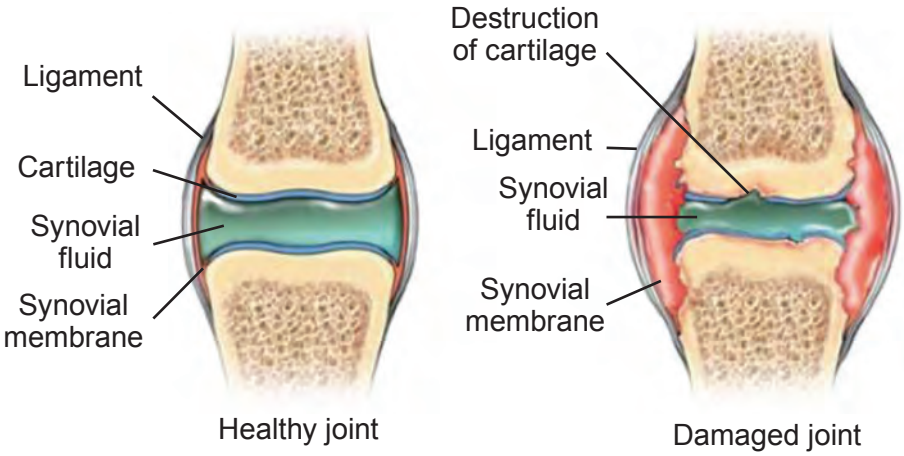
.....

.....

.....

Examiner only

(b) The diagrams below show a healthy and a damaged knee joint.



Healthy joint

Damaged joint

Explain why a footballer with a damaged knee joint would be in too much pain to continue playing football. [QWC 6]

Include in your answer:

- the role of cartilage, synovial fluid and ligaments in a healthy joint;
- what has happened to cause pain in the joint.

END OF PAPER

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