OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE

G622/01

APPLIED SCIENCE

Monitoring the Activity of the Human Body

TUESDAY 12 MAY 2015: Afternoon
DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	

Centre number						Candidate number				

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Electronic calculator
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

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INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION FOR CANDIDATES

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

The total number of marks for this paper is 90.

You are advised to show all the steps in any calculations.

Where you see this icon you will be awarded marks for the quality of written communication in your answer.

This means, for example, you should:

ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;

organise information clearly and coherently, using specialist vocabulary when appropriate.

You may use an electronic calculator.

Any blank pages are indicated.

Answer ALL the questions.

1 A doctor is called out to visit one of his patients, Mr Singh, at home.

Mr Singh is 78 years old and has had heart problems for many years.

(a) The doctor measures and records Mr Singh's pulse rate and blood pressure.

(i) State THREE steps in the procedure for measuring PULSE RATE.

step 1
step 2
step 3

[3]

(ii) State the name of the equipment used to measure blood pressure.

_____ **[1]**

(iii) State the blood pressure for a typical, healthy male aged 40 YEARS OLD.

blood pressure = _____ / _____ mm Hg [1]

(iv) The first value recorded for a blood pressure reading is called the systolic reading and the second value is the diastolic reading.

Use your knowledge of heart function to state what these two readings represent.

systolic _____

_____

diastolic _____

_____

[2]

(b) The doctor also measures Mr Singh's temperature and concludes that he is suffering from hypothermia.

(i) Give the likely value for Mr Singh's core temperature.

below _____ °C [1]

(ii) Mr Singh looks very pale.

Suggest how hypothermia causes his pale appearance.

_____

_____ **[1]**

(c) Mr Singh has had heart problems for many years and has high blood pressure. He has also been diagnosed with hypothermia.

The doctor must make the decision to either have Mr Singh admitted to hospital or to treat him at home.

State one RISK and one BENEFIT of admitting Mr Singh to hospital and of treating him at home.

Admitted to hospital	Treated at home
risk:	risk:
benefit:	benefit:

[4]

[TOTAL: 13]

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2 Gemma is studying the topic of respiration as part of her college course.

(a) Gemma's teacher says that cellular respiration has some similarities to the burning of fuels.

There are also some differences.

(i) Complete the following sentences about respiration in the cells of the human body.

Aerobic respiration uses oxygen.

The reaction involving oxygen takes place in the _____ of a cell.

Aerobic respiration generates carbon dioxide and water, but it also produces molecules of _____ .

Anaerobic respiration is carried out in the _____ of a cell.

Human muscle cells generate _____ and _____ during anaerobic respiration.

[5]

(ii) State TWO differences between the burning of fuels and cellular respiration in humans.

1 _____

_____

2 _____

_____

[2]

(b) Gemma is also finding out about the functions of the circulatory system.

State TWO features of the circulatory system that enable it to support the process of respiration.

feature 1 _____

_____

feature 2 _____

_____

[2]

(c) The analysis of a person's blood may indicate that they are experiencing problems with their respiratory system.

State THREE changes IN THE BLOOD, other than the cell counts, that may result from respiratory problems.

1 _____

_____

2 _____

_____

3 _____

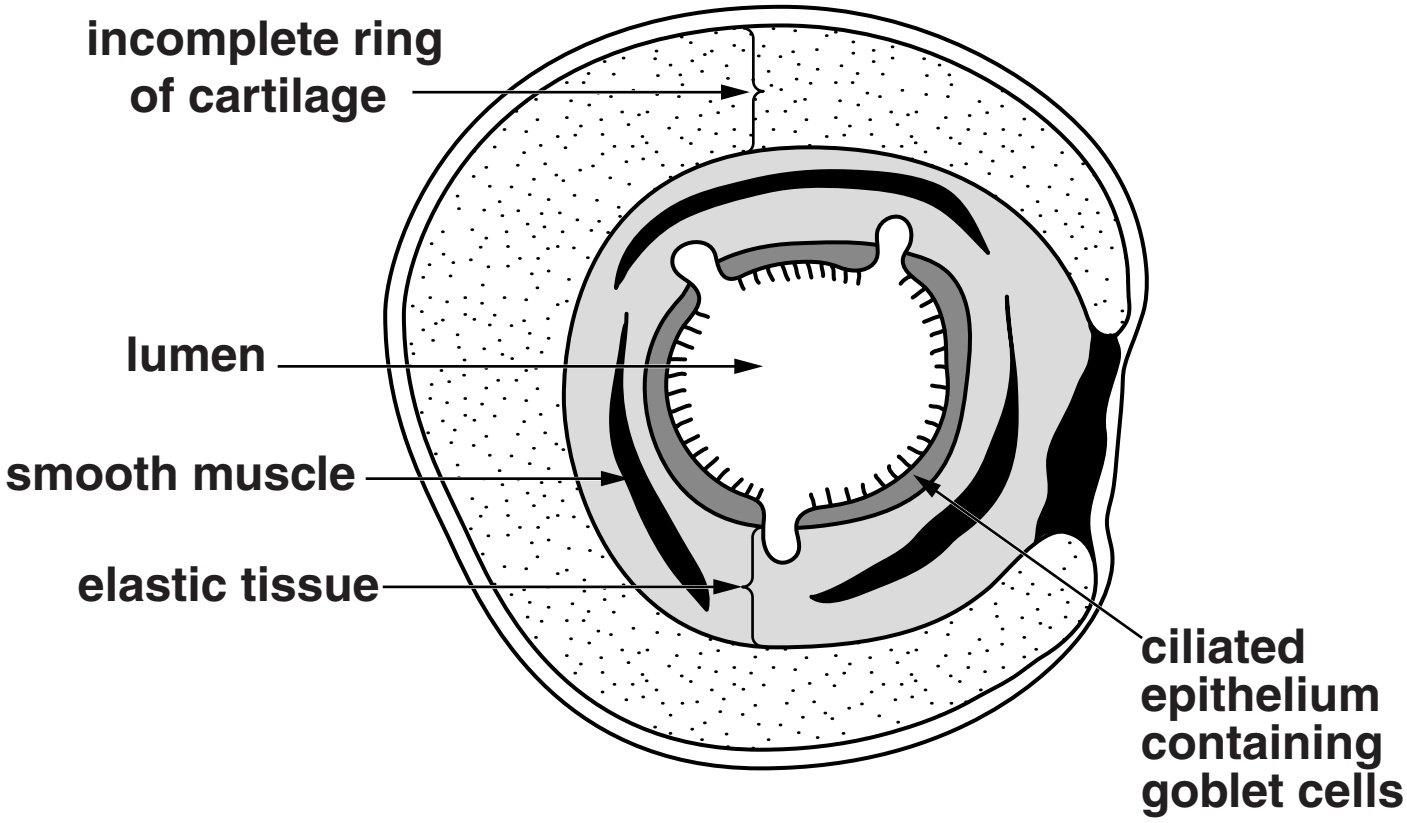
_____

[3]

(d) The respiratory system has a number of structures that make ventilation of the lungs more efficient.

Gemma's teacher shows her a drawing of a transverse section of the trachea, Fig. 2.1.

FIG. 2.1



(i) State the functions of the following structures.

STRUCTURE	FUNCTION
Incomplete ring of cartilage	
Smooth muscle	
Goblet cells	
Elastic tissue	

[4]

(ii) Name the equipment used to measure the maximum speed of expiration.

_____ [1]

(iii) Smoking inhibits the action of cilia in the ciliated epithelium.

Explain how this effect on cilia could eventually limit the maximum speed of expiration.

_____

_____

_____

_____ **[2]**

(iv) Another type of tissue is squamous epithelium, which is found in alveoli.

Explain how the structure of squamous epithelium is adapted to its function.

_____

_____

_____

_____ **[2]**

[TOTAL: 21]

3 Andy has a new job as a technician in the pathology laboratory at his local hospital.

Andy will be analysing tissue and blood samples that could become contaminated if not handled carefully. There is also a risk that Andy himself could become contaminated.

(a) State THREE different hazards that Andy should be aware of and the precautions he needs to take when handling tissue and blood samples in the laboratory so that he does not become contaminated.

Complete the table below.

HAZARD	PRECAUTION
1	
2	
3	

[6]

(b) Andy must learn how to carry out and analyse both red blood cell counts and white blood cell counts.

Complete the table below to give ONE example of a disorder that can be identified using each of these types of cell count.

CELL COUNT	DISORDER
red blood cells	
white blood cells	

[2]

(c) Blood samples can also be tested and analysed for the presence of drugs.

Andy finds out that different techniques and equipment are available to complete this analysis.

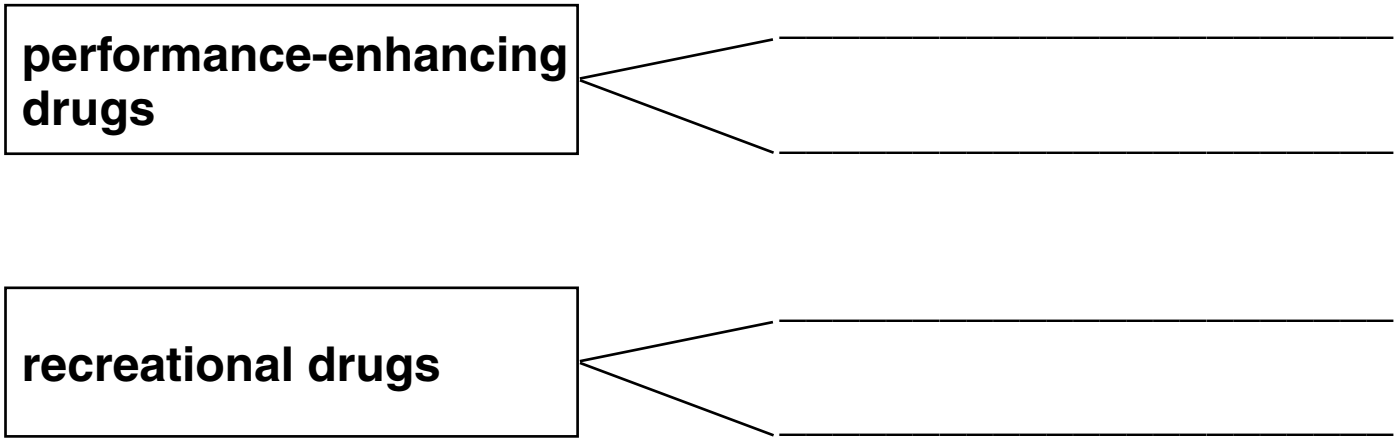
(i) Name TWO techniques or items of equipment available in a medical laboratory to analyse blood samples for drugs and alcohol.

1 _____

2 _____

[2]

(ii) **Give examples of TWO performance-enhancing drugs and TWO recreational drugs (other than alcohol).**



[2]

[TOTAL: 12]

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4 Patients with diabetes know how important it is to have their blood-glucose levels monitored.

(a) Some patients visited their local medical centre to take part in a glucose tolerance test.

(i) The patients had to fast for 8 to 12 hours before the start of the test.

Describe two OTHER important stages of the glucose tolerance test.

_____

_____

_____

_____ **[2]**

(ii) State the typical blood-glucose plasma concentration for patients after fasting.

Show the range of values and the units.

range = _____ to _____ units = _____

[2]

(iii) Explain why glucose may appear in the urine samples of patients with diabetes.

_____

_____

_____

_____ **[2]**

(b) Patients with diabetes may also monitor their own blood-glucose levels.

Describe how a person can monitor their own blood-glucose levels and how the results can be used by those with TYPE 1 diabetes and TYPE 2 diabetes to help manage their condition. [6]

(Do NOT include details of biochemical reactions involved in blood-glucose tests in your answer.)

_____

_____

_____

_____

_____

_____

_____

_____

(c) Pregnant women can develop GESTATIONAL diabetes, a temporary form of diabetes.

A research study concludes that immediately after pregnancy, 5 to 10 percent of women with gestational diabetes are still found to show type 2 symptoms. Women who have had gestational diabetes also have an increased chance of developing diabetes in the 10 to 20 years after pregnancy.

Use your knowledge of diabetes to suggest why women who have had gestational diabetes have an increased chance of developing diabetes in the 10 to 20 years after pregnancy.

_____

_____

_____

_____ **[2]**

[TOTAL: 14]

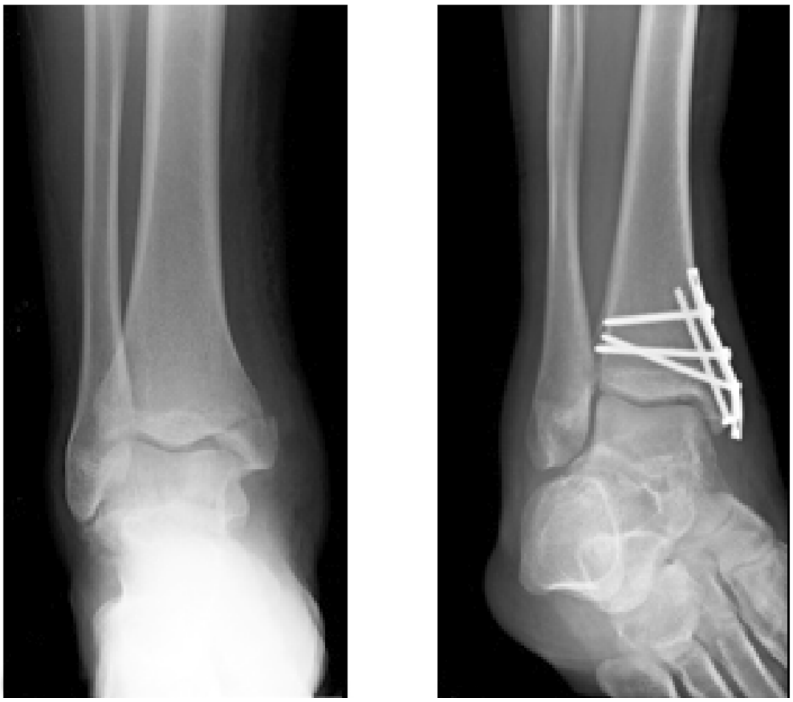
5 Jim is a footballer. He injures his ankle and undergoes surgical treatment.

The surgery involves the insertion of metal implants to hold his bones in place.

Fig. 5.1 shows X-ray images of Jim's ankle.

FIG. 5.1

Before treatment **After treatment**



(a) In Jim's X-rays, the bones and the metal implants can be seen more clearly than the muscles.

Explain why.

_____

_____

_____

_____

_____

_____ **[3]**

(b) Jim is advised not to have any MRI scans on his ankle following his surgery.

Explain why.

_____

_____

_____

_____ **[2]**

(c) Jim experiences complications after the surgery. The medical team believes that the blood flow into his foot is restricted. They decide to carry out further investigation.

(i) An ULTRASOUND SCAN is used to examine the blood flow into Jim's foot.

Give TWO features of ultrasound scans that make this an appropriate method to use for this investigation.

1 _____

2 _____

[2]

(ii) State two STRUCTURAL similarities and two STRUCTURAL differences between ARTERIES and VEINS.

similarities _____

_____

differences _____

_____

[2]

[TOTAL: 9]

6 Laura is a competitive cyclist. She is training hard to increase her performance levels (Fig. 6.1).

Laura trains in a sports laboratory alongside physiologists who measure her changing fitness levels.

FIG. 6.1

The physiologists use a spirometer to determine Laura's tidal volume before and after exercise.

(a) Two important safety procedures are followed.

- **Only exhaled air passes through a container of SODA LIME.**

- **Inhaled air is taken from a chamber in the spirometer which is filled with MEDICAL-GRADE AIR.**

Suggest why these safety precautions are necessary.

soda lime _____

_____

medical-grade air _____

_____

[2]

(b) The spirometer trace for Laura AT REST is shown in Fig. 6.2 opposite.

(i) Use the trace to calculate the tidal volume for Laura when she is at rest.

tidal volume = _____ dm^3 [1]

(ii) Compare Laura's tidal volume at rest with the average range expected for a female aged 20 years old.

average range expected = _____ to

_____ dm^3

_____

_____ **[1]**

(iii) Describe and explain the likely changes to Laura's tidal volume IMMEDIATELY AFTER intense exercise on the training bicycle.

_____

_____

_____

_____ **[2]**

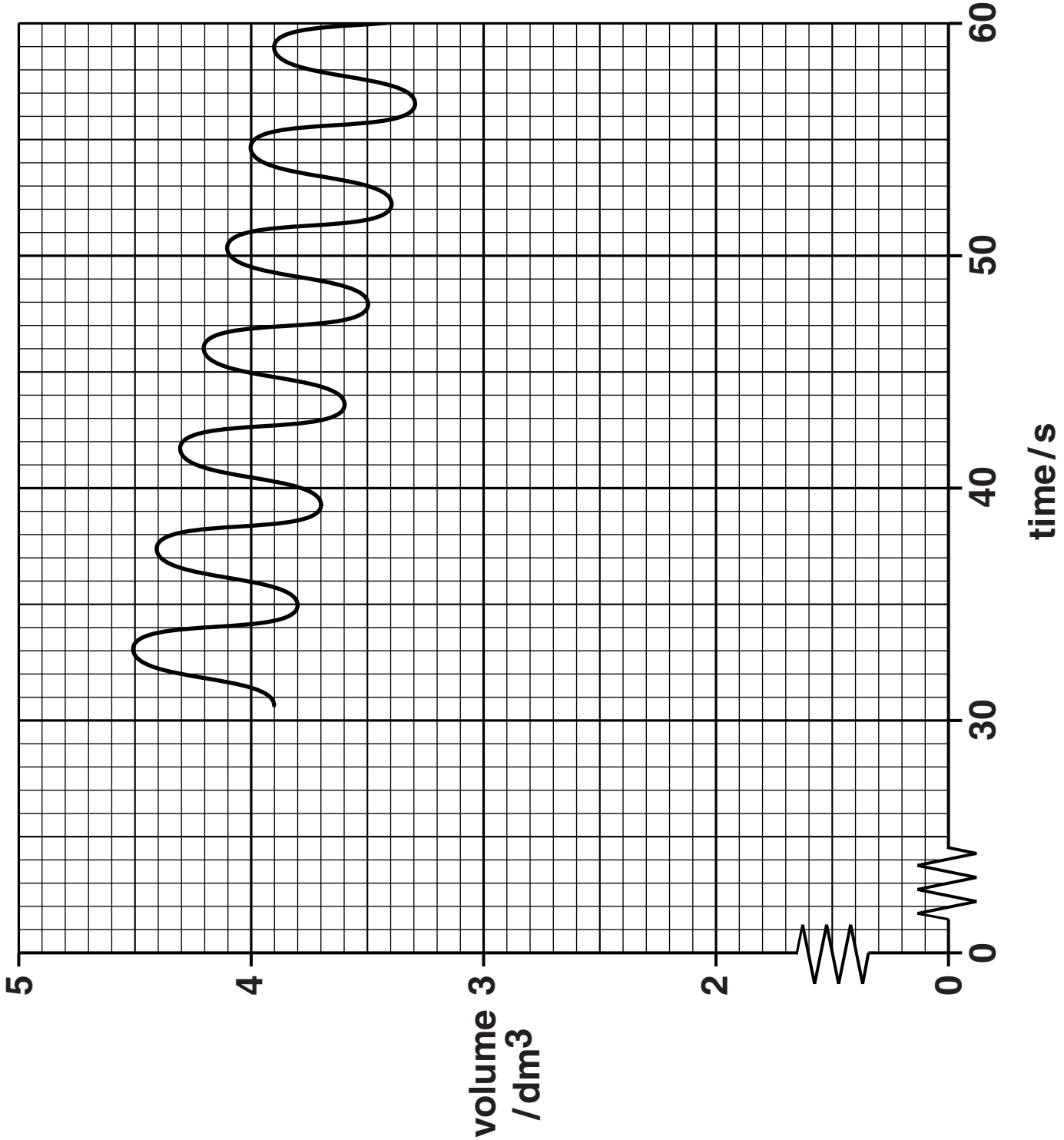


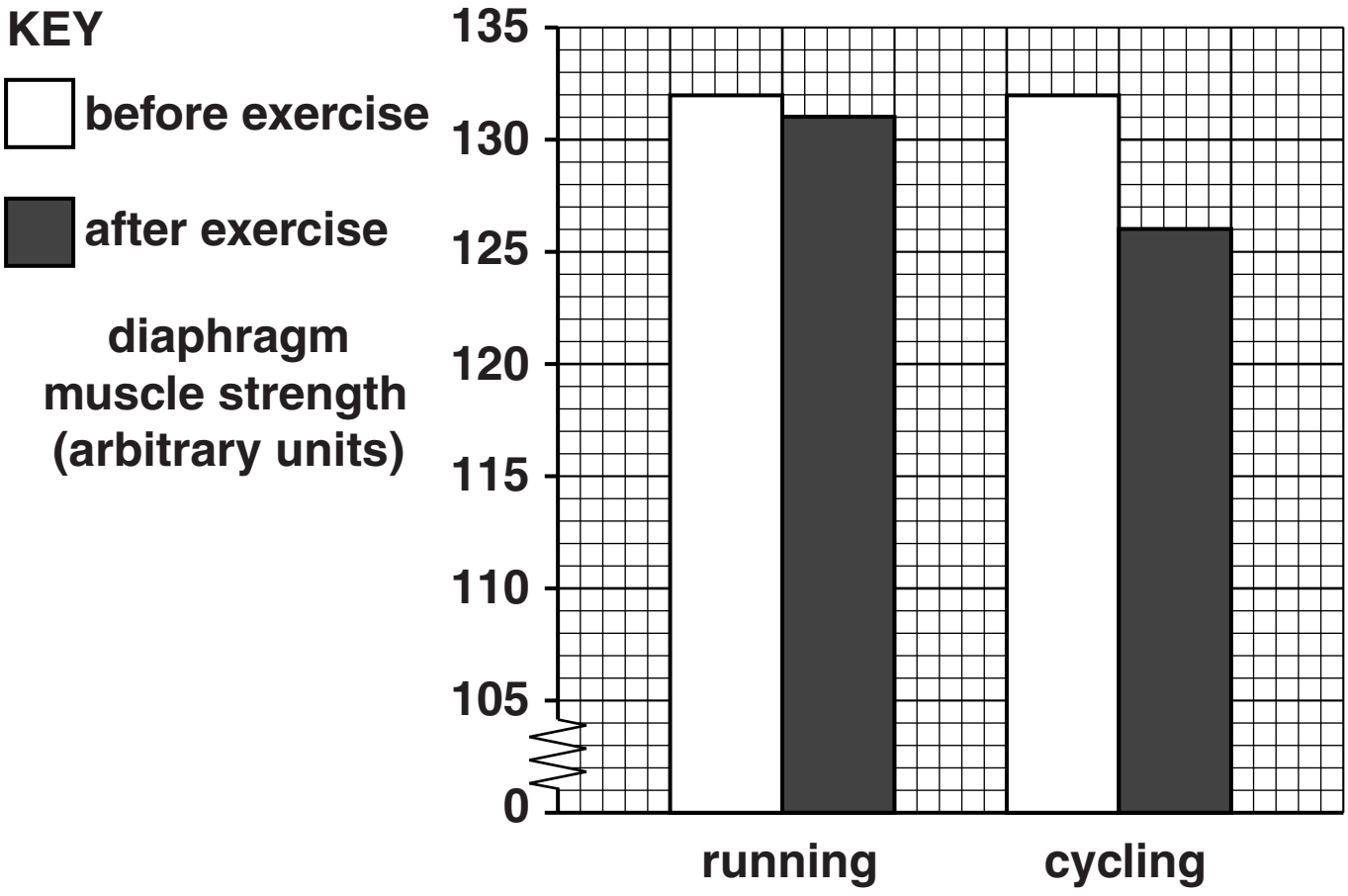
FIG. 6.2

(c) The contraction and relaxation of the DIAPHRAGM MUSCLE is essential for inspiration and expiration.

The diaphragm muscle is similar to other skeletal muscles because it can show fatigue and loss of muscle strength under certain conditions.

To measure this fatigue, the physiologists record Laura's diaphragm muscle strength before exercise and after exercise. They plot the results of their tests, Fig. 6.3.

FIG. 6.3



Laura exercises in two different ways:

running for 20 minutes

cycling for 20 minutes.

(i) Compare the effects of running and of cycling on the fatigue of Laura's diaphragm muscle. Support your answer using suitable data from Fig. 6.3.

_____

_____

_____

_____

_____

_____ **[3]**

(ii) Suggest TWO reasons why exercise could result in muscle fatigue.

1 _____

_____

2 _____

_____

[2]

(iii) DESCRIBE and EXPLAIN how fatigue in the diaphragm muscle will alter Laura's lung volume and peak-flow during breathing.

lung volume _____

_____

_____

_____

peak-flow _____

_____

_____

_____

[4]

(d) The physiologists also measure Laura's pulse rate.

Describe and explain how Laura's pulse rate can be used to monitor her fitness levels and discuss the changes that would take place in her cardiovascular system as her fitness increases over time. [6]

(Details of how to record pulse rate are not required.)

_____

_____

_____

_____

_____

[TOTAL: 21]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined pages. The question number(s) must be clearly shown in the margins.

