OCR
Oxford Cambridge and RSA

Friday 9 June 2023 – Afternoon

GCSE (9–1) Combined Science B

(Twenty First Century Science)

J260/08 Combined Science (Higher Tier)

Time allowed: 1 hour 45 minutes

H

You must have:
- a ruler (cm/mm)
- the Data and Equation Sheet for GCSE (9–1) Combined Science B (inside this document)

You can use:
- an HB pencil
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

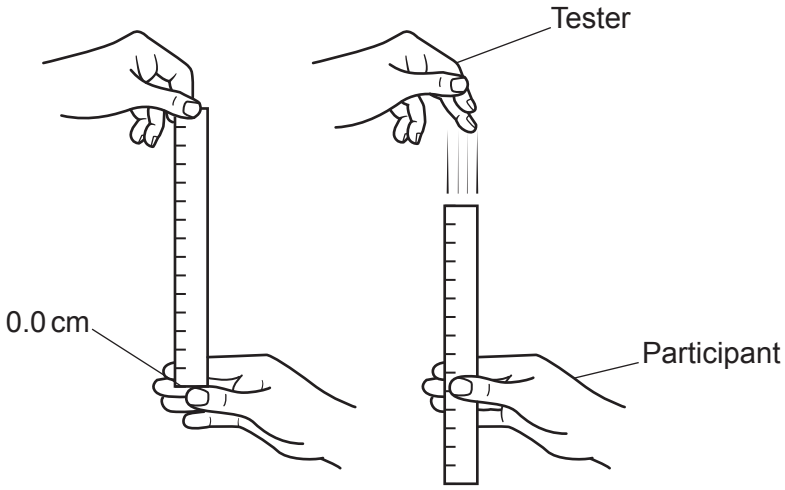
Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **75**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

1 Two students are doing an experiment to investigate reaction times. The diagram shows their experiment.



(a) The statements outline the method used. They are **not** in the correct order.

A	The tester lets go of the ruler.
B	The participant catches the ruler as soon as they realise the tester has let go of the ruler.
C	The distance the ruler has dropped is measured.
D	The participant has their fingers and thumb near, but not touching, the ruler.
E	The tester holds a ruler above the participant's hand.

(i) Write the letters in the boxes to show the correct order of the statements.

The first one has been done for you.

E				

[2]

(ii) Suggest **two** improvements to the method that would ensure that the measurements taken were valid.

Improvement 1 .....

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Improvement 2 .....

.....

[2]

(b) The experiment is repeated three times. **Table 1.1** shows the results.

Table 1.1

Repeat	Distance ruler falls (cm)
1	8.4
2	7.9
3	7.7

The students conduct a fourth repeat. The distance recorded is 12.7 cm.

Suggest **one** reason why this value of 12.7 cm is greater than the first three repeats.

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..... **[1]**

(c) The students find some data they can use to convert the distance fallen by the ruler into a reaction time. This information is in **Table 1.2**.

Table 1.2

Ruler reading (mm)	Reaction time (s)
10	0.05
20	0.06
30	0.08
40	0.09
50	0.10
60	0.11
70	0.12
80	0.13
90	0.14
100	0.14
110	0.15

A second participant repeats the experiment. The mean distance the ruler falls is 6.7 cm.

Use **Table 1.2** to estimate their reaction time.

Reaction time = ... s **[2]**

(d) Another way of determining the reaction time is to use a formula.

Calculate the reaction time when the ruler falls 0.0670 m.

Use the formula:

$$t = \sqrt{\frac{2d}{g}}$$

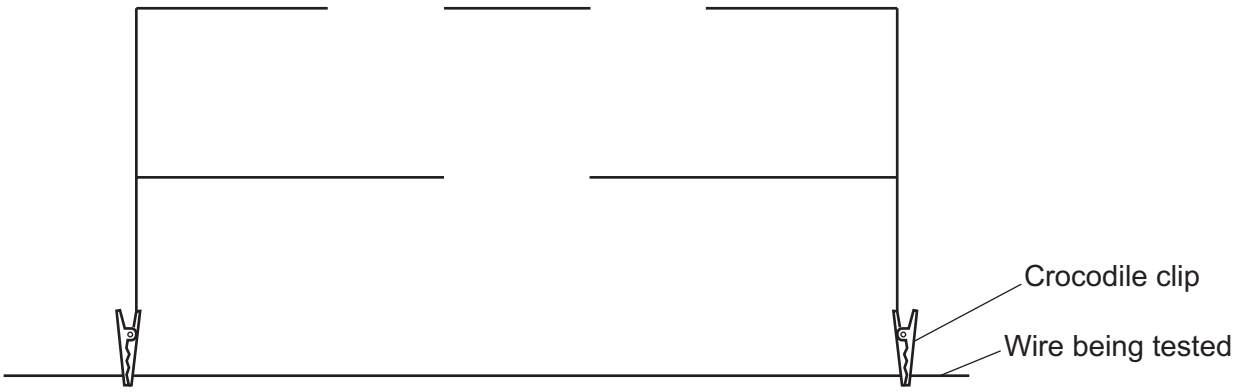
t = reaction time (s)
d = distance travelled by ruler (m)
g = 10 N / kg.

Give your answer to **3** significant figures.

Reaction time = ... s **[3]**

2 A student sets up a circuit to determine the resistance of a wire.

(a) Complete the circuit diagram by:
- adding a cell
- adding the equipment needed to measure the potential difference and current.



[1]

(b) The length of the wire used in the experiment is 90 cm. The current is 0.16 A and the potential difference is 1.5 V.

Calculate the resistance of the wire.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[2]**

(c) The student predicts that the longer the wire is the greater the resistance will be.

Describe how the student can extend their investigation to test their prediction.

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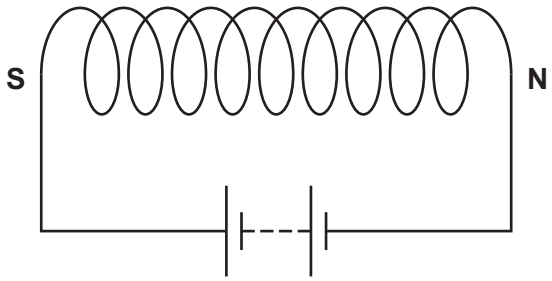
..... **[2]**

3 Kofi is investigating a solenoid, using the circuit shown. The north and south poles of the solenoid are labelled **N** and **S**.



(a) Kofi places a plotting compass near the solenoid.

How will the plotting compass show that there is a magnetic field around the solenoid?

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..... **[1]**

(b) Draw the magnetic field around the solenoid. **[2]**

(c) Kofi places some paperclips near the solenoid. The paperclips experience a magnetic force, which is caused by the magnetic field around the solenoid.

Give **three** ways in which Kofi can increase the effect of the magnetic field on the paperclips.

1 .....

2 .....

3 .....

[3]

(d) 57 C of charge flows through the solenoid in 30 seconds.

Calculate the current flowing through the solenoid.

Use the equation: charge = current × time

Current = ... A **[2]**

(e) The potential difference across the solenoid is 0.95 V.

Calculate the work done when 57 C of charge flows through the solenoid.

Use the equation: potential difference = $\frac{\text{work done}}{\text{charge}}$

Work done = ... J **[2]**

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4 Nina is studying potable (clean drinking) water.

(a) Two sources of potable water are waste water and sea water.

Identify one **other** source of potable water.

..... **[1]**

(b) The diagram shows the stages in the treatment of waste water.

(i) Describe the function of the 'aeration' and 'bacteria added' stages.

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..... **[2]**

(ii) What is the function of the filtration and settlement stages?

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..... **[1]**

(c) Describe **one** way in which potable water can be obtained from sea water.

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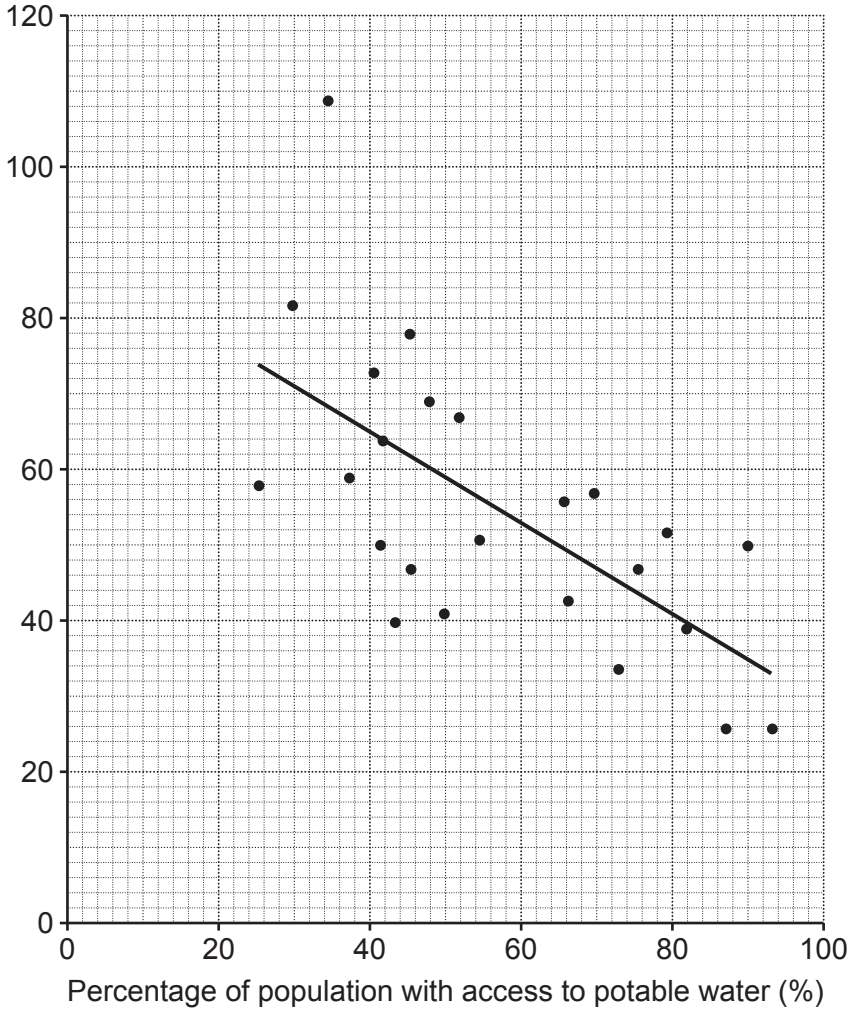
..... **[2]**

(d) Nina finds a graph (**Fig. 4.1**) that shows the relationship between the percentage of population with access to potable water and the number of deaths per 1000 people in the population.

Each point on **Fig. 4.1** represents a country.

Fig. 4.1



Nina forms a hypothesis about **Fig. 4.1**:

"The higher the percentage of the population that drink potable water, the lower the death rate."

Evaluate the quality of Nina's hypothesis.

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..... **[4]**

(e) Chlorine is added to water in some parts of the world because it kills microorganisms in the water.

Suggest why scientists in a developing country may have different opinions **for** and **against** using chlorinated water.

For .....

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.....

.....

Against .....

.....

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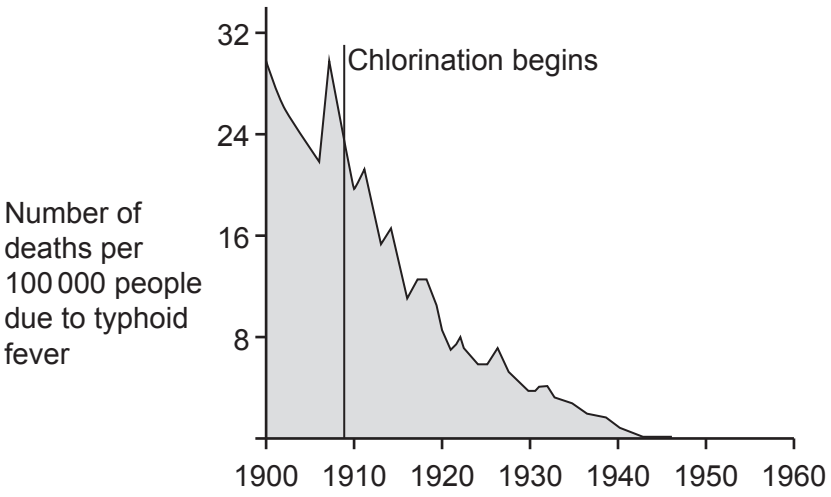
.....

[4]

(f) **Fig. 4.2** shows the number of deaths per 100 000 people due to typhoid fever from 1900 to 1960 in the USA.

Typhoid fever is a bacterial infection. It can be spread by drinking water that has not been treated.

Fig. 4.2



Explain what conclusions you can make from **Fig. 4.2** about the effectiveness of chlorination of water.

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..... **[3]**

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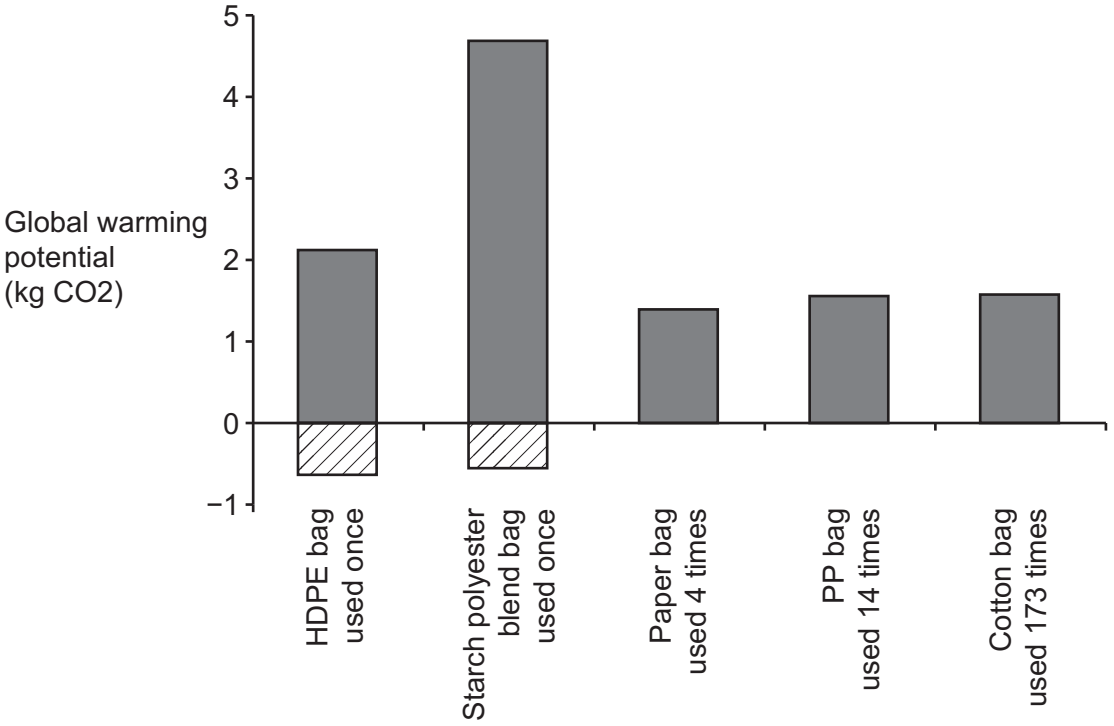
5 (a)* A supermarket wants to buy new shopping bags for their customers. They look at some data comparing the global warming potential (GWP) of different bags.

GWP is a measure that tells us the amount of greenhouse gas emissions that each bag produces over its lifetime.

The striped bar indicates that materials are recycled or reused during that bag's production, which reduces the overall GWP of that bag.



The table shows the cost of each type of bag to the customer.

Bag Type	HDPE plastic bag	Starch polyester blend bag	Paper bag	Polypropylene plastic (PP) bag	Cotton bag
Cost of bag to consumer	10p	10p	30p	55p	£1.50

Explain which bag the supermarket should buy.

In your answer you should explain why you have **not** chosen the other bags.

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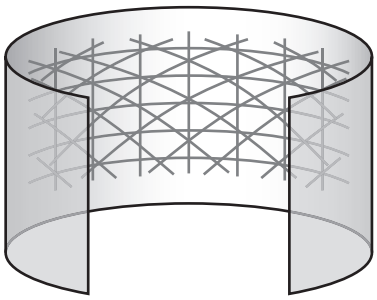
..... **[6]**

(b) Some plastic bottles are made from polyester. The polyester bottles are strong, hard and flexible.

The polymer chains in the polyester bottles are shown in the diagram.



Polymer chains
in three directions

Draw lines to connect each **feature of polyester** with the **property** it results in.

Feature of polyester	**Property**
Polymer chains are held by many intermolecular forces.	Hardness
Polymer chains are long and can move past each other.	Strength
Polymer chains crossing in 3 directions gives resistance to scratching.	Flexibility

[2]

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6 Some students are investigating osmosis in pieces of potato. The table shows their results.

Concentration of sugar solution (mol / dm^3)	Initial mass of the potato (g)	Final mass of the potato (g)	Percentage change in mass (%)
0.0	1.08	1.25	15.7
0.2	1.09	1.13	3.5
0.4	1.17	1.03	–12.0
0.6	1.12	0.85	–24.1
0.8	1.08	0.75	–30.1

(a) Describe the method the students use to obtain these results.

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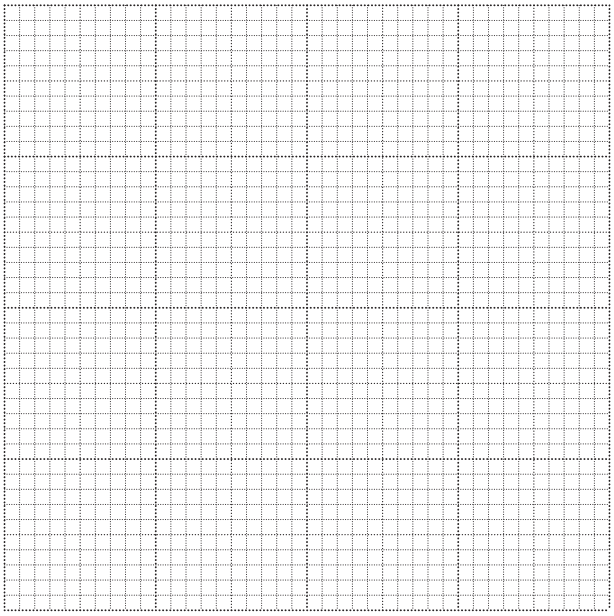
..... **[4]**

(b) **(i)** Plot the students' results on the grid **and** draw a line of best fit.

Use the concentration of sugar solution and percentage change in mass data.



[4]

(ii) The student concludes that the concentration of the potato cells is 0.2 mol / dm^3.

Explain why the student is **wrong**.

Use ideas about osmosis in your answer.

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..... **[3]**

(iii) Describe **two** ways in which the student can determine a more accurate value for the concentration of the potato cells.

1 .....

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2 .....

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[2]

(c) The student puts another piece of potato into a sugar solution of 0.4 mol / dm^3.

The initial mass of the potato is 1.04 g.
The final mass of the potato is 0.90 g.

Calculate the percentage change in mass for this piece of potato.

Give your answer to **2** decimal places.

Percentage change = ... % **[3]**

(d) Plants take in carbon dioxide and water for photosynthesis.

Describe how the carbon dioxide needed for photosynthesis enters the plant.

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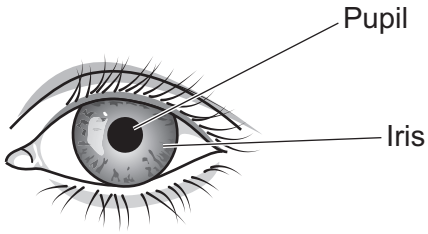
..... **[2]**

7 Some students are studying the pupil reflex. The amount of light entering the eye is controlled by this reflex.

The size of the pupil changes in response to light conditions. When it is dark, the pupil gets bigger, and when it's light, the pupil gets smaller.

The diagram shows the pupil and the iris of the eye. The iris controls the diameter of the pupil. When the iris is large, the pupil is small.



(a) Suggest a method the students can use to measure how long it takes for the pupil reflex response to take place.

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..... **[3]**

(b) **Fig. 7.1** and **Fig. 7.2** shows the diameter of the iris and the pupil before and after the reflex response.

Fig. 7.1 – Before reflex response

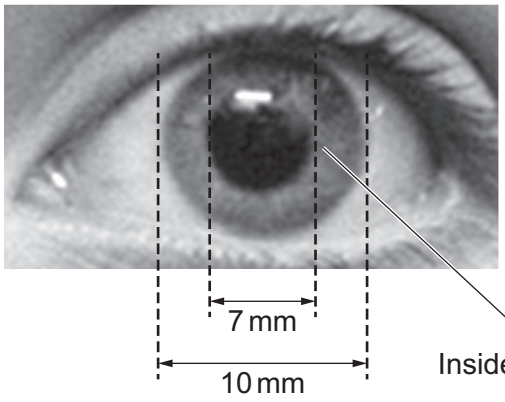
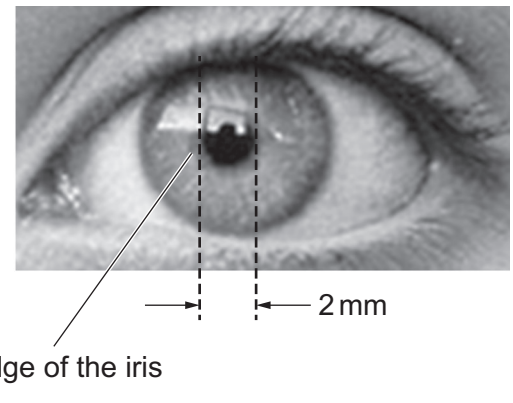


Fig. 7.2 – After reflex response



Calculate the average speed, in **m / s**. of the inside edge of the iris during the reflex response.

Use the equation: average speed = $\frac{\text{distance travelled}}{\text{time taken}}$

The time recorded for the reflex response was 0.25 s.

Average speed = ... m / s **[4]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

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