Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson BTEC Level 1/Level 2 First Award

Centre Number | | | | | | |

Learner Registration Number | | | | | | | | |

Wednesday 5 February 2020

Morning (Time: 1 hour 15 minutes) | Paper Reference **20474E**

Application of Science

Unit 8: Scientific Skills

You must have:
a pencil, a calculator and a ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 3 9 5 3 A 0 1 2 0

Pearson

Answer ALL questions. Write your answers in the spaces provided.

For multiple choice questions put a cross in each correct box ☒ to indicate your answer. If you change your mind, put a line through the box ☒ and then put a cross in another box ☒.

1 A technician prepares some agar plates to grow bacteria.

The agar will be poured into the container shown in Figure 1.

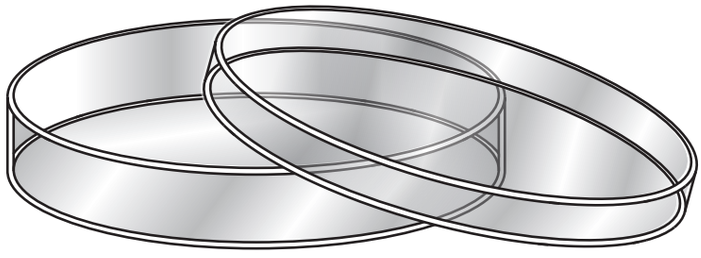

Figure 1

(a) Identify the container in Figure 1.

(1)

☒ **A** Boiling tube

☒ **B** Evaporating basin

☒ **C** Measuring cylinder

☒ **D** Petri dish

(b) The technician puts the agar into bottles and uses steam to sterilise the agar.

(i) State **one** risk to the technician when using steam.

(1)

.....

.....

(ii) The technician should wear personal protective equipment (PPE) to reduce the risk of infection by bacteria.

State **two** pieces of PPE the technician should wear.

(2)

1 .....

2 .....

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(c) The technician must spread the bacteria across the agar.

Figure 2 shows an agar plate and an inoculation loop.

An inoculation loop is used to spread the bacteria.

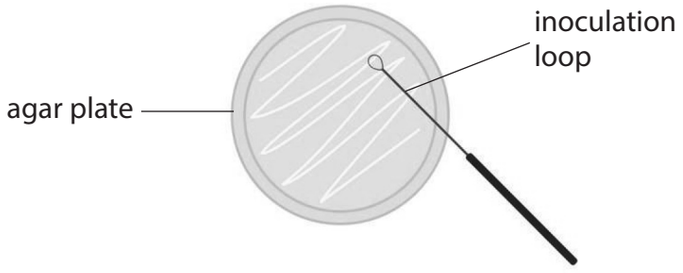


Figure 2

(i) Before using the inoculation loop, the technician heats the loop in a Bunsen burner flame.

Explain why the technician heats the inoculation loop.

(2)

.....

.....

.....

.....

(ii) The technician spreads bacteria on two agar plates.

One agar plate is stored at 20°C and the other agar plate is stored at 40°C.

The technician wants to see how temperature affects the growth of bacteria.

Give **two** factors the technician must keep the same to make this a fair test.

(2)

1 .....

2 .....

(Total for Question 1 = 8 marks)

2 Nappies are used to absorb a baby's urine.

Some nappies contain a substance called hydrogel.

Hydrogel absorbs urine so the baby's skin is kept dry.

A learner wants to investigate how much water different masses of hydrogel can absorb.

Write a method for an experiment to find out how much water can be absorbed by different masses of hydrogel.

Your method should include

- measurements to record
- variables to control.

(6)

(Total for Question 2 = 6 marks)

3 A learner finds some data about different planets in the solar system.

The data is about the average surface temperature measured in kelvin (K) on different planets.

Figure 3 shows the data.

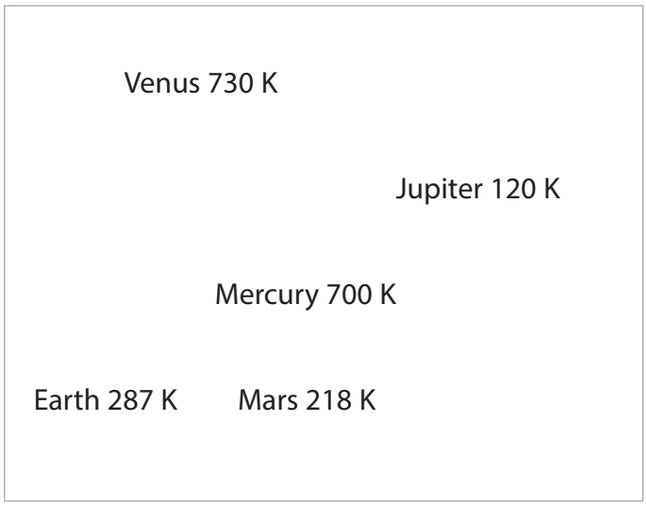


Figure 3

(a) Complete the table using the data in Figure 3.

(3)

(b) The learner finds some information about the speeds at which different planets orbit the Sun.

The data is shown on the graph in Figure 4.

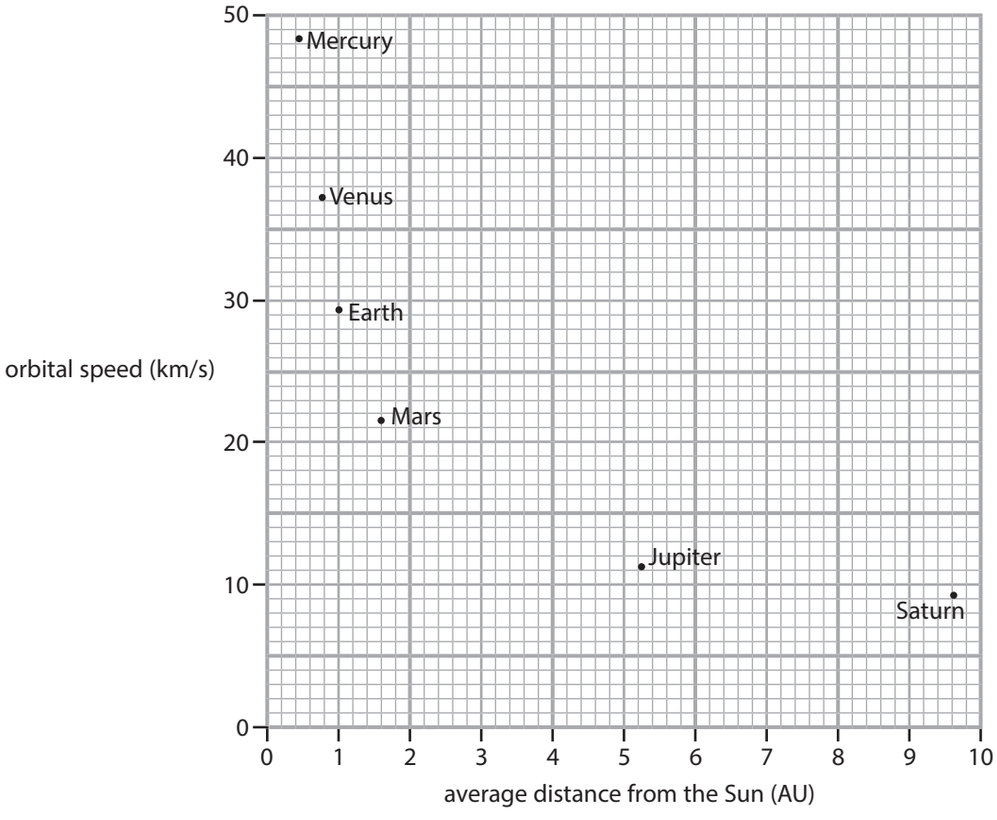


Figure 4

Draw a smooth curve of best fit on this graph.

(1)

(c) Figure 5 shows the approximate distance of different planets from the Sun.

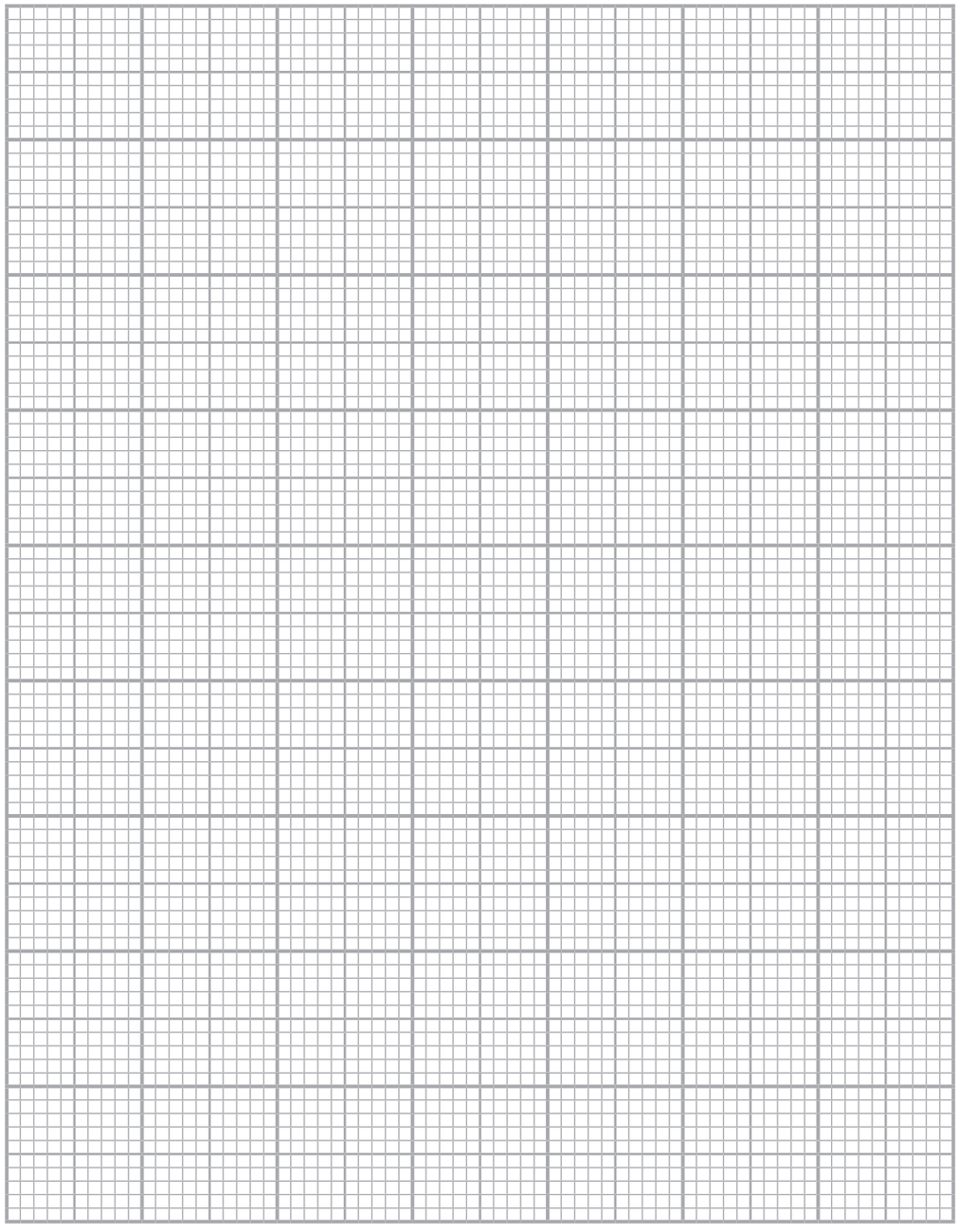
The distances are shown in millions of kilometres.

name of planet	approximate distance from the Sun (millions km)
Mercury	60
Venus	110
Earth	150
Mars	230
Jupiter	780
Saturn	1430

Figure 5

Draw a bar chart of this data on the graph paper.

(6)



(d) Light travels at a speed of 299 800 km/s.

Calculate the time light takes to travel a distance of 1.46×10^8 km.

Use the equation:

distance (km) = speed (km/s) x time (s)

(3)

Give your answer to two significant figures.

Show your working.

time = ... s

(Total for Question 3 = 13 marks)

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QUESTION 4 BEGINS ON THE NEXT PAGE

4 A learner investigates how the volume of alkali added to an acid affects the pH of a solution.

The learner adds 5 cm^3 of alkali solution to an acid and records the pH of the solution.

The learner continues to add 5 cm^3 measures of alkali until 60 cm^3 has been added in total.

The learner records the pH after each 5 cm^3 of alkali solution is added.

Figure 6 shows a graph of the learner's results.

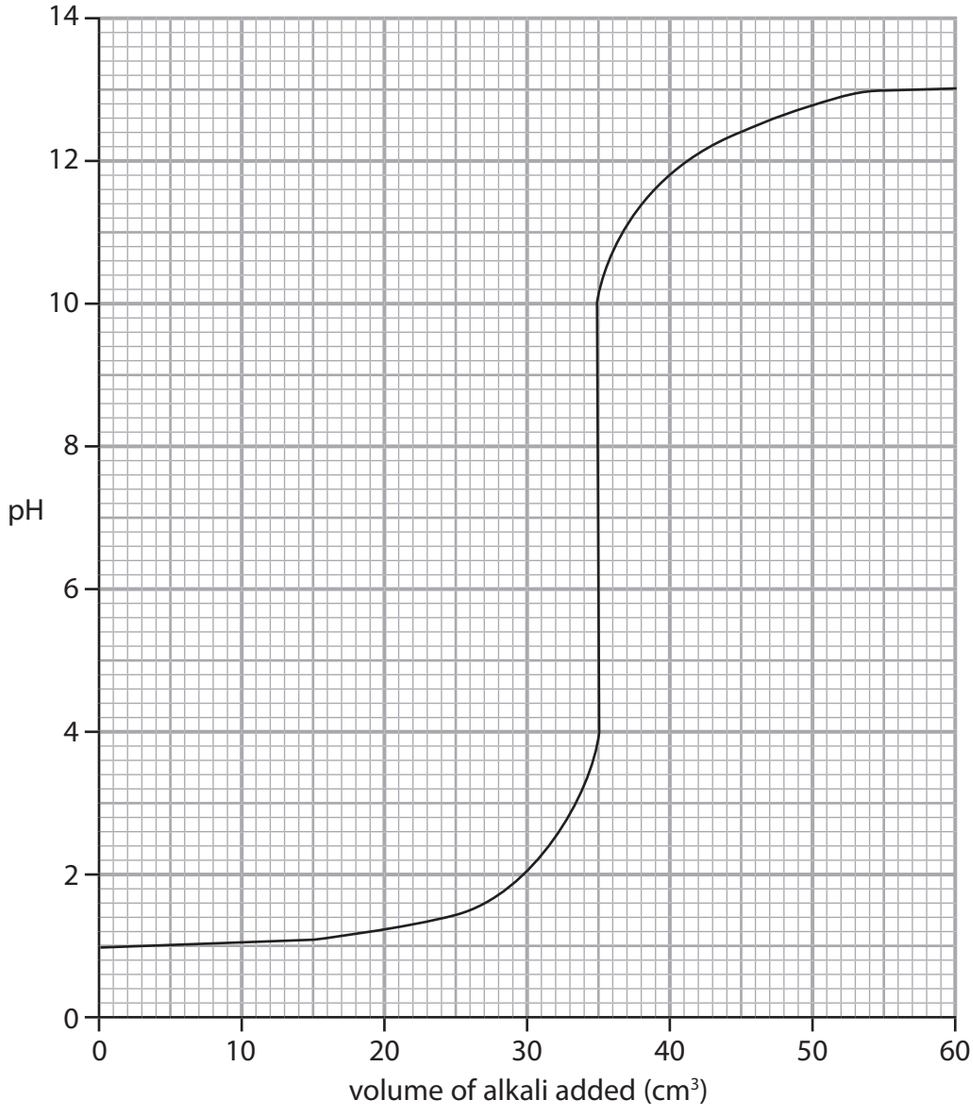

Figure 6

(a) State the volume of alkali added to produce a solution of pH 6.

(1)

.....

(b) Describe the pattern shown in Figure 6.

(3)

(Total for Question 4 = 4 marks)

5 A learner investigates the effect of concentration on the reaction between sodium thiosulfate and acid.

The concentration of sodium thiosulfate is changed by substituting water for some of the sodium thiosulfate.

The learner places a measured volume of sodium thiosulfate into a flask.

10 cm^3 of hydrochloric acid is added to the flask each time and a stopwatch is started immediately.

The flask is placed on a paper cross and the stopwatch is stopped when the cross is not visible.

The time taken for the cross to disappear from view is recorded.

The experiment is repeated three more times for each concentration.

Figure 7 shows how the experiment was set up.

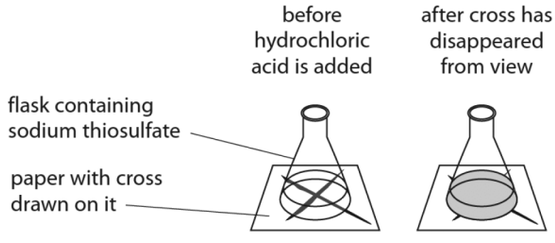

Figure 7

Figure 8 shows the learner's results.

volume of sodium thiosulfate (cm^3)	volume of water (cm^3)	volume of acid (cm^3)	time for cross to disappear (s)			
			trial 1	trial 2	trial 3	trial 4
50	0	10	47.5	51.2	48.2	50.3
40	10	10	64.6	64.1	63.7	64.2
30	20	10	95.0	150.0	96.5	94.2
20	30	10	222.2	219.0	220.8	221.3
10	40	10	1165.6	1168.3	1166.3	1162.5

Figure 8

(a) Calculate the average time taken for the cross to disappear from view when the volume of sodium thiosulfate is 50 cm^3.

(2)

Show your working.

average time taken for cross to disappear from view = ... s

(b) The learner has drawn a ring around an anomaly in Figure 8.

(i) State **two** things that the learner should do about this anomaly.

(2)

1 .....

.....

2 .....

.....

(ii) The time recorded for the anomaly is much greater than for the other trials in the same row.

Explain **two** possible reasons for the anomaly in Figure 8.

(4)

Reason 1 .....

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.....

.....

Reason 2 .....

.....

.....

.....

(Total for Question 5 = 8 marks)

6 A group of learners investigate how the average speed of a toy car moving down a ramp changes as the angle of the ramp changes.

One of the learners suggests that the average speed of the car increases when the angle of the ramp increases.

Figure 9 shows the apparatus that the learners use.

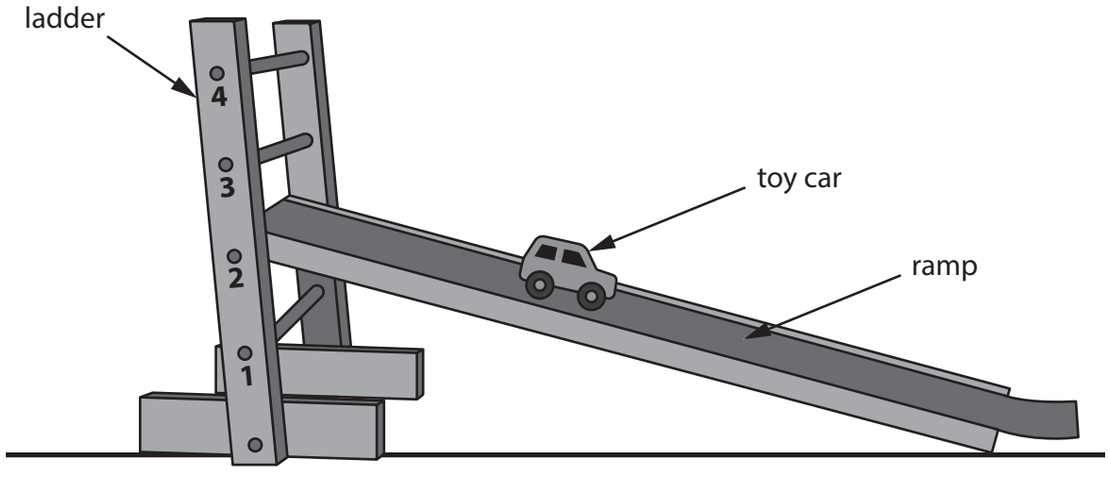


Figure 9

The learners use this method for the investigation.

- place the toy car on the ramp
- measure the distance the car moves
- measure the time the toy car takes to reach the bottom of the ramp
- repeat with the ramp at different heights
- calculate the average speed of the car.

(a) Explain **two** improvements that could be made to the method.

(4)

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(b) The learner finds that when the ramp is placed on step 2 of the ladder the car has an average speed of 10 cm/s.

The learner repeats the experiment with the ramp placed on step 4 of the ladder.

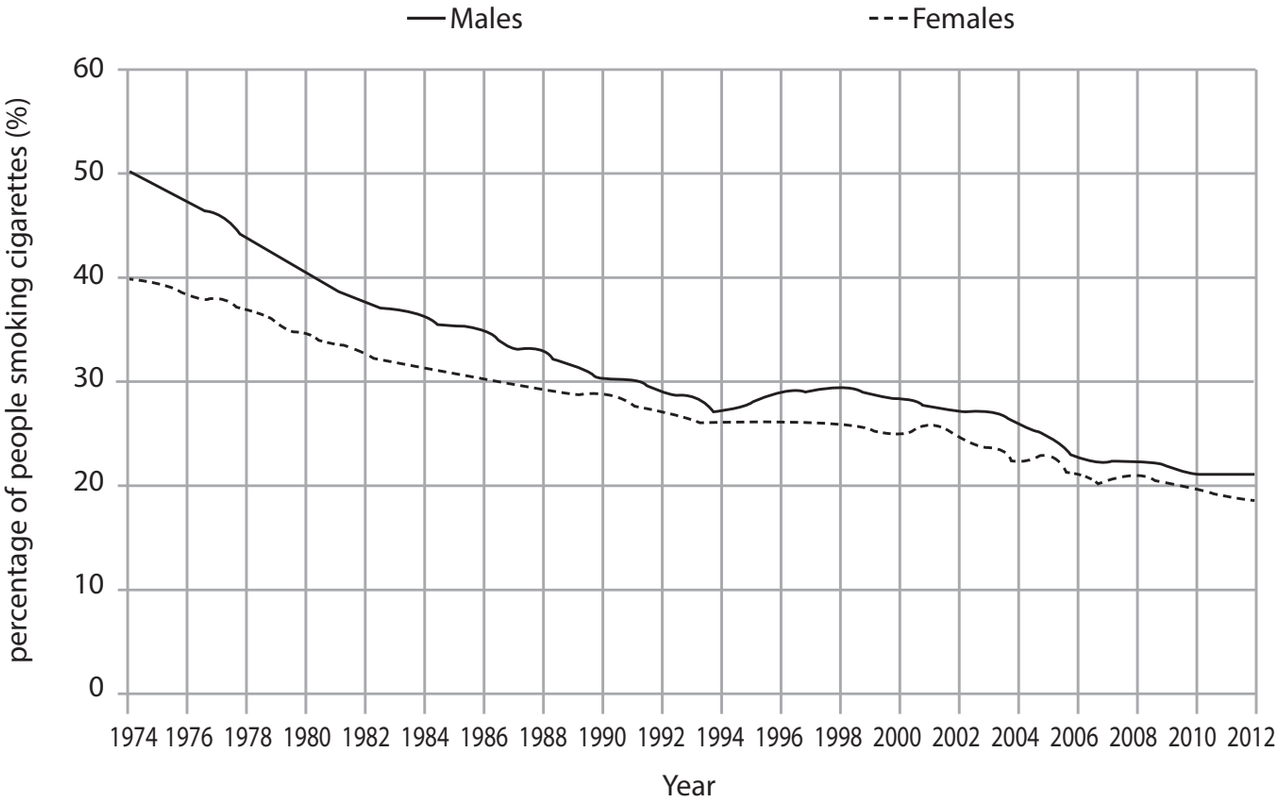
Suggest a value for the average speed of the car when the ramp is placed on step 4 of the ladder.

(1)

.....

(Total for Question 6 = 5 marks)

7 Figure 10 shows a graph a learner found showing the percentage of males and females smoking cigarettes in the UK between 1974 and 2012.



Sourced from https://www.cancerresearchuk.org/health-professional/cancer-statistics/risks/tobacco#heading-Three

Figure 10

The learner makes two conclusions.

Conclusion 1: 'Smoking in males and females has reduced between 1974 and 2012

Conclusion 2: 'Females have always smoked less than males.'

Discuss whether the information in Figure 10 supports the learner's **two** conclusions.

(6)

(Total for Question 7 = 6 marks)

TOTAL FOR PAPER = 50 MARKS

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