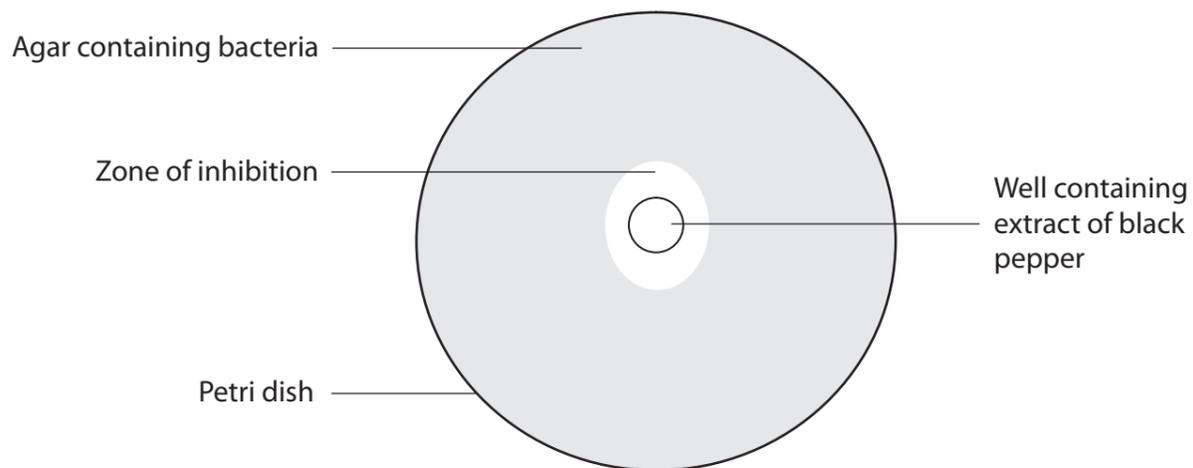


8 An investigation was carried out to extract antimicrobial substances from black pepper.

One extraction method used ethanol. The black pepper was crushed and soaked in the ethanol for 24 hours. The crushed pepper was then removed, leaving an ethanol extract.

A Petri dish containing agar and one species of bacterium (B1) had a cylinder of agar removed to produce a well. The ethanol extract was then placed in the well.

The Petri dish was incubated at 37°C for 24 hours. After incubation, the diameter of the zone of inhibition around the well was measured. This was repeated using Petri dishes with different species of bacteria (B2, B3, B4 and B5).



The investigation was repeated using an extract prepared with hot water in place of ethanol.

(a) (i) Describe how the bacteria should be added to the Petri dish.

(2)

.....

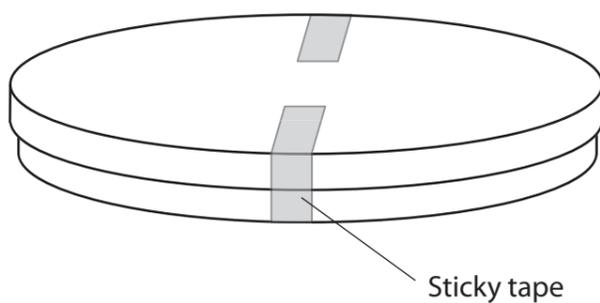
.....

.....

.....



(ii) Before incubation, the lid was secured to the base of the Petri dish as shown in the diagram below.



Explain why the lid was secured in this way.

(2)

.....

.....

.....

.....

.....

.....

(iii) Suggest why an incubation temperature of 37°C should not be used in a school or college laboratory.

(1)

.....

.....

.....



(b) The results of this investigation are shown in the table below.

Species of bacterium	Mean diameter of zone of inhibition / mm	
	Ethanol extract	Hot water extract
B1	27.4	18.2
B2	26.2	16.8
B3	15.0	29.6
B4	25.0	16.4
B5	15.0	29.8
Mean	21.7	22.2

- (i) One student used the data in the table to form the hypothesis that using ethanol was more effective than hot water at extracting antimicrobial substances from crushed black pepper.

Give evidence from the table that supports this hypothesis.

(1)

.....

.....

- (ii) A second student formed the hypothesis that using hot water to extract the antimicrobial substances was more effective than using ethanol.

Give evidence from the table that supports this hypothesis.

(1)

.....

.....



(c) Another investigation was carried out using cold water to extract the antimicrobial substances. The same method was used but only bacterium species B1 was tested.

The table below shows the mean diameter of the zones of inhibition and the ranges of the data.

Mean diameter of zone of inhibition / mm	
Hot water extract	Cold water extract
18.2 ± 1.4	16.4 ± 0.6

(i) A third student stated that some of the results for the hot water extract overlapped with some of the results for the cold water extract.

Suggest what evidence from the table above the student could have used to support this statement.

(2)

.....

.....

.....

.....

.....

.....

(ii) Using the table above, suggest whether the data for the hot or cold water extract were more reliable. Give a reason for your answer.

(2)

.....

.....

.....

.....

.....

.....

**(Total for Question 8 = 11 marks)**

**TOTAL FOR PAPER = 80 MARKS**

