

AQA, OCR, Edexcel

A Level

A Level Biology

Maths For A Level Biology

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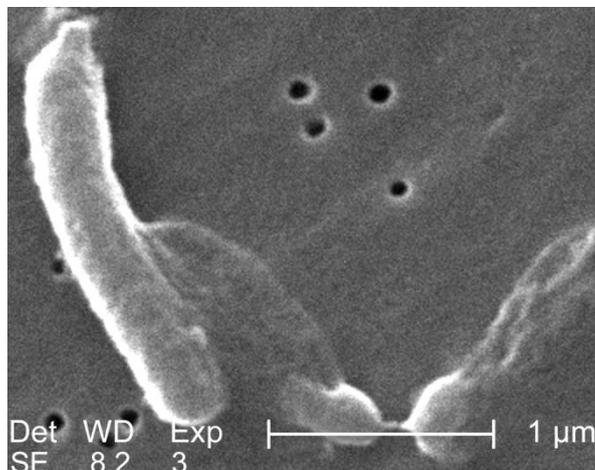
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Total Marks: /31

Maths for A Level Biology

1. The micrograph below shows a bacterial colony. Calculate the magnification of the microscope used?

(2 marks)



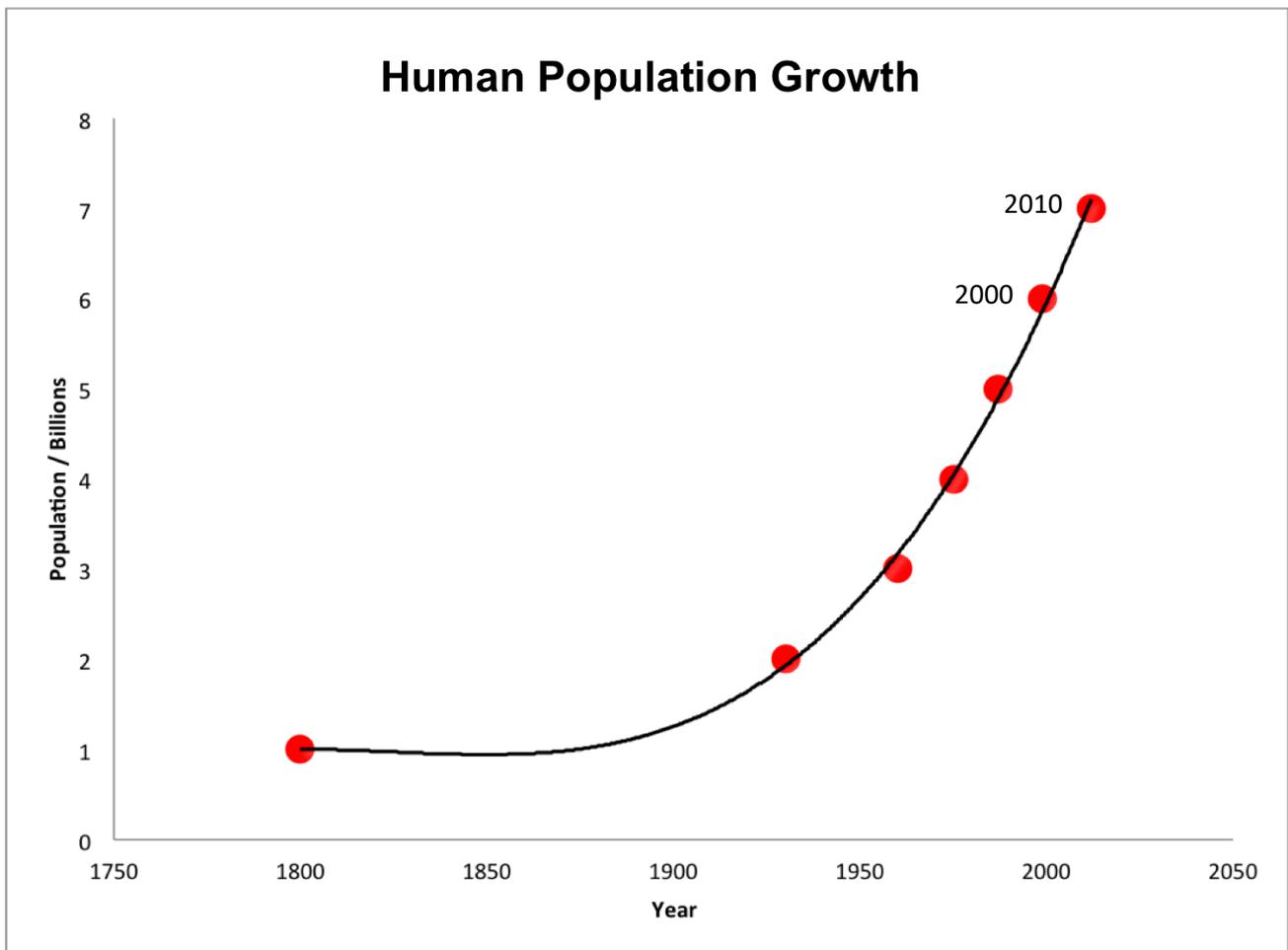
2. An experiment is conducted to understand the effect of osmosis. A potato chip is placed in a strong solution of sugar for different time intervals and its mass is recorded at each time interval.

Time in Solution (Minutes)	Mass (Grams)
0	5
5	7.5
10	10
15	12.5

Estimate the percentage increase in mass of the potato chip after 12.5 minutes

(3 marks)

3. The graph below shows the human population growth.



a. Calculate the average yearly rate of increase in the population between the year 2000 and 2010, which are represented by the last two red dots in the graph above.

(2 Marks)

b. Use the graph above to calculate the rate of population growth in 1900?

(3 marks)

4. The replication rates of two bacteria were analysed. Bacterial strain A was found to replicate every 20 minutes whereas bacterial strain B replicates every 50 minutes.
- a. After 1 hour 40 minutes what will the ratio of A to B be, given that both strains started dividing with the same number of bacteria?

(2 marks)

- b. Out of the 250 bacteria in culture A, 15 of them were antibiotic resistant. What percentage was not antibiotic resistant?

(2 marks)

5. An investigation into cancerous cells was carried out. An infected tissue contains 8×10^5 cells. If 2×10^2 of the cells are cancerous.

- a. Calculate the percentage of healthy cells in the tissue sample? Give your answer to 4 significant figures.

(3 marks)

- b. The size of the infected tissue was measured to be 15mm correct to the nearest mm. Calculate the percentage error in the measurement correct to one decimal place.

(2 marks)

6. Answer the following questions regarding Standard deviation.

a. Calculate the standard deviation of the data set highlighted in the table below. (4 marks)

Item	Mass (g)
A	170
B	600
C	470
D	300
E	430

Standard Deviation Formula:

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

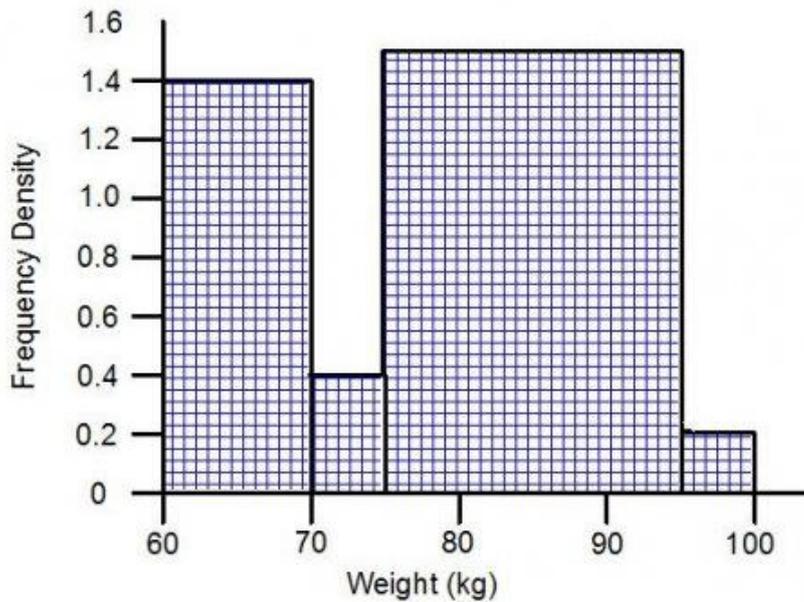
b. Define standard deviation in the context of this question? (2 marks)

7. Answer the following questions regarding conversions of units.

a. A beaker contained 5cm^3 of a solution. Convert the unit to mm^3 .

(1 mark)

b. The histogram below shows the weights of 47 people.



Use the histogram to determine how many people weighed less than 75 kilograms.

(3 marks)

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8. Cystic Fibrosis is a genetic condition inherited in an autosomal recessive manner, the average probability of inheriting Cystic Fibrosis is 0.0015.

a. How many people would you expect to have the disease in a population of 100,000?

(1 mark)

b. A new drug has been developed to treat Cystic Fibrosis. This drug is delivered in a spherical vector called a liposome. If the Liposomes have a diameter of 500nm, calculate their volume. Give your answer correct to the nearest μm .

(3 marks)

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Answers

Question 1

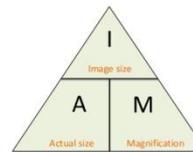
Answer: 30,000

Working Marks

1. scale is 30mm or 3cm.= 30000 μm
2. $30000/1 = 30,000$

Tips

- Memorise and use the formula triangle.



- Always measure in mm and then the conversion to μm is simply multiply by 1000.

Question 2

Answer = 125%

Working marks

1. 11.25 grams
2. $(6.25/5) \times 100$
3. 125%

Tips:

- Percentage increase, decrease, reduction and change can all be calculated using the equation: Percentage change = $(\text{Difference}/\text{Original}) \times 100$.
- Look for patterns in the data, in this question because the increases in mass were consistent between each time interval, you could assume that at 12.5 minutes the mass was 11.25g i.e. half way between 10g and 12.5g.

Question 3

3a. Answer: 0.1-0.16 Billion Yr⁻¹

Working Marks:

1. Change in the population = 1-1.4 billion
2. $1.2/10 = 0.12$

Tips:

- Use the equation for calculating the gradient of a line which is Change in the y axis values/ Change in the x axis Values.
- The units can be Billion Yr⁻¹ or Billion/Yr

3b. Answer: 0.012-0.016 Billion Yr⁻¹

Working Marks

1. Tangent drawn on the graph with values obtained
2. Change in Y/ Change in X shown
3. Answer between 0.012-0.016

Tips

- Draw a line up from 1900 until you hit the curve, then at this point draw a tangent to the curve.
- Calculate the gradient of this tangent in the same way you did for question 3a.

Question 4

4a. Answer: 2:5

Working Marks

1. Strain A replicates 5 times, strain B replicates twice.
2. Ratio 5:2
- 3.

Tips

- Because the number of bacteria in each strain is equal at the beginning you have to focus on how many times each strain will divide during the time given. Convert the time to minutes to make it easier, so 1 hour 40 minutes is 100 minutes, meaning strain A must divide 5 times and strain B twice.

4b. Answer: 94%

Working Marks

1. $250 - 15 = 235$
2. $(235/250) \times 100 = 94\%$

Tips

- This is a standard percentage. There are different ways to calculate a percentage, we would use $(\text{amount}/\text{total}) \times 100$.

Question 5

5a. Answer: 99.98%

Working Marks

1. $8 \times 10^5 - 2 \times 10^2 = 799800$
2. $(799800 / 8 \times 10^5) \times 100 = 99.975$
3. 99.98%.

Tips

- Work out the number of healthy cells first.
- Calculate your percentage, then for 4 significant figures count the first 4 numbers along and look at the 5th number to decide whether to round up or keep it the same. In this example the 5 rounds the 7 up to an 8.

5b. Answer:

- $(0.5/15)$
- $(0.5/15) \times 100 = 3.3\%$

Tips

- The error will always be whatever the unit used is divided by 2 e.g. if it is correct to 1mm, then the error could be 0.5 either side of the measured value.
- Use the percentage error formula: $(\text{error}/\text{measurement}) \times 100$.

Question 6

6a. Answer: How much members of a group within a data set differ from the mean value of the group.

6b. Answer: 164.7

Working Marks:

1. Mean = 394
2. $\sum(x - \bar{x})^2 = 108520$
3. $108520/4 = 27310$
4. $\sqrt{27310} = 164.7$

Tips

- Calculate the mean then add another column to the table for $(x - \bar{x})^2$
- $(x - \bar{x})^2$ Means the value in the table - the mean, then the answer squared e.g. for Item A $170-394 = -224$, $-224^2 = 50176$. Complete this for each item in the table and then add them all together to give you $\sum(x - \bar{x})^2$.
- n is the number in the sample.
- Sub in your values into the equation to get the final answer.

Question 7

7a. Answer: 5000mm³

Tips

- To convert from cm³ to mm³ simply multiply by 1000. To convert mm³ to cm³ you would divide by 1000.

7b. Answer: 16

Working Marks

1. 60-70kg = 14 people
2. 70-75kg = 2 people
3. 16 people

Tips

- 'How many' means frequency and the frequency is the area of each bar.
- To calculate the area, multiple the difference on your X axis by the Y axis value e.g. 60-70kg is $10 \times 1.4 = 14$ people.

Question 8

8a. Answer: 150

Working Marks

1. $0.0015 \times 100,000 = 150$

8b. Answer: 65450 μ m

Working Marks

1. Volume = $\frac{4}{3} \pi r^3 = \frac{4}{3} \pi 250^3$

2. $65449846.95 \text{ nm} / 1000$

3. $65450 \mu\text{m}$

Tips

- Radius is half the diameter = 250nm
- Memorise $\frac{4}{3} \pi r^3$
- To get from nm to μm divide by 1000. Practise these conversion and make sure you are confident with them.

Final Tips for Biology for Maths

- Make sure you have gone through the specification for your exam board and that you are comfortable with all of the calculations stated.
- Make sure you learn when to use Chi Squared, Spearman's Rank and the Student's t-test.
- Memorise all of the formula's you need to know including the volumes and surface areas of regular shapes such as the sphere and cylinder.
- Practise all of the calculations many times until you are confident.
- Where you are struggling ask your teacher or tutor for help.