Arithmetic and Numerical Computation (Maths Skills MS0): Edexcel SNAB A Level Biology Exam Questions

20 questions · 41 marks · about 49 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 1 · June 2025 · Q4(a) · 3 marks

4 Vitamin C can be found in many fruits and vegetables, including broccoli.

The table shows the vitamin C content of two types of broccoli.

Type of broccoli	Mean vitamin C content / μg per cm^3 extract
Green broccoli	30
Purple-sprouting broccoli	25

(a) It is recommended that a pregnant woman consumes 85 mg of vitamin C a day.

Calculate the volume of purple-sprouting broccoli extract that would provide 85 mg of vitamin C.

Give your answer in dm^3.

(3)

..... dm^3

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(b) During hibernation, the core body temperature of an arctic ground squirrel can fall from 37 °C to −3 °C.

The table shows the effect of air temperature on the metabolic rate in the arctic ground squirrel.

Air temperature / °C	Metabolic rate / cm^3 oxygen g^{-1} $hour^{-1}$
−16	0.18
−8	0.08
−4	0.04
0	0.02
4	0.02
8	0.02
12	0.02

(i) Calculate the change in metabolic rate for an arctic ground squirrel, with a body mass of 850g, as the air temperature increases from −16 °C to 4 °C.

Give your answer in dm^3 oxygen day^{-1}.

(3)

..... dm^3 oxygen day^{-1}

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Question 3 · A level Paper 2 · June 2022 · Q8(c) · 2 marks

(c) In one study, measurements were taken of a single Golgi apparatus.

The measurements were:

- total number of cisternae = 6
- height of each cisterna = 15 nm
- distance between adjacent cisterna = 25 nm

Calculate the total height of the stack of cisternae in this Golgi apparatus.

Give your answer in micrometres.

(2)

..... μm

Question 4 · information from earlier in the question

(b) Mitochondria move along the length of the axon in the cytoplasm.

The axon cytoplasm contains actin along its length. There is myosin on the surface of the mitochondria.

Question 4 · A level Paper 2 · June 2023 · Q8(b)(ii) · 2 marks

(ii) In an axon that is 9 cm long, the speed of mitochondrial movement was recorded as 0.5 $\mu m\, s^{-1}$.

Calculate the time it would take a mitochondrion to move the length of this axon. Give your answer in hours.

(2)

..... hours

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Question 5 · A level Paper 2 · June 2024 · Q9(a)(i) · 2 marks

9 Many organisms that live in the sea produce poisonous chemicals called neurotoxins.

(a) Pufferfish produce a neurotoxin called tetrodotoxin (TTX). This is believed to be a defence against predators.

An investigation studied TTX from five individuals of the same species of pufferfish.

(i) The investigation showed that the distribution of TTX within the pufferfish varies, as shown in the table.

Tissue	Mean concentration of TTX / mass per gram of tissue
Liver	0.046 mg
Muscle	2.000 µg
Gonad (ovary/testis)	0.365 mg
Skin	25.000 µg

Calculate the percentage difference in mean concentration of TTX in pufferfish liver tissue compared with skin tissue.

(2)

..... %

Question 6 · AS Paper 2 · November 2021 · Q2(a) · 2 marks

2 Plant-based products provide a sustainable alternative to oil-based plastics.

In a single year, over 7600 million single-use plastic bags were given to customers by supermarkets in England.

The mean mass of each bag was 5.5 g.

(a) Calculate the total mass in kilograms of plastic bags given out to customers.

Give your answer in standard form.

(2)

Answer ..... kg

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Question 7 · A level Paper 2 · June 2024 · Q4(a) · 1 mark

4 Mutations are rare changes in the sequence of bases in DNA.

(a) Each body cell contains 6 billion base pairs.

The mutation rate for human cells has been estimated to be 2.5×10^{-8} mutations per base pair per cell cycle.

Calculate how many mutations could happen per body cell in one cell cycle.

(1)

Answer .....

Question 8 · information from earlier in the question

10 Doctors believe that about 28% of the adult population in the UK are obese. This can lead to a number of health-related conditions including coronary heart disease.

(a) Food packaging often contains nutritional information.

The table shows some nutritional information about chocolate biscuits.

Component	Four biscuits contain	Percentage of total recommended daily intake (%)	Recommended daily intake (RI)
Energy content	700 kJ	8	
Fats	7.6 g	11	70 g
of which are saturated	4.7 g	23	20 g
Sugars	20.3 g	23	90 g

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Question 8 · A level Paper 2 · June 2023 · Q10(a)(iii) · 2 marks

(iii) The energy content for four biscuits and the percentage of total recommended daily intake can be used to calculate a recommended daily intake.

Calculate the daily recommended intake of energy from the data in the table. Give your answer in joules and in standard form.

(2)

.....

Question 9 · AS Paper 1 · June 2016 · Q6(d)(i) · 1 mark

(d) Starch contains two different molecules, amylose and amylopectin. The percentage of each molecule found in starch varies depending on its source.

The effect of amylose content on the hydrolysis of starch from different sources by enzymes was investigated.

Source of starch	Amylose content (%)	Percentage of starch hydrolysed after 4 hours (%)
Cassava	20.0	51.9
Peruvian carrot	18.7	54.2
Potato	28.9	39.6
Yellow maize	35.8	37.5

(i) Calculate the ratio of amylose to amylopectin in cassava. Give your answer in simplest form.

(1)

Answer .....

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Question 10 · AS Paper 1 · June 2019 · Q2(a)(i) · 2 marks

2 Different compounds have been given different sweetness values by comparing them with the sweetness of sucrose.

The table shows some of these compounds and their sweetness values.

Name	Type of compound	Sweetness value / a.u.
Maltose	Disaccharide	0.39
Glucose	Monosaccharide	0.77
Sucrose	Disaccharide	1.00
Sucralose	Modified disaccharide	600.00
Thaumatin	Protein	2000.00

(a) (i) Lactose is found in milk. The sweetness value of lactose is 0.16.

Calculate the ratio of the sweetness value of sucrose to lactose.

(2)

Answer .....

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Question 11 · A level Paper 2 · June 2017 · Q9(a)(i) · 2 marks

9 Emphysema is a condition that causes changes to the tissues in the lungs.

In an investigation, the surface area for gas exchange and the volume of the lungs of three groups of individuals were determined. The results are shown in the table.

Measurement	Individuals without emphysema	Individuals with mild emphysema	Individuals with severe emphysema
Mean surface area for gas exchange / m^2	118 ± 11	97 ± 8	30 ± 5
Mean total lung volume / cm^3	4772 ± 223	6232 ± 410	6725 ± 384
Mean surface area for gas exchange : volume ratio	247.3 : 1		44.6 : 1

(a) (i) Calculate the mean surface area for gas exchange : volume ratio for individuals with mild emphysema.

(2)

Answer .....

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Question 12 · AS Paper 2 · June 2016 · Q3(b)(i) · 2 marks

(b) The concentrations of some inorganic ions were measured in soil and in plants.

The table shows the concentration of nitrate ions in the soil and in different parts of a plant.

Site	Nitrate ion concentration / ppm
leaf	250
leaf stalk	990
stem	1200
root	2100
soil	29

(i) Calculate the percentage decrease in nitrate ion concentration from the root to the leaf.

(2)

Answer .....

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Question 13 · AS Paper 1 · June 2019 · Q4(a) · 2 marks

4 Some human babies are fed on breast milk.

The composition of breast milk changes throughout a feed. The milk at the start of a feed differs from the milk at the end of a feed.

The table shows how the nutrient proportions of breast milk change throughout a feed.

Stage of feeding	Mass of nutrient / g per 100 cm^3 of milk		
	Carbohydrate	Lipid	Protein
Start	6.6	1.8	0.6
End	6.5	7.5	0.6

(a) Calculate the percentage change in lipid during this feed.

(2)

Answer ..... %

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Question 14 · information from earlier in the question

8 The photograph shows a ghost shrimp that lives in fresh water.



© Nicholas Toh/Alamy Stock Photo

The effect of caffeine concentration on the heart rate of ghost shrimps was investigated.

A shrimp was placed in a caffeine solution and observed using a microscope.

The number of heartbeats in one minute was counted and the heart rate was recorded.

This was repeated for other concentrations of caffeine solution.

The investigation was repeated using two more ghost shrimps.

The table shows the results of this investigation.

Concentration of caffeine / mg cm^{-3}	Heart rate / beats min^{-1}		
	Shrimp 1	Shrimp 2	Shrimp 3
3	272	298	304
7	268	284	298
10	260	270	266
13	152	242	292

Question 14 · AS Paper 1 · November 2021 · Q8(b)(i) · 2 marks

(b) (i) Calculate the percentage change in the heart rate of shrimp 2 when the caffeine concentration of 10 mg cm^{-3} was replaced with 13 mg cm^{-3}.

Give your answer to one decimal place.

(2)

Answer ..... %

Questions, mark schemes and examiners' report extracts © Pearson Education Ltd.

Question 15 · A level Paper 1 · June 2024 · Q8(b)(i) · 2 marks

(b) In most mammals, the production of lactase enzyme decreases when the offspring stop feeding on milk.

In Europe, a single mutation resulted in the continued production of lactase enzyme by children and adults.

The study recorded changes in the frequency of this mutation over the past 4000 years.

Time, years ago	Frequency of mutation allowing lactase production into adulthood	
	UK	Central Europe
4000	0.096	0.079
3000	0.280	0.093
2000	0.680	0.250
1000	0.770	0.590
0 (Present)	0.740	0.440

(i) The frequency of this mutation in Central Europe has increased by 457% in the last 4000 years.

Calculate the percentage increase in the frequency of this mutation in the UK in the last 4000 years.

(2)

.....

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10 Some plants are adapted to grow in shady conditions.

A study was carried out to compare the effect of growing in different light intensities on rates of photosynthesis of plants.

The plants are rated for levels of shade tolerance.

Plant seedlings of nine species were grown in either 25% or 5% of full sunlight. All other abiotic factors were controlled.

These seedlings were grown for six weeks and then exposed to full sunlight for 15 minutes. The rate of photosynthesis was measured during the exposure to full light.

The table shows the results of this investigation for four species of plant.

Species	Shade tolerance	Rate of photosynthesis / a.u.	
		Seedlings grown in 25% of full sunlight	Seedlings grown in 5% of full sunlight
A	Intolerant	410	415
B	Intermediate	300	275
C	Tolerant	180	210
D	Very tolerant	150	215

(a) (i) Determine which species had the greatest percentage change in rate of photosynthesis when grown in lower light intensities.

(2)

Answer .....

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Question 17 · A level Paper 1 · November 2021 · Q10(a) · 2 marks

10 Anthropogenic climate change is linked to an increase in carbon dioxide in the atmosphere.

(a) The World Meteorological Association recorded carbon dioxide levels of 405 ppm in 2017.

This is an increase of 46% since 1817.

Calculate the level of carbon dioxide in 1817.

(2)

..... ppm

Question 18 · information from earlier in the question

9 Emphysema is a condition that causes changes to the tissues in the lungs.

In an investigation, the surface area for gas exchange and the volume of the lungs of three groups of individuals were determined. The results are shown in the table.

Measurement	Individuals without emphysema	Individuals with mild emphysema	Individuals with severe emphysema
Mean surface area for gas exchange / m^2	118 ± 11	97 ± 8	30 ± 5
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Mean surface area for gas exchange : volume ratio	247.3 : 1		44.6 : 1

(b) Fick's law of diffusion can be used to calculate a value for the effectiveness of the uptake of oxygen by the lungs.

This value can be calculated using the equation

$$\text{value} = \frac{\text{surface area} \times \text{concentration difference}}{\text{diffusion distance}}$$

The diffusion distance in alveoli is 0.5 μm.

The mean oxygen concentration in alveoli is 14 kPa and in the capillaries is 5 kPa.

The calculated value for healthy individuals is 2124.

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Question 18 · A level Paper 2 · June 2017 · Q9(b)(ii) · 2 marks

(ii) Calculate the percentage difference between the value for individuals with severe emphysema and the value for individuals without emphysema.

(2)

Answer .....

Question 19 · A level Paper 2 · June 2024 · Q7(c)(ii) · 3 marks

(ii) Some people do not have full colour vision and are described as being colour blind. Colour blindness is a recessive condition.

An investigation was carried out to discover the number of male and female people who are colour blind, in a sample of the UK population.

It was found that 4.5% of the sample were colour blind as shown in the table.

Type of colour blindness	Number of females	Number of males
Blue	1	2
Green	10	91
Red	2	25

The percentage of males in the whole sample was 55%.

Calculate the number of males in the whole sample who have full colour vision.

(3)

Answer .....

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Question 20 · A level Paper 3 · June 2018 · Q1(a)(ii) · 2 marks

(ii) One PCR cycle takes two minutes.

Show that the quantity of DNA would have been amplified over one million times after 40 minutes.

(2)

.....

.....

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Mark schemes

Question 1 · AS Paper 1 · June 2025 · Q4(a) · 3 marks

Question Number	Answer
4(a)	An answer that makes reference to the following: • correct conversion of units of mass for vitamin C (1) • correct calculation of volume of extract (1) • correct calculation of volume of extract in dm3 (1)

Additional Guidance	Mark
Example of calculation 85mg = 85 000 µg or 25 µg = 0.025mg 85000÷25 OR 85÷ 0.025 = 3400 cm^3 3400÷1000 = 3.4 dm^3 Correct answer without working gains full marks	**(3)**

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Question 2 · A level Paper 2 · June 2018 · Q7(b)(i) · 3 marks

Question Number	Answer
7(b)(i)	• change in metabolic rate calculated for the ground squirrel (1) • difference calculated for one day (1) • value correctly converted from cm^3 to dm^3 (1)

Additional Guidance	Mark
<u>Example of calculation</u> 0.18 at -16 ºC and 0.02 at 4 ºC =0.16 0.16 x 850 = 136 136 x 24 = 3264 3.264 / 3.26 / 3.3 Correct answer with no working gains full marks ALLOW 2 marks for 0.136 (if not calculated for one day)	**(3)**

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Question 3 · A level Paper 2 · June 2022 · Q8(c) · 2 marks

8(c)

- height of the six cisternae and distance between the six cisternae found (1)
- correct addition and conversion to micrometres (1)

Example of calculation
(6 x 15) = 90
plus (5 x 25) = 125

0.215 (µm)

215 gains one mark

(2)

Correct answer with no working gains full marks.

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Question 4 · A level Paper 2 · June 2023 · Q8(b)(ii) · 2 marks

Question Number	Answer
8(b)(ii)	• calculation of time to travel 9cm in seconds (1) • answer in hours (1)

Additional Guidance	Mark
Example of calculation 9cm = 90 000 μm ÷ 0.5 = 180 000 seconds Divided by 3 600 gives 50 hours ALLOW 1 mark for 0.5, 5 or 500 hours Correct answer with no working gains full marks	[2]

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Question 5 · A level Paper 2 · June 2024 · Q9(a)(i) · 2 marks

Question Number	Answer
9(a)(i)	• correct conversion to same units – either mg or μg (1) • correct calculation of percentage difference (1)

Additional Guidance	Mark
Example of calculation 0.046 to 46 OR 25 to 0.025 84% ALLOW 46 /45.7 / 45.65% ALLOW 59 / 59.2 /59.15% Correct answer with no working gains full marks	**2**

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Question 6 · AS Paper 2 · November 2021 · Q2(a) · 2 marks

Question Number	Answer
2 (a)	• number of bags × mass in kilograms (1) • correct answer given in standard form (1)

Additional guidance	Mark
Example of calculation $(7.6 \times 10^9) \times 0.0055$ 4.18×10^7 Correct answer with no working gains full marks	**(2)**

Question 7 · A level Paper 2 · June 2024 · Q4(a) · 1 mark

Question Number	Answer	Additional Guidance	Mark
4(a)	• correct calculation (1)	$(2.5 \times 10^{-8}) \times (6 \times 10^9) =$ 150 OR 1.5×10^2	**1**

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Question 8 · A level Paper 2 · June 2023 · Q10(a)(iii) · 2 marks

Question Number	Answer
10(a)(iii)	• calculate the RI using the biscuit data (1) • answer in standard form (1)

Additional Guidance	Mark
Example of calculation 700 x (100 ÷ 8) = 8 750 KJ or 8 750 000 (J) 8.75×10^6 (J) Correct answer with no working gains full marks	[2]

Question 9 · AS Paper 1 · June 2016 · Q6(d)(i) · 1 mark

Question Number	Answer	Additional Guidance	Mark
6(d)(i)	• correct answer (1)	Example of calculation 100 – 20 = 80 20 : 80 = 1 : 4 **1 : 4** Do not allow any reference to percentages	(1)

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Number	Answer
2(a)(i)	• numbers inserted into equation correctly (1) • correct ratio shown (1)

Additional Guidance	Mark
<u>Example of calculation</u> 1÷0.16 = 6.25:1 ALLOW 25:4 or 12.5:2 1:6.25 gains one mark Correct answer with no working gains full marks	**(2)**

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Question 11 · A level Paper 2 · June 2017 · Q9(a)(i) · 2 marks

Question number	Answer
9(a)(i)	• conversion of surface area from m^2 to cm^2 (1) • correctly dividing surface area by volume to determine ratio (1)

Additional guidance	Mark
Example of Calculation: 97 x 10000 = 970 000 divided by lung volume of 6232 Correct ratio of **155.6 : 1** (ALLOW 155.65 :1) ALLOW one mark only for **0.0155 : 1 / 0.156 : 1 / 155.6** Correct answer with no working gains full marks	(2)

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Question 12 · AS Paper 2 · June 2016 · Q3(b)(i) · 2 marks

Question Number	Answer
3(b)(i)	• correct calculation of the difference in concentration (1) • correct calculation of the percentage (1)

Additional Guidance	Mark
Example of calculation 2100 – 250 = 1850 1850 ÷ 2100 x 100 = 88% ALLOW 88.1% / 88.10% Answer should be given to no more than 2dp Correct answer with no working gains full marks	**(2)**

Question 13 · AS Paper 1 · June 2019 · Q4(a) · 2 marks

Question Number	Answer
4(a)	• correct calculation of change in lipid content (1) • correct calculation of percentage change (1)

Additional Guidance	Mark
Example of calculation 7.5-1.8(=5.7) / 5.7 (5.7÷1.8 × 100)= 316.67 / 316.7 / 317 (%)	**(2)**

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Question 14 · AS Paper 1 · November 2021 · Q8(b)(i) · 2 marks

Question Number	Answer
8 (b)(i)	• correct calculation of percentage change in heart rate (1) • correct calculation of percentage change given to one decimal place and with correct unit (1)

Additional Guidance	Mark
Example of calculation $\frac{270-242}{270} \times 100 = 10.37$ (-)10.4%	(2)

Question 15 · A level Paper 1 · June 2024 · Q8(b)(i) · 2 marks

Question Number	Answer
8(b)(i)	• difference in frequency of mutation calculated from figures in table (1) • percentage increase correctly calculated (1)

Additional guidance	Mark
Example of calculation 0.740 – 0.096 = 0.644 (0.644 ÷ 0.096) x 100 670.83 / 670.8 / 671 (%) Correct answer with no working gains full marks	(2)

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Question 16 · A level Paper 1 · June 2022 · Q10(a)(i) · 2 marks

Question Number	Answer
10(a)(i)	An answer that makes reference to the following • species D (1) • correct calculation of percentage change as {43.3/ 43} % (1)

Additional guidance	Mark
Example of calculation (215-150) ÷150 x 100	(2)

Question 17 · A level Paper 1 · November 2021 · Q10(a) · 2 marks

Question Number	Answer
10 (a)	An answer that makes reference to • correct method for calculation the change in value (1) • correct answer (1)

Additional guidance	Mark
Example of calculation 405 ÷ 1.46 277.4 (ppm) ALLOW 277 Correct answer without working gains full marks	**(2)**

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Question 18 · A level Paper 2 · June 2017 · Q9(b)(ii) · 2 marks

9(b)(ii)	• calculation of the difference using the value from (b)(i) (1) • correct answer (1)

Example of calculation: 2124 – 540 (= 1584) 1584/ 2124 x 100 = 74.6% or 75% **ECF** full marks if calculated correctly for value other than 540 Correct answer with no working gains full marks	(2)

Question 19 · A level Paper 2 · June 2024 · Q7(c)(ii) · 3 marks

Question Number	Answer
7(c)(ii)	• correct calculation of population size (1) • calculation of number of males in the sample (1) • number of males not colour blind (1)

Additional Guidance	Mark
Example of calculation 131 ÷ 0.045 = 2911 2911 x 0.55 = 1601 1601 - 118 = 1483 Correct answer with no working gains full marks	**3**

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Question 20 · A level Paper 3 · June 2018 · Q1(a)(ii) · 2 marks

Question Number	Answer
1(a)(ii)	• calculation correct (1) • correct answer provided (1)

Additional Guidance	Mark
<u>Example of calculation</u> 2^{20} 1 048 576 (> 1 000 000) or 1.05×10^6 Correct answer without working scores full marks	**(2)**

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