

**2019 AUSTRALIAN SCIENCE OLYMPIAD EXAM
BIOLOGY**

TO BE COMPLETED BY THE STUDENT. USE CAPITAL LETTERS.

First Name: **Last Name:**

Date of Birth:/...../.....

☐ Male ☐ Female ☐ Unspecified **Year 10** ☐ **Year 11** ☐ **Other:**

Name of School: **State:**

Examiners Use Only:

2019 AUSTRALIAN SCIENCE OLYMPIAD EXAM

BIOLOGY

Time Allowed

Reading Time: 10 minutes

Examination Time: 120 minutes

INSTRUCTIONS

- *Attempt all questions in ALL sections of this paper.*
- Permitted materials: non-programmable, non-graphical calculator, pens, pencils, erasers and a ruler.
- Answer all questions on the MULTIPLE CHOICE ANSWER SHEET PROVIDED. Use a pencil.
- Marks will not be deducted for incorrect answers.

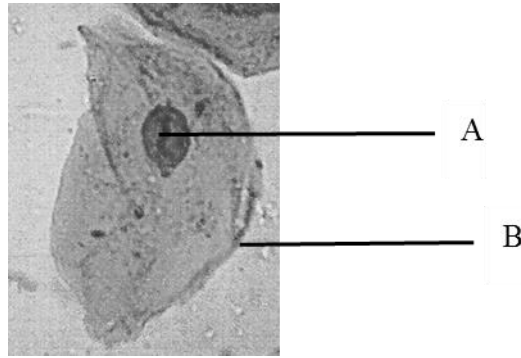
MARKS

- 1 mark for each question
- Total marks for the paper 70 marks

Integrity of Competition

If there is evidence of collusion or other academic dishonesty, students will be disqualified. Markers' decisions are final.

Questions 1 – 3 relate to the following image of a cell.

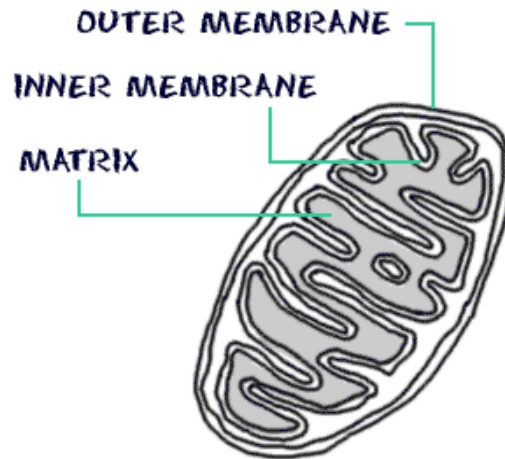


1. What type of cell is depicted in the above figure?
 - a. red blood cell
 - b. prokaryotic cell
 - c. plant cell
 - d. eukaryotic cell

2. What does the organelle labelled A produce when functioning normally in a cell?
 - a. protein
 - b. mRNA
 - c. ATP
 - d. endoplasmic reticulum

3. What does the label B point out?
 - a. cell membrane
 - b. cell wall
 - c. endoplasmic reticulum
 - d. mRNA

4. The cell organelle pictured below is present in all cells and is crucial to cellular respiration.



What organelle plays a similar role but is found only in certain types of cells?

- a. Mitochondria
 - b. Golgi apparatus
 - c. Chloroplast
 - d. Rough endoplasmic reticulum
5. What is the term that best describes the net movement of uncharged molecules from an area of low concentration to an area of high concentration?
- a. diffusion
 - b. active transport
 - c. passive transport
 - d. osmosis
6. Diffusion is:
- a. the spontaneous movement of molecules through a selectively permeable membrane
 - b. driven by a gradient in the volume of water
 - c. the net movement of molecules from a region of higher concentration to a region of lower concentration
 - d. the net movement of molecules from a region of lower concentration to a region of higher concentration
7. A solution that has a lower concentration of solute than another solution is called?

- a. hypertonic
 - b. hypotonic
 - c. isotonic
 - d. isoneutral
8. Which of the pH values listed below represents the strongest acid?
- a. 2
 - b. 4
 - c. 7
 - d. 15
9. DNA replication is semi conservative. This statement means that:
- a. each replicated strand of DNA is made of a quarter the original DNA and three quarters new DNA from free nucleotides
 - b. each replicated strand of DNA is made of half original DNA and half new DNA from free nucleotides
 - c. the nucleotides are moved from the old strand to the new strand
 - d. each strand of DNA has 50% new nucleotides
10. DNA is a polymer made of nucleotide monomers. Each nucleotide is composed of phosphate, a deoxyribose sugar and a nitrogenous base.
- If a bacterium composed of nitrogen 14 was grown in culture that contained nitrogen 16, the newly synthesised DNA would weigh:
- a. more than the original bacterium DNA
 - b. less than the original bacterium
 - c. the same as the original bacterium DNA
 - d. it would be unable to be weighed

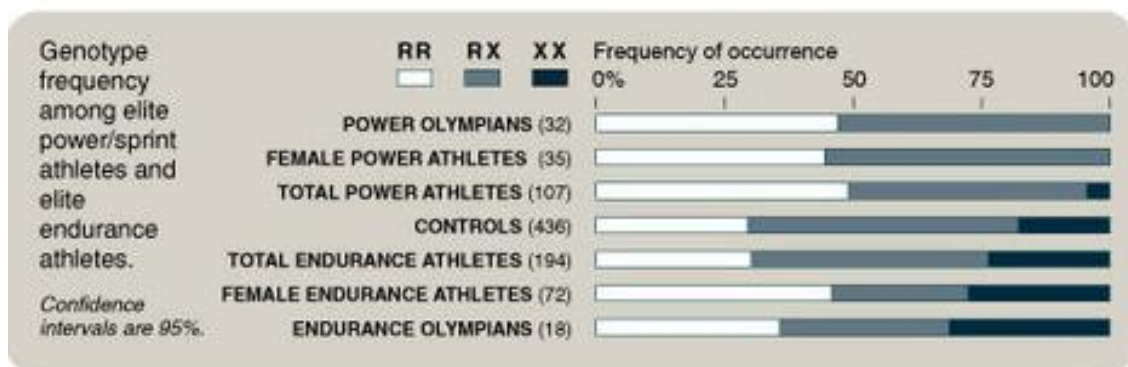
11. There are four different nitrogenous bases in DNA, guanine, cytosine, adenine and thymine. Within the double helix of DNA, guanine from one strand binds to cytosine while adenine binds to thymine.

A sequence of 55 base pairs of nucleotides contains 33 cytosine bases. How many adenine bases are there in the sequence?

- a. 11
- b. 22
- c. 44
- d. 55

Questions 12, 13 and 14 relate to the following information.

A single nucleotide polymorphism (SNP) is a DNA sequence variation occurring within a group of the same species in which a single nucleotide differs between individual members. SNPs can be in coding or non-coding regions of DNA. There are many studies that look at how SNPs correlate with a person's phenotype. ACTN3 is a gene coding for muscle specific protein alpha-actinin-3. Three genotypes exist for this gene: RR, RX and XX. Lack of this protein (XX) is not associated with disease.



Stephen M. Roth, Ph.D., University of Maryland; American Journal of Human Genetics

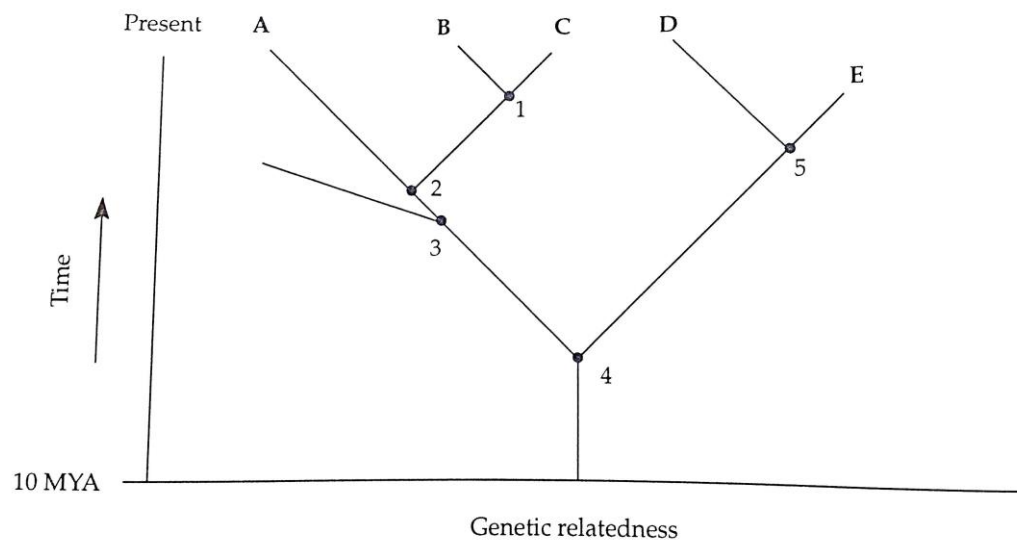
12. The alpha-actinin-3 protein?
- a. gives an advantage in becoming an endurance athlete
 - b. does not give an advantage in becoming an endurance athlete
 - c. gives an advantage in becoming a power athlete
 - d. does not give an advantage in becoming a power athlete

13. The lack of the R allele:

- a. prevents someone from becoming a power athlete
 - b. does not prevent someone from becoming a power athlete
 - c. prevents someone from becoming an athlete
 - d. does not prevent someone from becoming an athlete
14. The protein alpha-actinin-3 is most likely to be involved in:
- a. anabolic respiration
 - b. anaerobic respiration
 - c. aerobic respiration
 - d. catabolic respiration
15. A DNA molecule is made from two strands of nucleotides, known as coding and template. The template strand carries the information used by the cell, and the coding strand is complementary. This is biologically analogous to:
- a. an 'up' and a 'down' escalator
 - b. two opposite lanes of a highway
 - c. a pair of mittens
 - d. a photograph and its negative
16. When Scar referred to himself as being 'at the shallow end of the gene pool' to Simba in the Lion King, Disney met the world of science. What is the best description of the gene pool in this context?
- a. All the genes found in the lion population
 - b. The number of gene loci in the lion population
 - c. The groups of genes that determine the polygenic traits in lions.
 - d. The genes that conferred a selective advantage for strength in lions

17. When we discuss levels of biodiversity in an ecosystem, we are referring to
- a. the numbers of animals and plants in the ecosystem
 - b. how endangered the plants and animals in the ecosystem are
 - c. the number of species recorded in the ecosystem
 - d. how large the ecosystem is
18. The average amount of energy that is lost to cellular respiration from one heterotrophic level to the next in a four-step food chain is approximately:
- a. 10%
 - b. 90%
 - c. 15%
 - d. 60%

Use the following diagram to answer questions 19 - 20



19. Which is a possible common ancestor for species C and E?

- a. 1
- b. 2
- c. 3
- d. 4

20 Which pair represents the most closely related species?

- a. A and B
- b. C and B
- c. D and E
- d. E and A

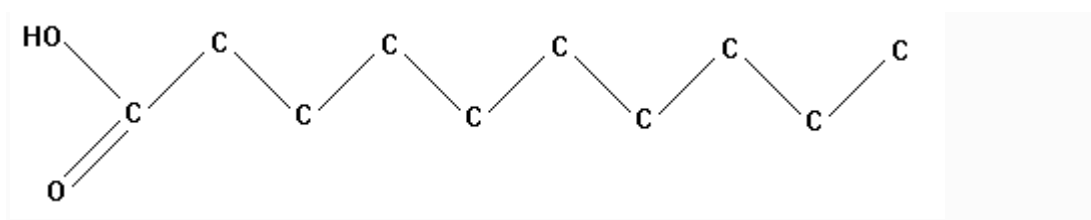
21. Which species is most likely to be extinct?

- a. B
- b. C
- c. D
- d. E

22. Kathryn leaves a potato outside and it gradually decays. One of the main substances in the potato is the starch amylose, which is made of many glucose molecules bonded together. What happens to the chemical energy in amylose molecules as the potato decays?

- a. Some of the energy is used to convert the amylose into nitrogen and phosphorous which passes into the soil as nutrients.
- b. Some of the energy is utilised by decomposers.
- c. Some of the energy is used to form carbon dioxide.
- d. Some of the energy is used up by decomposers and disappears.

23. The molecule below shows the Carbon skeleton of a:



- a. Fatty Acid
- b. Carbohydrate
- c. Protein
- d. Nucleic acid

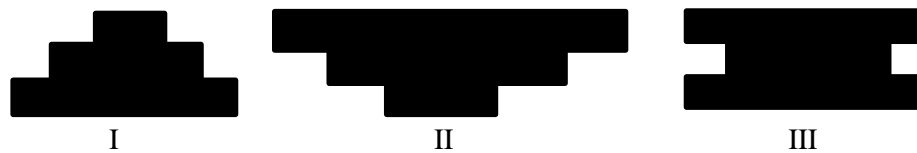
24. When protein enzymes are heated excessively in a test tube, their activity usually decreases. In some cases, activity is restored when the temperature is returned to normal. In such a case, which of the following was unaffected by the original heating?

- a. Ionic bonds
- b. Peptide bonds
- c. Hydrogen bonds
- d. Hydrophobic interactions

25. When protein enzymes are heated excessively in a test tube and their activity does not return to normal, the enzyme is said to be:
- a. saturated
 - b. denatured
 - c. dead
 - d. ineffective

Use the following information and diagram to answer questions 26-28.

Ecological pyramids are used in biology to represent relationships between and within populations quantitatively. Producers are shown on the bottom and subsequent layers represent higher-level consumers. The following diagram shows three different pyramids of population numbers.

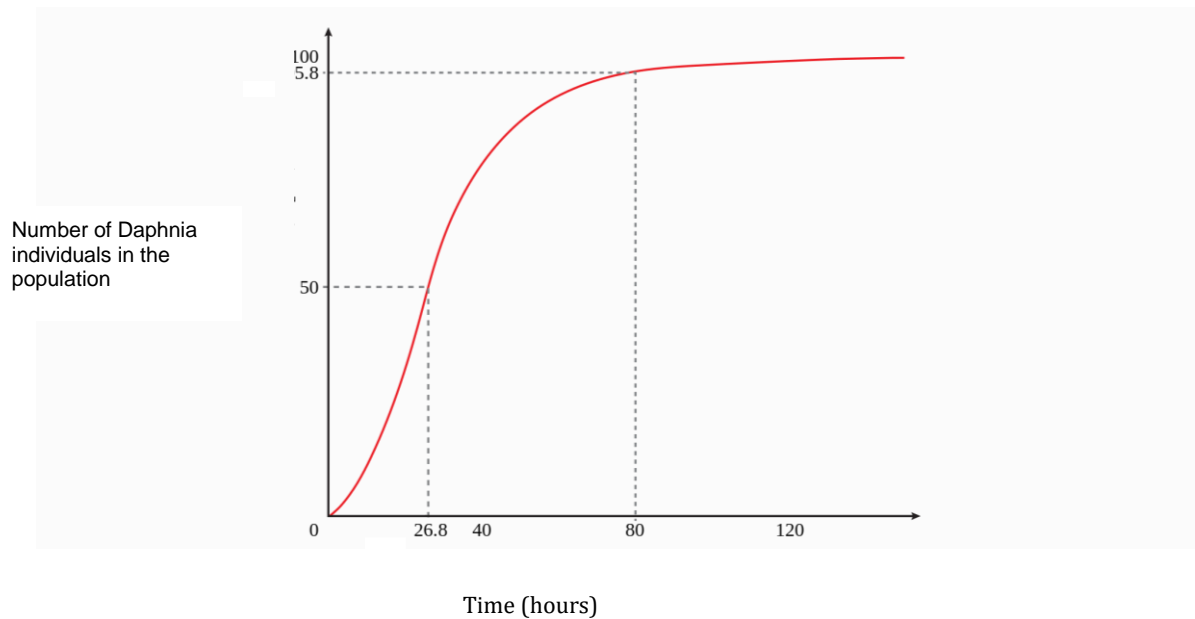


26. Which pyramid represents a population in the process of decreasing?
- a. I only
 - b. II only
 - c. III only
 - d. II and III
27. Which pyramid represents a population that is stable?
- a. I only
 - b. II only
 - c. III only
 - d. I and III

28. Which pyramid represents a pyramid of numbers in the African savannah?

- a. I only
- b. II only
- c. III only
- d. II and III

29. What type of population growth shown in the graph is exhibited by this hypothetical *Daphnia* sp. population that is reproducing in a water tank?

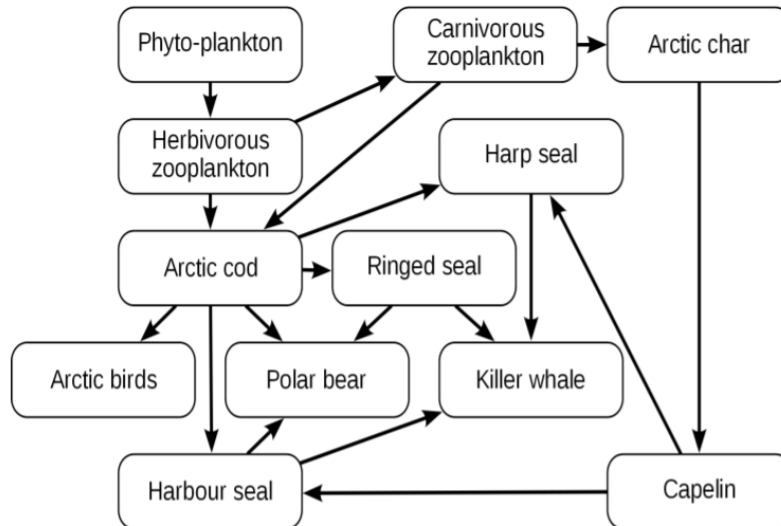


- a. Arithmetic growth
- b. Exponential growth
- c. Density-dependent growth
- d. Limited growth

30. How does the meaning of the term “dispersal” differ from “dispersion” in ecological terms?
Dispersal is

- a. immigration of animals into a territory.
- b. the pattern in which animals are dispersed in the ecosystem.
- c. the spreading of seeds.
- d. the movement of animals away from a home territory.

Use the following diagram of a marine food web to answer questions 31-32



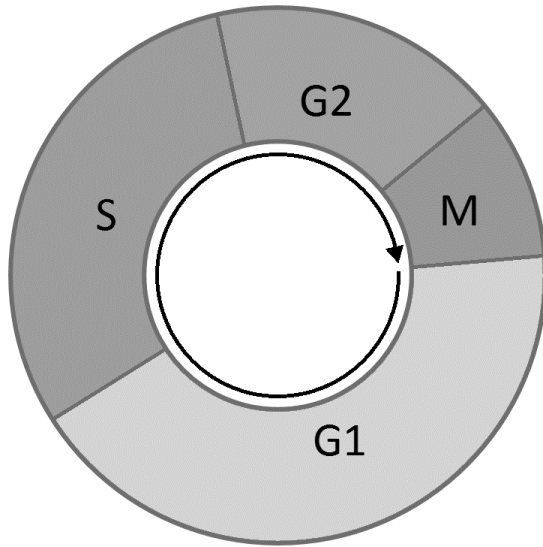
31. Which of the following statements is correct?

- Herbivorous zooplankton are primary producers.
- Polar bears are under threat of extinction because harbour seals are tertiary consumers in the food chain.
- Harp seals eat arctic cod and capelin and killer whales eat harp seals.
- The primary production is increased when the number of zooplankton increase.

32. Which of the following is most likely to be the keystone species in this food web?

- killer whale.
- arctic cod.
- phytoplankton.
- ringed seal.

Questions 33 – 34 relate to the following diagram of a cell cycle.



33. During which of the following stages of the cell cycle does DNA replication occur?

- a. S phase.
- b. G1 phase.
- c. G2 phase.
- d. M phase.

34. In which cell stage does cell division occur?

- a. S phase.
- b. G1 phase.
- c. G2 phase.
- d. M phase.

35. If the template strand of a DNA molecule has the sequence 3' CTTGGATCGA 5', which of the following mRNA strands would be produced?

- a. 5' CUUGGAUCGA 3'
- b. 5' GUUCCATCGA 3'
- c. 5' GAACCTAGCT 3'
- d. 5' GAACCUAGCU 3'

Use the following information to answer questions 36-38

Transpiration is the process by which water is lost by plants. To determine the effect that different conditions such as wind, humidity, and light intensity have on the rate of transpiration an experiment was designed using the progress of a tracer dye through the stem of a stick of celery. The distance travelled by the dye from the roots, up through vessels in the stem, was recorded in centimetres for a variety of treatments.

Time (s)	Simulated environmental condition			
	Wind	Humidity	Darkness	Bright Light
0	0	0	0	0
10	2	1	1	2.5
20	3.5	2.5	2	3.5
30	5.5	3.5	2.5	5
40	7	5	3.5	6.5

36. Based on the data provided, which of the following conclusions is valid?
- Wind causes more water loss due to transpiration than bright light
 - Humidity causes less water loss due to transpiration than darkness
 - Bright light causes less water loss due to transpiration than humidity.
 - Interaction of the tracer dye with the celery's tissues could explain discrepancies in the uniformity of the apparent rate of transpiration
37. With an increase in humidity, the rate of transpiration is expected to be lower owing to:
- a decrease in the rate of evaporation
 - an increase in the rate of evaporation
 - an increase in the rate of convection
 - a decrease in the rate of convection
38. The tracer dye would most likely travel through the plants:
- veins
 - xylem
 - phloem
 - stem

Questions 39 – 41 relate to the following information.

A volcano erupts in the middle of the Pacific Ocean, forming a new island. Marine eggs and larvae drift towards it on the currents allowing species to colonise and create a reef fringing the island. As time passes, factors such as predation, competition and diseases, result in the extinctions of some reef species.

39. If the reef is colonised each century by ten new species of plankton but 10% become extinct each century, how long will it take for the reef fauna to include at least 50 different species of plankton?
- a. 300 years
 - b. 400 years
 - c. 800 years
 - d. 1200 years
40. An El Nino event results in a change in the direction of marine current around the island, preventing the reef from being colonized by any new species. Assuming the extinction rate remains at 10% per century, how long will it take for the biodiversity of the reef to reduce from 50 species of plankton to 30 species?
- a. 500 years
 - b. 300 years
 - c. 800 years
 - d. 1200 years
41. You want to calculate the population size of turtles on the reef. You sample the number of turtles using a capture-mark-recapture survey. On the first visit you capture 20 turtles and mark their identity on their shell with a permanent marker. One month later on your second visit, you capture 15 turtles, 5 of which already had identity marks on their shell. How many individuals are in the population?

Using this formula: estimated population = $(T_1 \times T_2) / T_3$

where T_1 = number of animals marked in the first survey

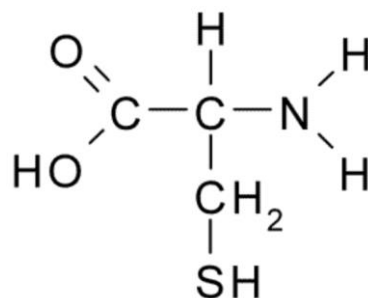
where T_2 = number of new animals marked in the second survey

where T_3 = number of animals recaptured

- a. 25
- b. 35
- c. 40
- d. 200

Questions 42 – 49 relate to the following information.

A fictitious protein named diflerrin has just been discovered in a new species of marine worms that live in highly saline environments with extremely low oxygen levels. Diflerrin is composed of two polypeptide chains and seven cysteine residues in total. It shares part of its amino acid sequence with the surface antigen of a parasitic human tapeworm by coincidence. It functions as a respiratory pigment similar to haemoglobin – it binds oxygen that flows over their gills, circulates around the body in the blood, and releases oxygen to respiring tissues.

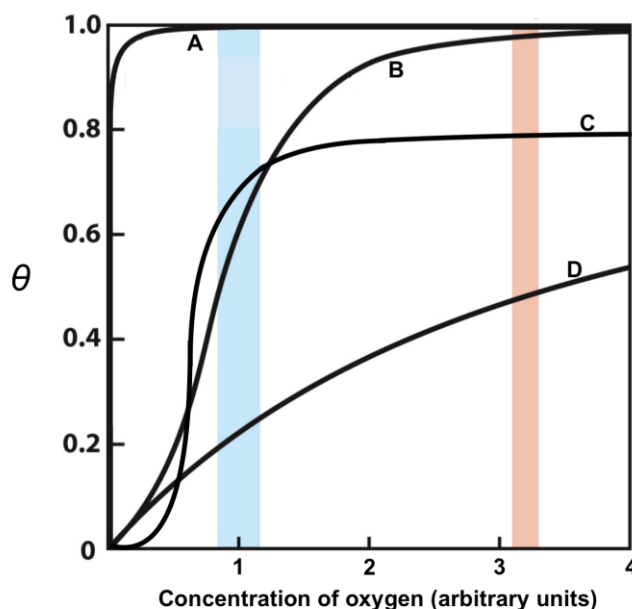


42. The structure of cysteine, a sulfur-containing amino acid, is shown above. How many disulfide bonds will be present in diflerrin?
- a. 2
 - b. 3
 - c. 4
 - d. 7
43. What level of protein structure will diflerrin display?
- a. Primary structure
 - b. Secondary structure
 - c. Tertiary structure
 - d. Quaternary structure

44. Where would you expect diflerrin to be predominantly localised in a red blood cell? Assume it is the same as haemoglobin in this regard.

- Embedded in the cell membrane so it can pick up oxygen more easily
- In the nucleus
- In the cytoplasm
- In the mitochondria so it can deliver oxygen more efficiently for aerobic cellular respiration

Consider diflerrin-oxygen dissociation curves A, B, C and D on the graph below. Note that curve A may be difficult to see as it is very close to the vertical axis and the line $\theta=1$. Theta (θ) is defined as the fraction of total diflerrin bound to oxygen at various concentrations of oxygen. The concentration of oxygen in marine worm tissues is approximately 1 arbitrary unit. In the seawater surrounding the worm the concentration is 3 arbitrary units, as shown by the shaded vertical bars.



Source: modified from Principles of Biochemistry (Lehninger 6th edition)

45. Which diflerrin-oxygen dissociation curve is most likely to be correct?

- Curve A
- Curve B
- Curve C
- Curve D

46. Using the same graph in the previous question, which curve represents the protein with the highest affinity to oxygen across the whole range of oxygen concentrations?
- Curve A
 - Curve B
 - Curve C
 - Curve D
47. Diflerrin is investigated for its viability as an orally administered haemoglobin substitute in humans. Is this likely to be effective, and why or why not?
- Yes, because it is a relatively small protein that may be absorbed by the microvilli of the small intestine.
 - Yes, because it will pass through the oral mucosa and diffuse into capillaries, where it can be taken up by red blood cells.
 - No, because it will be excreted in urine by the filtering mechanism of the kidneys.
 - No, because it will be broken down in the stomach by proteases.
48. Intravenous administration of diflerrin in humans is also considered as an option. Is this likely to be effective, and why or why not?
- Yes, because intravenous administration allows diflerrin to immediately contact the blood, where it will undergo facilitated diffusion across the membranes of red blood cells to assist in oxygen transport.
 - Yes, because intravenous administration allows diflerrin to bypass metabolism of toxins and foreign substances in the liver, so it remains active as an oxygen transporter in the bloodstream.
 - No, because diflerrin will be recognised as a foreign protein and attacked by immune cells such as eosinophils.
 - No, because red blood cells will phagocytose diflerrin and cause it to become denatured while it is circulating in the bloodstream.

49. What adaptation is the marine worm **LEAST** likely to have to survive in highly saline conditions

- a. Active excretion of salt
- b. Production of hypoosmotic waste
- c. Reduced permeability of body surface to salt
- d. Production of hyperosmotic waste

Use the following information to answer question 50 - 51.

The purpose of modern vaccines is to reduce the “lag” between infection and the production of sufficient antibodies to fight the pathogen. After being exposed to a virus responsible for influenza (the ‘flu), the antibody levels of two individuals were measured over the course of several days. This was done via blood sampling through a vein on the left arm. The counts of both individuals are presented below:

Day	Individual A	Individual B
1	2	5
2	5	100
3	50	3500
4	1000	10000<
5	10000<	10000<

50. Which individual/s is more likely to have received the influenza vaccine

- a. Individual A, as their antibody counts increased more rapidly
- b. Individual B, as their antibody counts increased more rapidly
- c. Neither individual as their antibody levels both peak at 10000<
- d. Both individuals as their antibody levels both peak at 10000.

51. Viruses are considered to be

- a. non-living.
- b. primitive precursors of bacteria.
- c. the missing link between life and non-life.
- d. very small bacteria.

Questions 52 to 57 relate to the following information.

Five different species of Australian animals were placed in laboratory chambers. The effect of changes in the temperature of the external environment (EM) on their metabolic rate was recorded and analysed. Each animal had similar body weights (around 50 grams) and the data was measured while the animals stayed at rest.

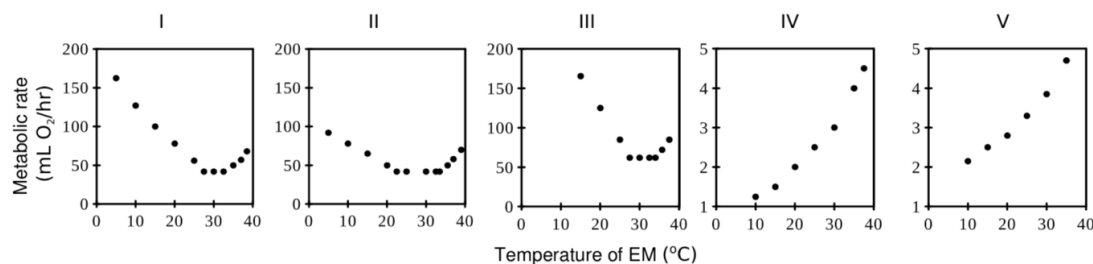


Image from 2016 IBO Theory paper A, question 27

52. Which of the following statements is true?

- Species III had a similar metabolic rate at 20°C to species I at 10°C.
- Species II had the lowest recorded metabolic rate of all five species.
- If the temperature was lowered to -20°C, the metabolic rate of species IV would be around -2mL O₂/hr.
- The maximum possible metabolic rate for species I is 160mLO₂/hr.

53. Choose the most correct statement

- The changes in body temperature in species IV is mostly dependent on the environment.
- Smaller animals generally have lower metabolic rates because they are better at retaining heat than larger animals.
- On a 15°C day, species IV will use less oxygen than species I.
- At 20°C, species I is producing heat at the same rate that it is losing heat to the environment.

54. Which of the following is the best explanation for the increase in metabolic rate when the temperature exceeds 35°C in species I, II, and III?

- a. A high temperature will increase the chemical reactions in the animal's body, which also increases the production of heat as a by-product.
- b. Bodily organs begin to dysfunction at these high temperatures, causing the animal to overheat.
- c. Above 35°C, the metabolic rates are too low to be accurately detected by the equipment used, resulting in unreliable results.
- d. At high temperatures, animals engage in energy-requiring behaviours to lose additional heat to prevent overheating.

55. Which of the following species correctly represents an ectothermic and endothermic animal?

Ectotherm	Endotherm
a. II	V
b. IV	I
c. V	IV
d. I	III

56. Certain animals are able to reduce heat transfer better than others. An example of this is a thick layer of body fat which helps insulate fur seals in cold ocean waters. Which of the following species was best able to insulate temperature, based on the data presented above?

- a. Species I
- b. Species III
- c. Species IV
- d. Species V

57. All endothermic animals have a basal metabolic rate. This is the rate of energy expenditure per unit of time at rest to keep the body functioning. Which of the following species had the highest basal metabolic rate?

- a. Species I
- b. Species II
- c. Species IV
- d. Species V

Questions 58 – 61 relate to the following information.

In the human body, lung function is affected by physical activity. As the intensity of activity increases, the body has a higher demand for lung function. The lungs respond to this by increasing two parameters: tidal volume and ventilation rate. Tidal volume is the volume of air that is breathed in and out by the lungs at rest (i.e. without extra effort to have a maximum inhalation or exhalation). Ventilation rate is a measure of how many breaths a person takes per unit of time. Below is a graph showing data for an athlete on a treadmill.

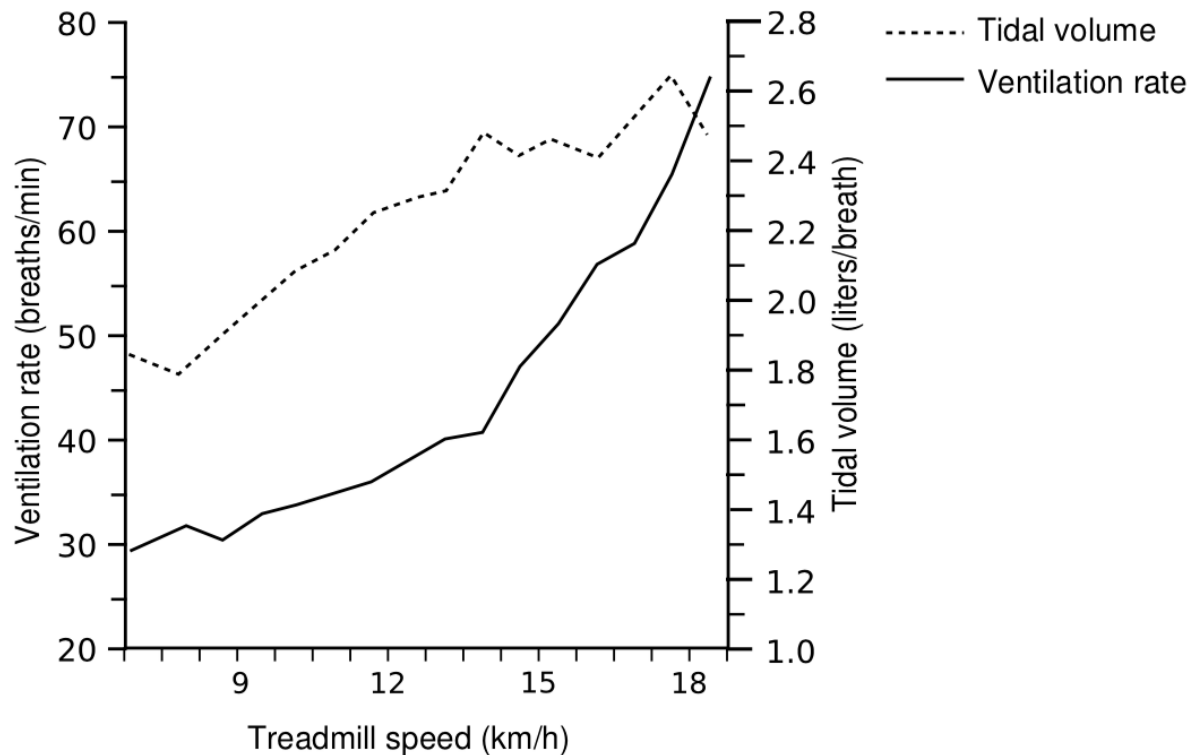


Image taken from 2016 IBO Theory paper A, question 21

58. At a treadmill speed of 12km/hr, what is the ventilation volume per minute closest to?

- a. 15 litres
- b. 95 litres
- c. 110 litres
- d. 125 litres

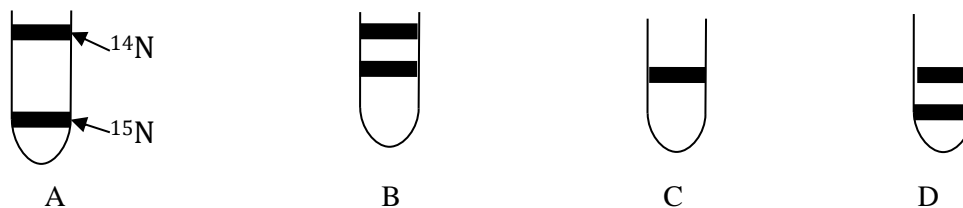
59. At different intensities of physical activity, tidal volume and ventilation rate increases to different degrees. In which of the following intervals does tidal volume increase faster than ventilation rate?
- 6km/hr to 9km/hr
 - 8km/hr to 11km/hr
 - 13km/hr to 16km/hr
 - 15km/hr to 18km/hr
60. At higher altitudes, there is less oxygen available (owing to the change in pressure) in the air for gas exchange. If this experiment was repeated at high altitude (for example, on top of a mountain), how would you expect the results to be different when the athlete was running at 8km/hr?

	Vital capacity	Ventilation rate
a.	Higher	Higher
b.	Lower	Lower
c.	Unchanged	Lower
d.	Higher	Unchanged

61. Which of the following statements is true?
- At a treadmill speed of 0km/hr, the tidal volume would approach 0 litres/breath.
 - If this experiment were completed on a young child instead of a fit athlete, both the tidal volume and ventilation rate would likely be significantly lower.
 - In an adult, a tidal volume of 0.15 litres and a ventilation rate of 40 breaths per minute would provide equally effective ventilation as a tidal volume of 0.6 litres and a ventilation rate of 10 breaths per minute.
 - If the treadmill speed continued to increase, the tidal volume would eventually reach a maximum value and would no longer increase any further.

Use the following information and diagram to answer 62 -64.

Nitrogen exists in two stable and non-radioactive isotopes as heavy (^{15}N) and “light” nitrogen (^{14}N). There also exist a number of radioactive isotopes that have short half-lives. When bacteria were grown in a medium containing ^{15}N for several generations, the DNA had a higher density than bacteria grown in a medium containing ^{14}N .

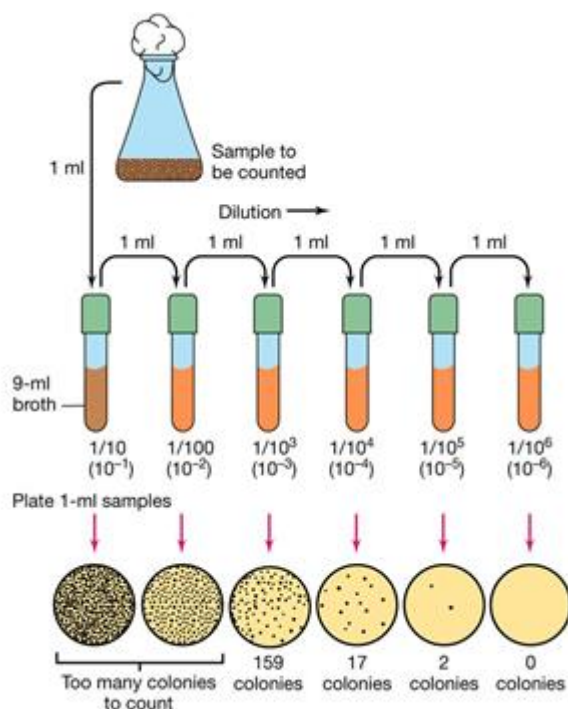


62. When bacteria were taken from both media and mixed together, the DNA could be separated. Following centrifugation, “heavy” (^{15}N) DNA was found at the bottom while “light” (^{14}N) DNA was found on the top of the test tube. Which test tube best represents this?
- Test Tube A
 - Test Tube B
 - Test Tube C
 - Test Tube D
63. Bacteria grown in the ^{15}N medium were transferred to a medium containing ^{14}N and allowed to grow for one generation. Which test tube best represents DNA after one generation?
- Test Tube A
 - Test Tube B
 - Test Tube C
 - Test Tube D
64. Bacteria grown in the ^{14}N medium were transferred to a medium containing ^{15}N and allowed to grow for two generations. Which test tube best represents the DNA after two generations?
- Test Tube A
 - Test Tube B
 - Test Tube C
 - Test Tube D

Use the following information and figure to answer questions 65- 68.

Bacterial count of a liquid culture can be determined by three different methods:

1. Cells can be counted under a microscope using a counting chamber;
2. The absorbance of the culture can be measured in a spectrophotometer (with $A_{600} = 1$ corresponding to 8×10^8 bacterial cells/ml);
3. Several dilutions of the culture can be plated on agar and the colonies can be counted (see the figure below) to calculate the number of colony forming units per milliliter (cfu/ml).



65. A culture with $A_{600} = 0.1$ and a doubling time of 30 minutes will reach

- a. 4×10^8 cells/ml in less than two hours of growth
- b. 6×10^8 cells/ml in less than two hours of growth
- c. 8×10^8 cells/ml in less than two hours of growth
- d. 10×10^8 cells/ml in less than two hours of growth

66. Counting colonies on plates:
- a. Gives a greater estimate of the number of bacterial cells than counting cells under a microscope.
 - b. Gives a smaller estimate of the number of bacterial cells than counting cells under a microscope.
 - c. Gives a more exact number of bacterial cells than counting them under a microscope.
 - d. It is impossible to count colonies on plates.
67. Using the plate giving the most accurate results (from the figure), the culture X is estimated to contain
- a. 1.0×10^5 cfu/ml
 - b. 1.6×10^5 cfu/ml
 - c. $1.9.0 \times 10^6$ cfu/ml
 - d. 2.0×10^6 cfu/ml
68. When repeating the plating of the most dilute solution, shown in the figure, many times:
- a. some plates will show colonies.
 - b. no growth will be observed on any plates.
 - c. some plates will show too many colonies to count.
 - d. three in ten of the plates will show growth

Use the following information to answer questions 69- 70

		second letter					
		U	C	A	G		
first letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA stop UAG stop	UGU } Cys UGC } UGA stop UGG Trp	U C A G	third letter
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G	
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G	
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G	

69. The following mRNA strand translates into which protein strand?

mRNA: 5'CAAUCCUCAGCU3'

- Gln.Ser.Ser.Ala
- Asn.Pro.Gln.Leu
- Ala.Ser.Ser.Gln
- Ser.Thr.Pro.Asn

70. A frameshift mutation changes the reading frame of the nucleotides in a DNA molecule. If a frameshift mutation such that two c nucleotides were added at the 5' end of the mRNA stand shown in question 69, the following protein strand would be produced instead of the correct one.

- Leu.Gln.Pro.Asn.Pro.
- Pro.Asn.Pro.Gln.Leu
- Pro.Asn.Pro.Gln.
- Gln.Pro.Asn.Pro.

END OF EXAM