1. What is the mass of 1 mole of neutrons?

A) 1/12 g

B) 0.1 g

C) 1 g

D) 10 g

2. In the container is a solution of sodium hydroxide in clean water. The Na^+ concentration is 0.1 mol/L. The temperature of the solution is 25 °C. What is the pH of this solution?

A) 0.1

B) 1

C) 10

D) 13

3.

How many grams of nitrogen occupy a volume of 224 L at a temperature of 0 °C?
A_r(N) = 14

A) 14 g

B) 28 g

C) 140 g

D) 280 g

4. Tetrapyrroles are among the important compounds involved in the transfer of substances or functional groups. A central metal atom is often bound to the centre of the tetrapyrrole ring. Which of the following metals is the central atom of tetrapyrroles most often?

A) Aluminium

B) Calcium

C) Iron

D) Sodium

5. During the digestion of fat composed of glycerol and palmitic acid residues, a molecule of 2-monoacylglycerol was formed. How many free -OH groups does this 2-monoacylglycerol contain in its molecule?

A) One

B) Two

C) Three

D) Four

6. The formula for magnesium chlorate is

A) $MgCl_2$

B) $Mg(ClO)_2$

C) $Mg(ClO_3)_2$

D) $Mg(ClO_2)_2$

7. Which of the following compounds behaves as the strongest acid?

A) $HClO_4$

B) H_2SO_3

C) HF

D) KCN

8. Which of the following substances is formed by the reaction of an alkyl halide with NaOH?

A) Alkoxide

B) Alkane

C) Ester

D) Alcohol

9. Four containers contain chlorine, bromine, fluorine and iodine in gaseous state under normal laboratory conditions (temperature approximately 20 °C, pressure approximately 100 kPa).
Which of these gases will have the strongest oxidising effects?

A) Fluorine
B) Iodine
C) Bromine
D) Chlorine

10. Which of the following mixtures is homogeneous?

A) Smoke
B) Emulsion
C) Metal alloy
D) Suspension

11. Which of the following amino acids is the LEAST polar?

A) Glutamine
B) Isoleucine
C) Serine
D) Asparagine

12. Determine the mass of oxygen contained in carbon dioxide per 6 g of carbon:

A) 12.0 g
B) 16.0 g
C) 32.0 g
D) 53.3 g

13. From a nutritional point of view, fats with essential fatty acids are important. These mainly include molecules that contain

A) branched chains with double bonds.
B) double bonds in the *cis* position.
C) double bonds in the *trans* position.
D) conjugated double bond systems.

14. Which two substances are *cis–trans* isomers of each other?

A) Maleic and fumaric acid.
B) Oleic and linoleic acid.
C) Oleic and stearic acid.
D) Maleic and succinic acid.

15. What is the process for obtaining aluminium metal from aluminium oxide?

A) By reaction with concentrated nitric acid.
B) By reaction with potassium hydroxide.
C) By electrolysis of its melt.
D) By reaction with concentrated hydrochloric acid.

16. Which oxidation number do alkali metal atoms most often acquire in inorganic compounds?

A) –II
B) –I
C) I
D) II

17. What properties does the -NH_2 group give to organic substances?

A) Acidic
B) Basic
C) Electrophilic
D) Oxidative

18. Which type of interactions predominates in a crystal of table salt?

A) Ionic interactions
B) Nonpolar covalent bonds
C) Polar covalent bonds
D) Van der Waals forces

19. Amalgam can be formed

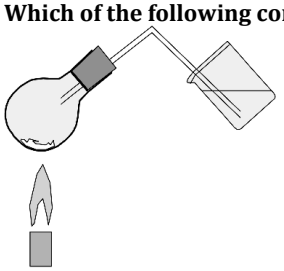
A) by the reaction of silver nitrate with hydrogen sulfide.

B) by electrolysis of silver nitrate with a mercury electrode.

C) by the reaction of mercuric cations with halide anions.

D) by the reaction of silver nitrate with mercuric chloride.

20. There is about 0.5 g of solid substance A in the flask. The flask is heated with the flame of a burner. Gas is produced, which is fed through a tube into a beaker with lime water (calcium hydroxide solution). When the gas passes through the solution, a white haze is formed.
Which of the following compounds could be substance A?



A) Aluminium sulphide

B) Sodium hydrogencarbonate

C) Ammonium sulphate

D) Copper(II) chloride

21. What type of bond connects the atoms in an oxygen molecule?

A) Coordinate covalent

B) Non-polar covalent

C) Polar covalent

D) Ionic

22. Chloroform is

A) ethene dichloride.

B) trichloromethane.

C) vinyl chloride.

D) methyl chloride.

23. The α radiation particle is made up of

A) two helium nuclei.

B) two protons and two neutrons.

C) two neutrons and two electrons.

D) two protons and two electrons.

24. Which of the following substances is most easily formed by the oxidation of 2-propanol?

A) Butyric acid

B) Propionic acid

C) Acetone

D) Propionaldehyde

25. Carbon in the ground state has

A) four electrons in the configuration $1s^2\ 2s^2$.

B) five electrons in the configuration $1s^2\ 2s^2\ 2p^1$.

C) six electrons in the configuration $1s^2\ 2s^2\ 2p^2$.

D) seven electrons in the configuration $1s^2\ 2s^2\ 2p^2\ 3s^1$.

26. Consumption of undercooked fish meat (e.g. pike, perch or bream) can result in human infection with

A) the broad tapeworm (*Diphyllobothrium latum*).

B) liver fluke (*Fasciola hepatica*).

C) the urinary blood fluke (*Schistosoma haematobium*).

D) the tapeworm (*Echinococcus granulosus*).

27. A slightly obese man of 50 years of age was found to have a low urea level in his blood serum during a preventive medical examination.
This is most likely a sign of decreased function of which organ?

A) Pancreas

B) Liver

C) Hypothalamus

D) Kidneys

28. The influence of various factors on gene frequencies differs in small and large populations. Which of the following factors has a much greater influence on gene frequencies in small populations than in large populations?

A) Environmental changes

B) Genetic drift

C) Selection

D) Mutagenic substances

29. During conjugation in bacteria:

A) two bacterial cells fuse with subsequent cell division.

B) part of a chromosome is transferred from one cell to another.

C) the recipient bacterium divides into a vegetative cell and a spore.

D) two bacterial cells merge.

30. Blood pressure was measured in the four areas below for a standing person. In which of them could the lowest value be measured?

A) In the hollow veins.

B) In skeletal muscle capillaries.

C) In the right atrium.

D) In the veins of the lower extremities.

31. What are centrioles?

A) Primary chromosome constrictions.

B) Endoplasmic reticulum cisternae located in close proximity to the nucleus.

C) Actin organelles forming the central part of the cytoskeletal framework of an erythrocyte.

D) Microtubular structures important in cell division.

32. Which of the following types of blood circulation do amphibians have?

A) Partially separated pulmonary and systemic circulation with a partially divided heart chamber.

B) Simple (heart-body-lungs-heart).

C) Partially separate pulmonary and systemic circulation with a common heart chamber.

D) Completely separate pulmonary and systemic circulation.

33. Where is rRNA synthesised?

A) In ribosomes.

B) In the endoplasmic reticulum.

C) In the nucleolus.

D) In the cytoplasm.

34. The roundworm parasite (*Ascaris lumbricoides*) is transmitted to humans by ingesting its eggs. Where are these eggs most commonly found?

A) In uncooked beef.

B) In cat faeces.

C) In uncooked pork.

D) On unwashed vegetables or fruit.

35. A common feature for all adult mammals is the same number of

A) stomachs.

B) toes on the lower limbs.

C) heart chambers.

D) teeth in the upper dental arch.

36. Where are the genes that determine matrilineal inheritance stored?

A) In mitochondrial DNA.

B) In the satellite region of acrocentric chromosomes.

C) On the X chromosome.

D) On all chromosomes of a woman.

37. The term mydriasis refers to

A) lens accommodation.

B) pupil constriction.

C) pupil dilation.

D) lens constriction.

38. How does a new plant form during vegetative reproduction?

A) From seeds without the participation of spores.

B) From cells formed by meiosis.

C) By apoptosis.

D) From cells formed by mitosis.

39. Which blood vessels does the umbilical cord contain (during physiological pregnancy)?

A) Two arteries and one vein: the arteries carry oxygen-rich blood, the vein carries oxygen-poor blood.

B) One artery and two veins: the artery carries oxygen-rich blood, the veins carry oxygen-poor blood.

C) One artery and two veins: the artery carries oxygen-poor blood, the veins carry oxygen-rich blood.

D) Two arteries and one vein: the arteries carry oxygen-poor blood, the vein carries oxygen-rich blood.

40. The polar body:

A) is the name for a centriole in metaphase.

B) arises during the process of oogenesis.

C) is a cell of the posterior pole of the eyeball.

D) polarises membranes at the site of the nerve-muscle synapse.

41. What phenotype does the karyotype 45,Y correspond to in humans?

A) This combination is not compatible with life.

B) A male with Turner syndrome.

C) A female with Turner syndrome.

D) Normal male phenotype.

42. Which of the following diseases is transmitted by fleas?

A) Plague

B) Spotted fever

C) Smallpox

D) Rubella

43. Which of the following types of antibodies is most important for the primary immune response?

A) IgG

B) IgM

C) IgA

D) IgE

44. In the lymph nodes:

A) Lymph is formed.

B) Erythrocytes are broken down.

C) T lymphocytes are formed.

D) Microorganisms are trapped.

45. Which of the following cells are considered to be permanently blocked in the G_0 phase?

A) Ganglion cells

B) Blastomeres

C) Tumour cells

D) Bone marrow stem cells

46. Which of the following effects is the most prominent consequence of treating symptoms in people with hereditary diseases?

A) Positive change in the genotype of treated individuals.

B) The gene pool of the population improves.

C) The frequency of mutated alleles in the population decreases.

D) Positive change in the phenotype of treated individuals.

47. Bone growth in length occurs

A) from the periosteum.

B) from the bone marrow.

C) by mitotic division of osteocytes diffusely throughout the bone.

D) in the growth cartilages between the diaphysis and epiphysis.

48. Which of the following plants are evolutionarily the youngest?

A) Angiosperms

B) Ginkgos

C) Gymnosperms

D) Conifers

49. Microtubules are the building blocks of

A) centromeres.

B) muscle fibres.

C) spindle fibres.

D) ion channels.

50. Mutations in mitochondrial DNA can disrupt the process of oxidative phosphorylation. Which substance is most likely to be elevated in a biochemical blood test of a person suffering from such a mitochondrial disease?

A) Glucose

B) Ketone bodies

C) Triacylglycerols

D) Lactate

51. A DNA sample contains 30% cytosine.
What percentage is guanine?

A) 15%

B) 20%

C) 30%

D) 40%

52. Which of the following quantities has the dimensions of energy?

A) Mass × acceleration

B) Force × distance

C) Power × time^2

D) Force × velocity

53. What is the total electrical resistance of two resistors connected in parallel?

A) It is greater than the resistance of either resistor

B) It equals the arithmetic mean of the resistances

C) It is lower than the smallest individual resistance

D) It depends only on the source voltage

54. A laboratory instrument reports a concentration as $4.5 \cdot 10^{-4}$ mol·L^{-1} with two significant figures.

Which recorded value respects the measurement precision?

A) 0.000450 mol·L^{-1}

B) 0.00044 mol·L^{-1}

C) 0.00045 mol·L^{-1}

D) 0.0004500 mol·L^{-1}

55. Measured sample masses (g):
0.98, 1.01, 1.00, 1.02, 0.99
Target value: 1.00 ± 0.05 g
Which statement best describes the situation?

A) The values are outside tolerance.

B) The mean is substantially shifted.

C) Variability is zero.

D) All values are within tolerance and the mean is close to target.

56. Which statement is correct?

A) Blue light propagates faster than red light.

B) All electromagnetic radiation propagates at the same speed in vacuum.

C) The speed of light depends on wavelength.

D) Visible light is slower than ultraviolet radiation.

57. The period of a simple pendulum depends on:

A) the mass of the bob

B) the density of the surrounding medium

C) the amplitude of oscillation

D) the length of the string and gravitational acceleration

58. An object slides down an incline at constant speed.
What follows from this observation?

A) The net force is zero

B) The acceleration is maximal

C) The normal force equals the weight

D) Friction is zero

59. A speed of 72 km/h corresponds to:

A) 10 m/s

B) 15 m/s

C) 18 m/s

D) 20 m/s

60. Which type of radiation has the shortest wavelength?

A) Infrared

B) Visible light

C) X-rays

D) Microwaves

61. An object falls freely from a height of 10 m (neglect air resistance).
What is the approximate impact speed?

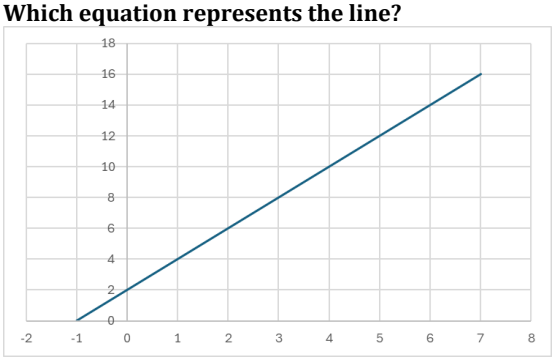
A) 10 m/s

B) 14 m/s

C) 20 m/s

D) 30 m/s

62. Which equation represents the line?



A) y = 3x + 1

B) y = x + 3

C) y = 2x + 4

D) y = 2x + 2

63. A bacterial culture doubles every 30 minutes.
Initial count: $2 \cdot 10^3$ cells.
How many cells are present after 2 hours?

A) $3.2 \cdot 10^4$

B) $6.4 \cdot 10^4$

C) $1.6 \cdot 10^4$

D) $8 \cdot 10^3$

64. A fertilizer is applied at a dose of 1.5 kg per 100 m^2. A garden measures 20 m × 15 m.

How much fertilizer is required?

A) 3.0 kg

B) 4.5 kg

C) 6.0 kg

D) 9.0 kg

65. The speed of an object is reduced to one half.
How does its kinetic energy change?

A) It is reduced to one quarter

B) It remains unchanged

C) It is reduced by half

D) It is reduced to one eighth

66. The concentration of a substance follows
$C(t) = C_0 \cdot e^{-kt}$
How can k be expressed?

A) $k = \ln(C_0/C) / t$

B) $k = C_0 / (C \cdot t)$

C) $k = e^t / C$

D) $k = \ln(C/C_0) / t$

67. Plant height has a mean of 50 cm and a standard deviation of 5 cm.
What proportion lies between 45 and 55 cm?

A) 84%

B) 68%

C) 50%

D) 95%

68. A study reports a correlation coefficient r = +0.81 between sleep duration and cognitive test performance (p < 0.001).

Which conclusion is the most appropriate?

A) The correlation is weak and insignificant

B) Longer sleep is associated with better test performance

C) Longer sleep causes higher intelligence

D) There is no relationship between the variables

69. The volume of a tank is 0.075 m^3.
What is this volume in liters?

A) 7.5 L

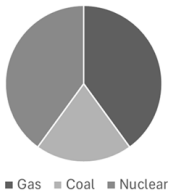
B) 75 L

C) 750 L

D) 7500 L

70. The total energy consumption of a hospital is 500 MWh. The chart shows where the energy comes from.

How many MWh are from gas?



A) 200 MWh

B) 180 MWh

C) 220 MWh

D) 150 MWh

71. What volume in cm^3 corresponds to 0.02 m^3?

A) $2 \cdot 10^4$ cm^3

B) $2 \cdot 10^5$ cm^3

C) $2 \cdot 10^6$ cm^3

D) $2 \cdot 10^7$ cm^3

72. An object accelerates from 0 to 6 m/s in 3 s and then moves at constant speed for 5 s.
What total distance is traveled?

A) 21 m

B) 24 m

C) 33 m

D) 39 m

73. What is the buoyant force acting on a 2 cm^3 object submerged in water?

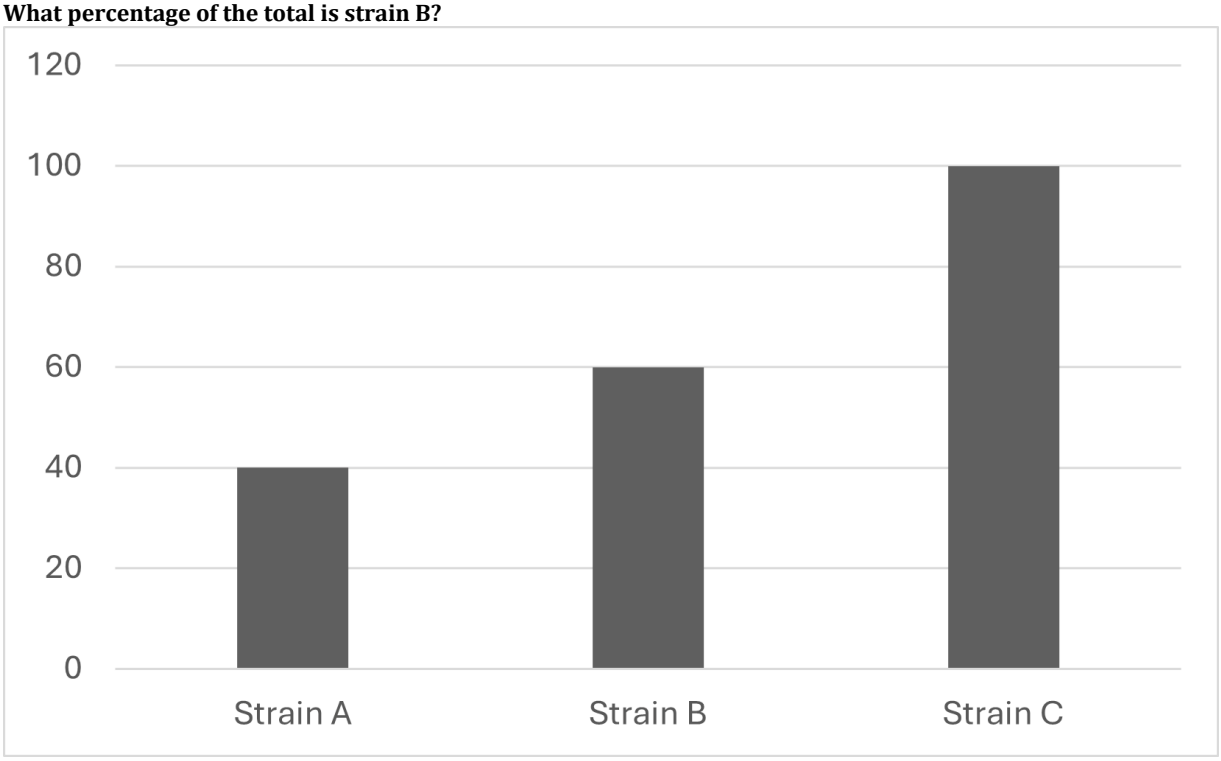
A) It cannot be determined without knowing the pressure

B) Approximately 20 mN

C) It depends on the density of the object

D) Approximately 2 mN

74. The bar chart shows counts of colony forming units (CFU) of three bacterial strains
What percentage of the total is strain B?



A) 20%

B) 25%

C) 30%

D) 40%

75. An ultrasound wave enters a medium where the propagation speed is higher.
The frequency remains constant.
What happens to the wavelength?

A) It decreases

B) It increases

C) It first decreases and then increases

D) It remains the same

question	answer
1	C
2	D
3	D
4	C
5	B
6	C
7	A
8	D
9	A
10	C
11	B
12	B
13	B
14	A
15	C
16	C
17	B
18	A
19	B
20	B
21	B
22	B
23	B
24	C
25	C

question	answer
26	A
27	B
28	B
29	B
30	C
31	D
32	C
33	C
34	D
35	C
36	A
37	C
38	D
39	D
40	B
41	A
42	A
43	B
44	D
45	A
46	D
47	D
48	A
49	C
50	D

question	answer
51	C
52	B
53	C
54	C
55	D
56	B
57	D
58	A
59	D
60	C
61	B
62	D
63	A
64	B
65	A
66	A
67	B
68	B
69	B
70	A
71	A
72	D
73	B
74	C
75	B