UNIT 1 Matter

Section A

1 The relative atomic mass of an element is defined as

A $\dfrac{\text{mass of one atom of the element}}{\text{mass of one atom of carbon-12}}$

B $\dfrac{\text{mass of one atom of the element}}{\text{mass of one mole of carbon-12}}$

C $\dfrac{\text{mass of one atom of the element}}{\text{mass of one atom of carbon-12}} \times 12$

D $\dfrac{\text{mass of one atom of the element}}{12 \times \text{mass of one atom of carbon-12}}$

2 Chlorofluorocarbons, CFCs, are responsible for the destruction of ozone in the stratosphere. In the stratosphere, the CFC molecules are fragmented by ultra-violet radiation to produce chlorine free radicals, $Cl^{\cdot}$. What is the composition of a $^{35}Cl^{\cdot}$ free radical?

	No. of protons	No. electrons	No. of neutrons
A	35	35	35
B	17	18	18
C	17	17	18
D	17	17	35

3 The nucleon number of an atom refers to

A the number of protons
B the number of neutrons
C the total number of protons and neutrons
D the total number of protons, electrons and neutrons

4 What is the mass of 1 atom of carbon-12?
[L = Avogadro constant]

A 1 g **B** 12 g **C** $12L$ g **D** $\dfrac{12}{L}$ g

5 The mass of one atom of ^{12}C is 1.99×10^{-23} g. What is the mass of 1 a.m.u?
[a.m.u. = atomic mass unit]

A 12 g **B** $\dfrac{1}{12}$ g **C** 23.9×10^{-23} g **D** 16.6×10^{-23} g

6 The Avogadro constant is defined as

A the amount of particles present in one mole of the substance
B the number of atoms in 12 g of carbon
C the number of atoms in 12 g of carbon-12
D the number of atoms in 12 g of an element

7 The relative atomic mass of chlorine is 35.5. How many times is one atom of chlorine heavier than one atom of ^{12}C?

A 35.5 **B** 0.34 **C** 2.96 **D** 426

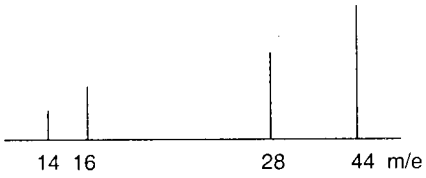
8 The mass spectrum of an element X consists of three peaks at m/e values of 40, 41 and 42 in the ratio of $a : b : c$. The relative atomic mass of X is

A $\frac{40}{a} + \frac{41}{b} + \frac{42}{c}$
B $\frac{40 + 41 + 42}{a + b + c}$
C $\frac{40a + 41b + 42c}{a + b + c}$
D $\frac{(41a)(42b)(43c)}{a \times b \times c}$

9 Boron (relative atomic mass = 10.8) consists of two isotopes ^{10}B and ^{11}B. What is the ratio of the lighter isotope to the heavier isotope?

A 1 : 1 **B** 1 : 2 **C** 1 : 4 **D** 1 : 5

10



Which of the following substance is expected to give the mass spectrum above?

A CO_2
B C_3H_8
C N_2O
D Mixture of N_2 and O_2

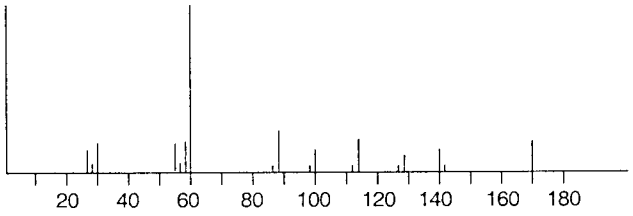
11 How many electrons are to be eliminated to give 1×10^{-3} mol of Na^+ ions from gaseous sodium atoms? (Na = 23, F = 9.65×10^4 C mol^{-1})

A $\frac{1 \times 10^{-3} \times 6.02 \times 10^{23}}{9.65 \times 10^4}$
B $1 \times 10^{-3} \times 6.02 \times 10^{23}$
C $1 \times 10^{-3} \times 23 \times 6.02 \times 10^{23}$
D $\frac{1 \times 10^{-3} \times 6.02 \times 10^{23}}{23}$

12 The number of fragment ions (considering only unipositive ions) that can be formed from the compound NO_2 in a mass spectrometer is

A 1 **B** 2 **C** 3 **D** 4

13 The mass spectrum of X is as shown below:



X might be

A C_4H_{10} **B** C_5H_{12} **C** $C_{12}H_{26}$ **D** C_6H_{14}

14 What is the function of the vacuum pump in the mass spectrometer?

A To reduce the pressure in the spectrometer
B To remove unionised atoms or molecules
C To facilitates the ionisation of the atoms or molecules
D To remove slow moving ions

15 What is formed when ^{32}P disintegrate by emitting a β particle?

A ^{33}P **B** ^{32}S **C** ^{28}Al **D** ^{32}Si

16 10 cm^3 of methane, CH_4, is mixed with 100 cm^3 of oxygen and the mixture sparked continuously. The mixture is cooled and bubbled through aqueous sodium hydroxide. What volume of gas will be absorbed by the sodium hydroxide?

A 10 cm^3 **B** 55 cm^3 **C** 80 cm^3 **D** 110 cm^3

17 Which of the following isotopes contains the same number of neutron as $^{31}_{15}P$?

A $^{32}_{16}S$ **B** $^{40}_{20}Ca$ **C** $^{32}_{15}P$ **D** $^{24}_{12}Mg$

18 The relative molecular mass of ^{12}CO is 27.9949. What is the relative molecular mass of $^{12}CO_2$?

A 47.9847 **B** 43.9898 **C** 43.9949 **D** 39.9949

19 During the radioactive decay of an isotope a particle ^1_0X is emitted. Which of the following is particle ^1_0X ?

A Electron **B** Neutron **C** α-particle **D** Proton

20 The volume (in cm^{-3}) of 0.20 mol dm^{-3} sulphuric acid required to react with 20.0 cm^{-3} of 0.20 mol dm^{-3} barium chloride is

A 10 **B** 20 **C** 30 **D** 40

21 If n is the number of atoms in 12 g of carbon, what is the number of atoms in 16 g of oxygen gas?

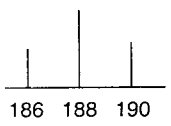
A n **B** $\frac{1}{2}n$ **C** $12n$ **D** $\frac{16}{12}n$

22 The number of atoms in 500 cm^3 of oxygen under room conditions is

A 2.50×10^{22}
B 2.68×10^{22}
C 6.0×10^{22}
D 6.0×10^{26}

23 Part of the mass spectrum for $^{12}C_2{}^1H_4Br_2$ is shown below. Assuming that bromine consists of two isotopes of ^{79}Br and ^{81}Br in equal abundance, which of the graphs is correct?

A



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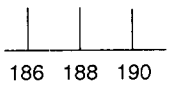

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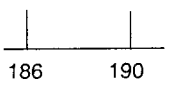
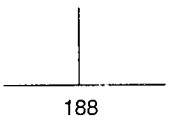


D



24 Ethanol, C_2H_5OH and dimethylether, CH_3OCH_3, are analysed separately in a mass spectrometer. Which of the following will be identical in both the mass spectrum?

A The number of peaks
B The relative height of the peaks
C The position of the molecular peak
D The number of fragment ions

25 The relative atomic mass is defined as

A $\dfrac{\text{mass of one atom of the isotope}}{\text{mass of one atom of C-12}}$

B $\dfrac{\frac{1}{12} \times \text{mass of one atom of the isotope}}{\text{mass of one atom of C-12}}$

C $\dfrac{\text{mass of one atom of the isotope}}{\text{mass of one atom of C-12} \times 12}$

D $\dfrac{\text{mass of one atom of the isotope}}{\text{mass of one atom of C-12}} \times 12$

26 Which of the following sets of m/e values correctly represent the mass spectrum of chlorine gas?

A 35 35.5 37 70 71 74
B 35 37 70 72 74
C 35 37 70 74
D 35 37 71

27 A protein (relative molecular mass = 68 000) contains 0.33% if iron by mass. How many moles of iron atoms are there in one mole of the protein?

A 2 **B** 3 **C** 4 **D** 5

28 100 drops of a liquid compound, X, have a total volume of V cm^3. Each drop of the liquid contains n molecules of X. What is the density of X?
[Relative molecular mass of $X = M$; L = Avogadro constant]

A $\dfrac{MLn}{v}$ **B** $\dfrac{100Mn}{LV}$ **C** $\dfrac{100MnL}{V}$ **D** $\dfrac{MLn}{100V}$

29 When excess sulphuric acid is added to 50.0 cm^3 of an aqueous solution containing the Ba^{2+} ions, 0.244 g of barium sulphate is precipitated. What is the concentration of the Ba^{2+} ion in the original solution?
[R.m.m. of $BaSO_4$ = 233]

A 2.09×10^{-2} mol dm^{-3}
B 5.23×10^{-5} mol dm^{-3}
C 3.15×10^{-5} mol dm^{-3}
D 6.25×10^{-6} mol dm^{-3}

30 A hydrated salt (R.m.m. = 120) loses 40% of its mass when heated. What is the relative molecular mass of the anhydrous salt?

A 24 **B** 28 **C** 52 **D** 72

31 A sample of nitrogen trichloride, NCl_3, is analysed in a mass spectrometer. How many molecular peaks can be found in the mass spectrum of NCl_3?
[Chlorine consists of two isotopes, while nitrogen is monoisotopic].

A 3 **B** 4 **C** 5 **D** 6

32 The volume (in cm^{-3}) of a 0.10 mol dm^{-3} silver nitrate solution required to react with 40.0 cm^{-3} of a 0.020 mol dm^{-3} barium chloride solution is

A 4 **B** 8 **C** 12 **D** 16

33 An oxide of nitrogen reacts with hydrogen in the presence of a catalyst to produce ammonia and water according to the equation:

$N_xH_y \rightarrow xNH_3 + yH_2O$

2.24 dm^3 (measured at s.t.p.) of the oxide produces 7.2 g of water and 3.4 g of ammonia. The oxide could be

A N_2O **B** NO **C** NO_2 **D** N_2O_4

34 0.050 g of a monobasic acid reacts with 5.0 cm^{-3} of 0.050 mol dm^{-3} sodium hydroxide. What is the relative molecular mass of the acid?

A 85 **B** 100 **C** 125 **D** 200

35 4.00 g of iron(III) sulphate(VI), $Fe_2(SO_4)_3$ is dissolved in 250 cm^3 of water. What is the molar concentration of the SO_4^{2-} ions? [Relative molecular mass of $Fe_2(SO_4)_3$ = 400]

A 0.010 **B** 0.016 **C** 0.040 **D** 0.12

36 1 dm^3 of helium contains x atoms. How many molecules are there in 1 dm^3 of oxygen gas under the same conditions?

A $\frac{x}{4}$ **B** $\frac{x}{2}$ **C** x **D** $2x$

37 An element *X* consists of two isotopes with nucleon numbers of 20 and 22. If the relative atomic mass of *X* is 20.2, what is the percentage abundance of the lighter isotope?

A 1% **B** 10% **C** 50% **D** 90%

38 The table below list the relative molecular mass of % of *W* for three compounds of *W*.

Compound	*R.m.m.*	*% W*
1	100	48
2	64	50
3	40	40

What is the most probable relative atomic mass of *W*?

A 16 **B** 32 **C** 40 **D** 48

39 Which of the following ions will be deflected most in a mass spectrometer?

A $^{35}Cl^+$ **B** $^{37}Cl^+$ **C** $^{35}Cl_2^+$ **D** $^{35}Cl^{37}Cl^+$

40 The mass spectrum of bromine contains two peaks of equal height at m/e values of 158 and 162, and no other peaks with m/e value greater than 162. The relative atomic mass of bromine is

A 79 **B** 80 **C** 81 **D** 160

41 When 3.17 g of XCl_3 was added to excess aqueous silver nitrate, 8.61 g of silver chloride was precipitated. What is the relative atomic mass of *X*?

[Ag = 108; Cl = 35.5]

A 27 **B** 52 **C** 58 **D** 68

42 Which of the following ions will not be formed when a sample of 2-propanol is analysed in a mass spectrometer?

A $CH_3CH(OH)CH_2^+$ **C** $CH_3CH_2CH_2OH^+$

B $CH_3CHCH_3^+$ **D** $CH(OH)^+$

43 Which one of the following combinations represents the number of α-particles and β-particles emitted when one atom of the isotope $^{233}_{91}X$ disintegrates to one atom of the isotope $^{225}_{89}Y$?

	α-particles	*β-particles*
A	3	1
B	2	1
C	2	2
D	1	3

44 When $^{27}_{13}Al$ is bombarded with high energy neutrons, $^{28}_{13}Al$ is formed. This then disintegrates to $^{28}_{14}Si$ with the emission of

A an α-particle **C** γ-radiation

B an β-particle **D** neutron

45 An isotope $^{216}_{84}X$ disintegrates by emitting 2 α-particles and 2 β-particles to form *Y*. What is the proton number and nucleon number of *Y*?

	Proton number	*Nucleon number*
A	208	82
B	212	82
C	210	83
D	218	84

46 4n atoms of an element *X* (R.m.m. = 186) weighs 446.4 g. What is the mass of *n* atoms of an element *Y* (R.m.m. = 106)?

A 446.4 g **B** 63.6 g **C** 111.6 g **D** 106 g

47 β-particles are best describe as

A ejected from the nucleus when a proton breaks down to form an electron and a neutron

B ejected from the nucleus when a neutron breaks down to form an electron and a proton

C ejected from the nucleus when a neutron breaks down to form a β-particle and an electron

D ejected from the nucleus when an electron breaks down to form a β-particle and a positron

48 Which of the following statement is correct regarding one mole of aluminium?

A 27.0 g of aluminium

B Amount of aluminium which contains exactly 6.02×10^{23} atoms

C Amount of aluminium which occupies 22.4 dm^3 at s.t.p.

D Amount of aluminium that contains the same number of atoms as the number of atoms in exactly 12 g of ^{12}C

49 The mass of a neutron cannot be determined by mass spectroscopy because

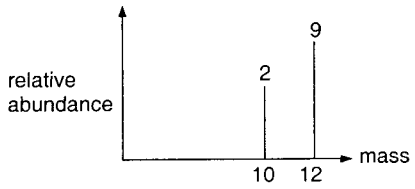
A it is too light **C** it is a mass of zero on the ^{12}C scale

B it is neutral **D** it has the same mass as a proton

50 When 0.50 moles of a hydrocarbon is burned completely in excess of oxygen, 36 g of water and 44.8 dm^3 (measured at s.t.p.) of carbon dioxide is produced. The molecular formula of the hydrocarbon is

A C_2H_6 **B** C_3H_8 **C** C_4H_8 **D** C_4H_{10}

51



The relative atomic mass of the above element is

A $\frac{10 + 12}{2}$ **C** $\frac{(2 \times 10) + (9 \times 12)}{10 + 12}$

B $\frac{(10 \times 9) + (2 \times 12)}{10 + 12}$ **D** $\frac{(2 \times 10) + (12 \times 9)}{2 + 9}$

52 The relative atomic mass of carbon (proton number 6) is 12.011. Carbon has two isotopes having 6 and 7 neutrons respectively. What is the percentage composition of the lighter isotope?

A 13.0 **B** 42.0 **C** 29.0 **D** 99.0

53 The number of ions in 0.10 m of iron(III) chloride is

A $1 \times 0.10 \times 6.02 \times 10^{23}$ **C** $3 \times 0.1 \times 6.02 \times 10^{23}$

B $2 \times 0.1 \times 6.02 \times 10^{23}$ **D** $4 \times 0.1 \times 6.02 \times 10^{23}$

54 Which one of the following isotopes would be formed by the emission of a β-particle followed by γ-radiation from $^{14}_{6}C$?

A $^{13}_{6}C$ **B** $^{13}_{7}N$ **C** $^{14}_{7}N$ **D** $^{13}_{6}C$

55 Bromine consists of two isotopes, Br-79 and Br-81. The relative molecular mass of bromine is 159.8. What is the percentage composition of the Br-79 isotope?

A 38.6 **B** 45.0 **C** 50.0 **D** 55.0

56 Which of the following statements regarding the isotope ^{23}Na is correct?

A It is unstable
B It contains 11 proton and 23 neutron
C It contains 11 protons, 12 neutrons and 12 electrons
D If a proton is added to its nucleus, an isotope of magnesium is produced.

57 On the ^{12}C scale, the relative atomic mass of ^{12}C is

A 1 **B** 6 **C** 12 **D** $\frac{12}{6.02 \times 10^{23}}$

58 A hydrated salt has the formula of $M.nH_2O$. When x g of the hydrated salt is heated, y g of anhydrous salt is left. The value of n in the formula is
[Relative molecular mass of M is M_r]

A $\frac{(x - y)y}{18M_r}$ **C** $\frac{M_r(x - y)}{18y}$

B $\frac{18M_r(x - y)}{xy}$ **D** $\frac{(x - y)M_r}{18}$

59 20 dm^3 (measured at room conditions) of an air sample is bubbled through limewater so that all the carbon dioxide are precipitated as calcium carbonate. The mass of calcium carbonate obtained is 0.40 g. What is the percentage by volume of carbon dioxide in the air sample?

A 0.24 **B** 0.48 **C** 0.72 **D** 0.76

60 Ammonia burns in oxygen according to the equation

$$4NH_3(g) + 3O_2(g) \rightarrow 2N_2(g) + 6H_2O(g)$$

100 cm^3 of ammonia is burnt in 100 cm^3 of oxygen. What is the volume of oxygen remaining?

A 25 cm^3 **B** 50 cm^3 **C** 75 cm^3 **D** 80 cm^3

61 The relative atomic mass of sodium is 23 and its density is 0.97 g cm^{-3}. If the volume of one sodium atom is V, what is the value for the Avogadro constant?

A $\frac{23 \times 0.97}{V}$ **B** $\frac{0.97}{23}$ **C** $\frac{23V}{0.97}$ **D** $\frac{23}{0.97V}$

62 Which of the following ions will not give a peak in the mass spectrum of 1-propanol?

A $CH_3CH_2CH_2OH^+$
B $CH_2CH_2OH^+$
C CH_3^+
D $CH_3CH_2OH^+$

63 A beaker contains 250 cm^3 of a 0.40 mol dm^{-3} of sodium hydroxide. Water is added to the solution to increase its volume to 1.0 dm^3. What is the new concentration of the sodium hydroxide solution?

A 0.10 mol dm^{-3}
B 0.40 mol dm^{-3}
C 0.80 mol dm^{-3}
D 1.60 mol dm^{-3}

64 The molecule NCl_3 consists of ^{14}N, ^{35}Cl and ^{37}Cl atoms. How many different molecular ion peak will be observed in the mass spectrum of the molecule?

A 1 **B** 2 **C** 3 **D** 4

65 Which of the following species will be deflected the most in a mass spectrometer?

A $^{35}Cl_2^+$ **B** $^{37}Cl_2^+$ **C** $^{35}Cl^{37}Cl^+$ **D** $^{35}Cl_2^{2+}$

66 When a sample of chlorine gas (^{35}Cl and ^{37}Cl) is analysed in a mass spectrometer, the relative abundance of the three molecular peak of mass 70, 72 and 74 is 9 : 6 : 1. What is the relative abundance of the ^{35}Cl to the ^{37}Cl isotope?

A 1 : 1 **B** 1 : 2 **C** 1 : 3 **D** 3 : 1

67 Chlorine consists of two isotopes ^{35}Cl and ^{37}Cl in the ratio of 3 : 1. The mass spectrum of chlorine consists of three molecular peaks at m/e 70, 72 and 74. What is the relative abundance of these three peaks?

A 1 : 6 : 9 **B** 1 : 3 : 3 **C** 9 : 6 : 1 **D** 70 : 72 : 74

68 50 cm^3 of methane, CH_4, is completely burned in 200 cm^3 of oxygen. What is the total volume of the mixture at room temperature?

A 50 cm^3 **B** 100 cm^3 **C** 150 cm^3 **D** 250 cm^3

69 0.10 g of a monobasic acid requires 12.6 cm^3 of 0.25 mol dm^{-3} sodium hydroxide for complete reaction. What is the relative molecular mass of the acid?

A 31.7 **B** 63.4 **C** 95.1 **D** 126.8

70 4.8 dm^3 of a gaseous organic compound (measured at room conditions) burns completely in oxygen to produce 35.2 g of carbon dioxide. How many carbon atoms are there in one molecule of the organic compound?

A 2 **B** 4 **C** 6 **D** 8

71 In which of the following ions is the number of protons and neutrons the same but the number of protons is less than the number of electrons?
[D = deuterium, ^2H]

A OD^+ **B** OH^- **C** H_3O^+ **D** D^-

72 The volume of 100 drops of an organic acid (R.m.m. = 350) is V cm^3. Each drop of the acid consists of n molecules and the density of the acid is 0.98 g cm^{-3}, what is the expression for the Avogadro constant?

A $\frac{0.98 \times 100 \times V}{350 \times n}$ **C** $\frac{0.98 \times 100 \times V \times n}{350}$

B $\frac{350 \times 100 \times n}{0.98 \times V}$ **D** $\frac{350 \times n \times V}{100 \times 0.98}$

Section B

A	B	C	D
1 only is correct	1 and 2 only are correct	2 and 3 only are correct	1,2 and 3 are correct

73 Which of the following particles can be describe as nucleons?
1 Proton
2 Neutron
3 Electron

74 One mole of carbon dioxide contains an Avogadro number of
1 carbon atoms
2 carbon dioxide molecules
3 oxygen atoms

75 The proton number of argon and potassium is 18 and 19 respectively. However, their relative atomic mass is 40 and 39 respectively. Which of the following statements regarding the most abundant isotopes of argon and potassium is/are correct?
1 Atoms of argon contain more neutrons than atoms of potassium
2 Atoms of argon contain more protons than atoms of potassium
3 Atoms of argon contain more electrons than atoms of potassium

76 The degree of deflection of a positive ion in a mass spectrometer depends on
1 the charge on the ion
2 the mass of the ion
3 the strength of the magnetic field

77 Which of the following statements regarding the isotopes ^{32}P and ^{32}S are correct?
1 ^{32}P contains more neutron than ^{32}S
2 If a neutron is added to ^{32}P, ^{32}S is produced
3 Atoms of both isotopes contains 32 electrons

78 The mass spectrum of a sample of bromine consists of a peak at m/e 79. Which of the following species is/are responsible for this peak?
1 $^{79}Br^{+}$ 2 $^{79}Br_2^{2+}$ 3 $^{79}Br^{2+}$

79 The relative molecular mass of chlorine, Cl_2, is 71. However no atom of chlorine of relative atomic mass 35.5 exists. Correct statements about this phenomenon include
1 naturally chlorine consists of isotopes
2 no chlorine molecule of relative mass 71 can exists
3 chlorine-35.5 is radioactive

80 The relative atomic mass of diamond is 12.011. It can be concluded that
1 diamond consists of two isotopes of carbon, ^{12}C and ^{13}C
2 the relative atomic mass of graphite is also 12.011
3 the relative abundance of ^{12}C is much higher than that of ^{13}C

81 A radioactive element *W* disintegrates according to the sequence:

$$W \xrightarrow{\beta} X \xrightarrow{\alpha} Y \xrightarrow{\beta} Z$$

Which of the following is/are true regarding the above disintegration?
1 *W* and *Z* are isotopes
2 *Y* and *Z* are isotopes
3 The nucleon number of *X* and *Z* is the same

82 An element *X* (relative atomic mass = 69.3) consists of two isotopes with relative isotopic mass of 69 and 71. Which of the following statements is/are correct regarding *X*?
1 There are more ^{69}X atoms than there are ^{71}X atoms in a sample of *X*.
2 ^{71}X has two more neutrons than ^{69}X
3 Both the isotopes have the same electronic configuration

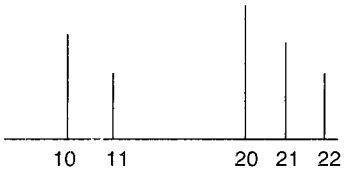
83 Which of the following contains the same number of atoms as the number of atoms in one mole of oxygen gas?
1 1.0 mol nitrogen gas
2 0.5 mol ammonia
3 0.5 mol nitrogen monoxide

84 Which of the following solution contains the same number of particles as the number of particles in 250 cm^{-3} 2.0 mol dm^{-3} sodium chloride?
1 1 dm^3 of 1.0 mol dm^{-3} ethanol
2 500 cm^{-3} of 1.0 mol dm^{-3} hydrochloric acid
3 500 cm^{-3} of 1.0 mol dm^{-3} ethanoic acid

85 The main features of a mass spectrometer includes
1 production of positive ions from the gaseous sample
2 measurement of the ionisation energy of the element
3 detection of electrons

86 ^{12}C was chosen as the standard in the determination of relative atomic mass because
1 it is a solid at room conditions
2 it has a mass of exactly 12 g
3 it is the only stable isotope of carbon

87 The mass spectrum of an gaseous element is shown below.



Which of the following statements are true?
1 The element is a diatomic gas
2 The element has 5 isotopes
3 The relative molecular mass is 20

88 The process $^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr$ is accompanied by the emission of
1 neutrons 2 protons 3 electrons

89 Isotopes of the same element differ in their
1 relative masses
2 first ionisation energy
3 chemical reactivity

90 The Avogadro constant can be calculated from
1 $\dfrac{\text{mass of 1 mole of carbon-12}}{\text{mass of 1 atom of carbon-12}}$
2 $\dfrac{\text{volume of 1 mole of chlorine gas}}{\text{volume of a chlorine molecule}}$
3 $\dfrac{\text{mass of 1 mole of oxygen gas}}{\text{mass of 1 oxygen atom}}$

91 Which of the following statements are correct regarding the structure of atoms?
1 All atoms contain proton, neutron and electron
2 Atoms with the same proton number but different nucleon number are atoms of the same element.
3 Almost all of the mass of an atom is concentrated in the nucleus.

92 The mass spectrum of ethanol consists of a peak of very low intensity at m/e of 47. This peak could be cause by
1 the presence of the ^{13}C isotope
2 the presence of the ^{2}H isotope
3 the $[C_2H_5OH]^{2+}$ ion

93 An organic compound has the following composition by mass:
C, 40.0%; H, 6.7%; O, 53.3%
It can be concluded that
1 its empirical formula is CH_2O
2 its molecular formula is $C_2H_4O_2$
3 its relative molecular mass is 60

94 The Avogadro constant refers to
1 the number of electrons in one mole of electron
2 the molar volume of a gas at s.t.p.
3 the relative atomic mass of an element expressed in gram

95 Which of the following aqueous solutions contains the same number of particles as the number of ions in 250 cm^3 of 2 mol dm^{-3} potassium nitrate?
1 1 dm^3 of 1 mol dm^{-3} 1-propanol
2 500 cm^3 of 1 mol dm^{-3} nitric(V) acid
3 250 cm^3 of 2.5 mol dm^{-3} magnesium chloride

96 Bromine consists of two isotopes of ^{79}Br and ^{81}Br in the ratio of 1 : 1. It can be concluded that
1 the mass spectrum of bromine will consists of three molecular peaks with the relative abundance of 1 : 2 : 1
2 The relative atomic mass of bromine is 80
3 ^{81}Br is radioactive while ^{79}Br is not radioactive

97 Which of the following statements regarding the ^{13}C isotope are correct?
1 It has the same chemical properties as ^{12}C
2 It is heavier than ^{12}C
3 It is denser than ^{12}C

98 1 mole of an organic compound on complete combustion in excess of oxygen produces 4 moles of water. The compound could be
1 C_3H_8 2 C_4H_8 3 $CH_3CH_2OCH_3$

99 The empirical formula of a compound shows
1 the type of different atoms present
2 the actual number of each type of atoms present in one molecule
3 the type of bonds in the molecule

100 Which of the following properties can be used to differentiate between ^{35}Cl and ^{37}Cl?
1 Relative mass 2 Oxidising power 3 Colour

101 In a mass spectrometer, the deflection of a positively charge ion increases with
1 increasing charge on the ion
2 increasing mass of the ion
3 increasing speed of the ion

102 Which of the following statements is/are correct regarding radioactive decay?
1 The β particle emitted comes from the decomposition of the neutron in the nucleus
2 All radioactive decays involve emission of charged particles
3 When an α particle is emitted, the daughter nucleus contains 4 proton less than the original nucleus

103 The mass spectrum of a gaseous element consists of only two lines of relative mass 40 and 42 in the ratio 4: 1. Which of the following statements are true?

1 Its relative atomic mass is 40.0
2 It is a monatomic gas.
3 It is consists of two isotopes only

104 The proton numbers of three elements X, Y and Z are m, $m+1$ and $m+2$ respectively (where $m \neq 1$). Z forms only one stable ion of Z^+. It can be concluded that

1 X is a halogen
2 the atom of Y has more electrons than the atom of Z
3 X, Y and Z are in the same period in the Periodic Table

105 The relative molecular mass of chlorine is 71.0. From this data alone it can be concluded that

1 the relative atomic mass of chlorine is 35.5
2 all chlorine molecules are 71 times heavier than $\frac{1}{12}$ times the mass of one atom of carbon-12
3 chlorine consists of two isotopes, ^{35}Cl and ^{37}Cl

106 Which of the following is true regarding the atom $^{3}_{1}T$?

1 It is an isotope of hydrogen
2 It contains 3 protons in the nucleus
3 It has a relative mass of 1

107 A radioactive isotope X emits one α-particles followed by two β-particles to form Z. Which of the following statements is/are **not** true?

1 The atoms of Z contain two protons, two neutrons and two electrons less than atoms of X
2 Both Z and X contains the same number of electrons
3 Element Z occupies the same position in the Periodic Table as element X.