CHEMISTRY ONLINE
TUITION

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CHEMISTRY

Physical Chemistry

Level & Board	**OCR (AS-LEVEL)**
TOPIC:	**ATOMIC STRUCTURE**
PAPER TYPE:	**SOLUTION -2**
TOTAL QUESTIONS	**12**
TOTAL MARKS	**36**

Atomic Structure - 2

Q.1

(a) Example of isotopes:

	$^{16}_{8}O$	,	$^{18}_{8}O$
Protons	8		8
Electron	8		8
Neutron	16-8 =8		18-8 =10

- Same number of Protons and Electrons
- Different number of Neutrons

(b)

Element	Mass No	Protons	Neutrons	Electron	Electric charge
Na (sodium)	23	11	12	11	-1
K (Potassium)	39	19	20	19	0

Q.2

(i)

	Protons	Neutrons	Electrons
^{18}O	8	10	8

(ii)

R.A.M Calculation

$$R.A.M = \frac{(16\times92.76)+(18\times7.24)}{100}$$

$$= \frac{1484.16 + 130.32}{100}$$

$$= \frac{1614.48}{100}$$

$= 1614.48$

Rounding off two decimal places

$= 16.14$

Q.3

(i)

m/z	Protons	Neutrons	Electrons
24	12	12	12
25	12	13	12
26	12	14	12

(ii)

$$R.A.M = \frac{\sum isotopic\ mass \times abundance}{Total\ abundance}$$

$$= \frac{(24\times79)+(25\times10)+(26\times10)}{100}$$

$$= \frac{1896 + 250 + 286}{100}$$

$$= \frac{2432}{100}$$

$$= 24.32$$

Q.4

(a) Isotopes have the same number of Protons but different number of neutrons

(b) $$R.A.M = \frac{\sum isotopic\ mass \times abundance}{Total\ abundance}$$

$$= \frac{(107 \times 46) + (109 \times 54)}{100}$$

$$= \frac{4922 + 5886}{100}$$

$$= 108.08\ amu$$

(ii) Step 1: 64% of 7g would be

$$= 7 \times \frac{64}{100} \quad = 4.48\ grams$$

Now calculate the moles by using formula

$$Moles = \frac{given\ mass}{Moles\ mass}$$

$$= \frac{4.48}{197}$$
$$= 0.022\ moles$$

Step 2: No of particles = moles×N_A

= 0.022×6.02×10^{23}

= 1.869×1022 atoms of gold

Q.5

Relative	Relative mass	Relative charge	Position
Proton	1	+1	Nucleus
Neutron	1	0	Nucleus
Electron	$\frac{1}{2000}$	-1	shell

Q.6 Two isotopes of hydrogen

H-1 , H-2

Let x be the abundance of H-1

Therefore, abundance of H-2 would be

= 100-x

Isotope mass	Abundance
1	X
2	100-x

Using the formula of R.A.M

$$1.01 = \frac{(1 \times x) + (2 \times (100 - x))}{100}$$
$$1.01 \times 100 = x + 200 - 2x$$
$$101 = x + 200 - 2x$$
$$101 = 200 - x$$
$$101 - 200 = -x$$
$$-99 = -x$$
$$x = 99\%$$

The abundance of H-1 is 99% where as H-2 is 1%

Q.7 (a)

(i) Atoms of the same element, with same number of Protons and different number of neutrons

(ii) Chemical properties are same because of same Electronic configuration of isotopes.

(iii)

Protons	Neutrons	Electrons
78	117	78

(b)

(i) Average mass of atom compared to $\frac{1}{12^{th}}$ of an atom of C-12

(ii) Let x be the mass of other isotope of Platinum

Isotope mass	Abundance
195	90
X	100-90 =10

Now apply the formula of R.A.M

$$R.A.M = \frac{(195 \times 90) + (x \times 10)}{100}$$

$$195.08 = \frac{17550 + 10x}{100}$$

Note: R.A.M given in the question

$195.08 \times 100 = 17550 + 10x$

$19508 = 17550 + 10x$

$19508 - 17550 = 10x$

$1958 = 10x$

$x = 195.8$

Q.8

(i) R.A.M $\frac{\sum isotopic\ mass \times abundance}{Total\ abundance}$

$$= \frac{(10 \times 18.7) + (11 \times 81.3)}{100}$$

$$= \frac{187 + 894.3}{100}$$

$$= \frac{1081.3}{100}$$

$$= 10.813\ amu$$

(ii) The element is likely to be Boron

Q.9

(a)

	Protons	Neutrons	Electrons
$^{166}Ho^{3+}$	67	99	64

(b)

1st - subshell – 2
3p orbital – 2
3rd shell – 18

Q.10

(i) Average mass of an atom compared to 1/12th of mass of atom of carbon – 12

(ii) Let x be the mass of third isotope

Isotope	Abundance
18	24.3
19	65.5
x	100 - (65.5+24.3)= -10.2

R.A.M is already given so apply the formula

$$18.99 = \frac{(18 \times 24.3) + (19 \times 65.5)(x \times 10.2}{100}$$

$$18.99 \times 100 = 437..4 + 1244.5 + 10.2x$$

$$1899 = 1681.9 + 0.2x$$

$$1899 - 1681.9 = 10.2x$$

$$x = \frac{217.1}{10.2} = 21.28$$

So, isotopes has mass of approx. 21.28

Q.11

(i) Average mass of an atom compared to 1/12th of mass of atom of carbon – 12

(ii) Apply the formula

$$R.A.M = \frac{\sum isotopic\ mass \times abundance}{Total\ abundance} = \frac{(63 \times 69.17) + (65 \times 30.83)}{100}$$

$$= \frac{4357.71 + 2003.95}{100}$$

$$= 63.61\ amu$$

Q.12

Radicle	Charge	Number of each particle present in a $^{150}_{65}Tb^{2+}$
Proton	+1	65
Neutron	0	85
Electron	-1	68

- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students UK and worldwide since 2008
- CIE & EDEXCEL Examiner since 2015
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