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1. Two elements X and Y need to be arranged in Mendeleev's periodic table. X has 3 protons more than Y but their neutrons are equal in number. Which of the following is correct about X and Y?

- ☒ A. X will be placed after Y
- ☐ B. X and Y should be placed together.
- ☐ C. X and Y are isotopes.
- ☐ D. Y will be placed after X.

In Mendeleev's periodic table, elements are arranged according to increasing atomic mass. Now since neutrons and protons are responsible for the atomic mass of an atom, so X will be placed after Y.

2. Identify the option that is not one of the Dobereiner's triad?

- ☒ A. Chlorine-35, Bromine-80, Iodine-127
- ☒ B. Potassium-39, Chlorine-35.5, Bromine-80
- ☒ C. Calcium-40, Strontium-88, Barium-137
- ☒ D. Lithium-6, Sodium-22, Potassium-39

A Dobereiner's triad is formed in such a way that the average atomic mass taken of the first and last element is equal to the atomic mass of the element in the middle. On applying this to the given options we have:

1) Calcium (Ca)-40, strontium (Sr)-88, barium (Ba)-137

$$\frac{\text{Atomic mass of Ca} + \text{Atomic mass of Ba}}{2} = \text{Atomic mass of Sr}$$

$$\text{Arithmetic mean of first and third element} = \frac{40+137}{2} = \text{Atomic mass of Sr} = 88$$

Hence it is a Dobereiner's triad.

2) Chlorine (Cl)-35, bromine (Br)-80, iodine (I)-127

$$\frac{\text{Atomic mass of Cl} + \text{Atomic mass of I}}{2} = \text{Atomic mass of Br}$$

$$\text{Arithmetic mean of first and third element} = \frac{35+127}{2} = \text{Atomic mass of Br} = 80$$

Hence it is a Dobereiner's triad.

3) Lithium (Li)-6, sodium (Na)-22, potassium (K)-39

$$\frac{\text{Atomic mass of Li} + \text{Atomic mass of K}}{2} = \text{Atomic mass of Na}$$

$$\text{Arithmetic mean of first and third element} = \frac{6+39}{2} = \text{Atomic mass of Na} = 22$$

Hence it is a Dobereiner's triad.

4) Potassium (K)-39, chlorine (Cl)-35.5, bromine (Br)-80

$$\frac{\text{Atomic mass of K} + \text{Atomic mass of Br}}{2} \neq \text{Atomic mass of Cl}$$

Hence it is not a Dobereiner's triad.

3. The atomic masses of X and Z are 20 u and 40 u, respectively. If X, Y and Z form a Dobereiner's triad, what should be the atomic mass of Y?

- ☐ A. 20 u
- ☐ B. 40 u
- ☒ C. 30 u
- ☐ D. 50 u

According to Dobereiner's law of triads, the atomic mass of the middle element of the triad is equal to the arithmetic mean of the atomic masses of the other two elements.

Since, Y is the middle element of the triad, its mass should be the average of X and Z, that is,

$$\text{Mass of Y} = \frac{\text{Mass of X} + \text{Mass of Z}}{2} = \frac{20u + 40u}{2} = 30 u$$

4. Identify the set of elements that will form Dobereiner triad.

- ☒ A. Lithium, sodium, potassium
- ☐ B. Nitrogen, phosphorus, arsenic
- ☐ C. Helium, neon, argon
- ☐ D. Helium, hydrogen, potassium

According to Dobereiner, when the three elements in a triad are written in the increasing order of atomic masses, the atomic mass of the middle element is roughly the average of the atomic masses of the other two elements. When we apply this to the given options, then we have:

(A) Atomic mass of lithium = 7, sodium = 23 and potassium = 39

$$\Rightarrow \frac{(7+39)}{2} = 23$$

(B) Atomic mass of helium = 4, neon = 20 and argon = 40

$$\Rightarrow \frac{(4+40)}{2} = 22$$

(C) Atomic mass of nitrogen = 14, phosphorus = 31 and arsenic = 75

$$\Rightarrow \frac{(14+75)}{2} = 44.5$$

(D) Atomic mass of lithium = 7, calcium = 40 and potassium = 39

$$\Rightarrow \frac{(7+39)}{2} = 23$$

In the given options, only the set consisting of lithium, sodium, and potassium is satisfying Dobereiner's triad.

5. Which of the following statements is correct?

- ☒ A. Law of octaves worked quite well for heavier elements but failed for lighter elements.
- ☒ B. Law of octaves failed for both lighter elements and heavier elements.
- ☒ C. Law of octaves worked quite well for lighter elements but failed for heavier elements.
- ☒ D. Law of octaves was first given by Mendeleev.

John Newlands arranged the then discovered elements in the order of their increasing atomic masses.

He noticed that every eighth element exhibits similar properties as compared to the first element. He called this observation as the 'Law of Octaves' better known as 'Newlands' Law of Octaves'.

Law of octaves worked quite well for lighter elements but failed with heavier elements. This is one of the demerits of Newlands' law of octaves.

6. How many groups and periods are there in the modern periodic table?

- ☒ A. 18 Groups and 7 Periods
- ☐ B. 7 Groups and 18 Periods
- ☐ C. 18 Groups and 9 Periods
- ☐ D. 18 Groups and 18 Periods

The Modern periodic table has vertical columns called groups and horizontal rows called periods. There are 18 groups and 7 periods in total.

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	*	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	**	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
119 Uun																	
			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

7. Which of the following statement is incorrect regarding the given elements?

		1	2		13	14	15	16	17	18
1										
2		EE				FF			AA	
3			CC				DD			BB

- ☒ A. AA is the most electronegative element
- ☒ B. BB is a noble gas
- ☒ C. CC is an alkali metal
- ☒ D. DD has 5 electrons in its outermost shell

CC belongs to the second group of the periodic table. Hence, it is an alkaline earth metal.

8. Metallic character _____ down the group in the periodic table.

- ☒ A. increases
- ☒ B. decreases
- ☒ C. increases and then decreases
- ☒ D. decreases and then increases

Metallic character is the tendency of an element to lose an electron easily. As we go down the group, the size of atoms increases.

Due to this, the effective nuclear charge experienced by valence electrons decreases as electrons are farther away from the nucleus and hence, electrons can be lost easily. Therefore, metallic character increases down the group.

9. Which of the following elements has twice as many electrons in its second shell as it has in its first shell?

- ☒ A. Carbon
- ☐ B. Nitrogen
- ☐ C. Oxygen
- ☐ D. Sulphur

K-shell of an atom can accommodate maximum of two electrons. According to the question, the L-shell of the element must have twice as many electrons it has in its K-shell, which means L-shell must have four electrons. Therefore, the atomic number of this element must be six. Here, carbon is the element which has atomic number six.

10. The valency of aluminium is :

- ☐ A. 1
- ☐ B. 2
- ☒ C. 3
- ☐ D. 4

The atomic number of aluminium is 13. So, the electronic configuration is 2, 8, 3. It loses 3 electrons and form Al^{3+} ion, therefore it has a valency of 3.