Solution 1
(a) Mendeleev arrange the element in his periodic table on the basis of atomic masses.
(b) Now they are arranged on the basis of atomic numbers.
Solution 2
(a) False
(b) False
(c) False
Solution 3
Mendeleev said that the properties of elements are a periodic function of their atomic masses.
Solution 4
(a) Periods have elements with consecutive atomic numbers.
(b) Correct.
(c) Correct.
Solution 5
(a) Newlands.
(b) Dobereiner.
Solution 6

$$\text{Mass of B} = \frac{7 + 39}{2} = 23$$

Solution 7
Six elements.
Solution 8
Mendeleev's basis for the classification of elements was the atomic mass of elements.
Solution 9
Mendeleev was guided by two factors:
(i) Increasing atomic masses.
(ii) Grouping together of elements having similar properties.
Solution 10
Gallium and Scandium.
Solution 11
Scandium, Gallium, Germanium.
Solution 12
Eka-Aluminium (gallium) and Eka-Silicon (germanium).
Solution 13
The elements lithium, sodium and potassium form a Dobereiner's triad. Lithium is the first element of this triad, sodium is the middle element whereas potassium is the third element of the triad.
Sodium (middle element) has atomic mass 23.
According to Dobereiner,

$$\text{Atomic mass of Sodium} = \frac{\text{At.mass of Li} + \text{At.mass of K}}{2} = \frac{7 + 39}{2} = 23$$

Solution 14
Noble gases. Since they are chemically unreactive, so they got a place in the periodic table in the form of a separate group and hence did not disturb the original order of Mendeleev's periodic

table

Solution 15
(a) Atomic number .
(b) Periods.
(c) Alkali metals .
(d) Halogens .
(e) Noble Gases .
(f) Eighth.
Solution 16
(a)(i) The vertical columns in a periodic table are called groups.
(ii) The horizontal rows of elements in a periodic table are called periods.
(b) There are seven periods and eighteen groups in the long form of periodic table.
(c) (i) Group 1: Lithium and Sodium.
(ii) Group 17: Fluorine and Chlorine.
(iii) Group 18: Neon and Argon.
Solution 17
(a) Lithium, Beryllium are metals.
(b) The real significance of atomic number in the modern periodic classification is that it relates the periodicity in the properties of elements to the periodicity in their electronic configurations.
Example: The atomic number increases from 3 in lithium to 11 in sodium, there is a repetition of electronic configuration from 2,1 to 2,8,1 (both having 1 valence electron).
Solution 18
(a) Position of isotopes: All the isotopes of an element have the same number of protons, so their atomic number is also the same. Since, all the isotopes of an element have the same atomic number; they can be put at one place in the same group of the periodic table.
(b) Position of Cobalt and Nickel: The atomic number of cobalt is 27 and that of nickel is 28. According to modern periodic law, the elements are arranged in order of increasing atomic numbers. So, cobalt with lower atomic number (27) should come first and nickel with higher atomic number (28) should come later, even if their atomic masses are in the wrong order.
(c) Position of hydrogen: Hydrogen has been placed at the top of group 1, above the alkali metals in the modern periodic table because the electronic configuration of hydrogen is similar to those of alkali metals. Both, have 1 valence electron each.
Solution 19
(a) Left side.
(b) Right side.
(c) Metalloids.
Solution 20
(a) Lithium, Sodium, Potassium .
(b) Magnesium, Calcium .
(c) Helium, Neon, Argon .
Solution 21
Dobereiner's law of triads: When elements are arranged in order of increasing atomic masses, groups of three elements (triads), having similar chemical properties are obtained. The atomic mass of the middle elements of the triad being equal to the arithmetic mean of the atomic masses of the other two elements.
For example: Alkali metal group (Dobereiner's triad) : Lithium is the 1st element, sodium is the middle element whereas potassium is the 3rd element of the triad.
Solution 22
According to the Newlands' law of octaves, when elements are arranged in the order of increasing atomic masses, the properties of the eighth element (starting from a given element) are a repetition of the properties of the first element.
For example: If we start with lithium as the first element, we find that

the eighth element from it is sodium having the similar properties to lithium.

Solution 23

(a)Yes,Dobereiners triads also exist in the columns of Newlands' Octaves.

Consider the elements lithium (Li), sodium (Na) and potassiu m (K) which are present in the second column of Newlands' classification of elements. Now, if we start with lithium as the 1 st element, then the 8 th element from it is sodium, and according to Newlands' law of octaves, the properties of 8 th element , sodium should be similar to thos e of the 1 st element, lithium. Again, if we take sodium as the 1 st element, then the 8 th element from it is potassium, and according to Newlands ' law of octaves, the properties of 8 th element, potassium should be similar to those of the 1 st element, sodium. This means that according to Newlands' law of octaves, the elements lithium, sodium and potassium should have similar chemical properties. We also know that lithium, sodium and potassium form a Dobereiner's triad having similar chemical properties. From this, we conclude that Dobereiners triads also exist in the columns of Newlands Octaves.

(b) The main limitation of Dobereiner's classification of elements was that it failed to arrange all the then known elements in the form of triads of elements having similar chemical properties. Dobereiner could identify only three triads from the elements known at that time. So, his classification of elements was not much successful. Another limitation was that Dobereiner failed to explain the relation between atomic masses of elements and their chemical properties.

(c) Newlands' law of octaves for the classification of elements had the following limitations:

(i) Newlands' law of octaves was applicable to the classification of elements up to calcium only. After calcium, every eighth element did not possess the properties similar to that of the first element. Thus, this law worked well with lighter elements only.

(ii) Newlands assumed that only 56 elements existed in nature and no more elements would be discovered in the future. But later on, several new elements were discovered whose properties did not fit into Newlands' law of octaves.

(iii) In order to fit elements into his table, Newlands put even two elements together in one slot and that too in the column of unlike elements having very different properties. For example, the two elements cobalt (Co) and nickel (Ni) were put together in just one slot and that too in the column of elements like fluorine, chlorine and bromine which have very different properties from these elements.

Solution 24

(a) According to Mendeleev's periodic law: The properties of elements are a periodic function of their atomic masses. It was the discovery of atomic number which led to a change in Mendeleev's periodic law which was based on atomic mass.

(b) The noble gases are placed in a separate group because they are chemically very inert or unreactive (having completely filled outermost electron shells).

Solution 25

(a) Merits of Mendeleev's classification of elements:

(i) Mendeleev's periodic law predicted the existence of some elements that had not been discovered at that time.

(ii) Mendeleev's periodic table could predict the properties of several elements on the basis of their positions in the periodic table.

(iii) It could accommodate noble gases when they were discovered.

(b) Anomalies of Mendeleev's classification of elements:

(i) The position of isotopes could not be explained: If the elements are arranged according to atomic masses, the isotopes should be placed in different groups of the periodic table. But, the isotopes were not given separate places in Mendeleev's periodic table. They

were placed at the same place in the table. This placing of the isotopes at same place could not be explained by Mendeleev's periodic law.
(ii) Wrong order of atomic masses of some elements could not be explained: In Mendeleev's periodic table, when certain elements were put in their correct group on the basis of their chemical properties, it was found that the element with higher atomic mass comes first and the element with lower atomic mass comes later. Mendeleev's periodic law could not explain this abnormal situation of wrong order of atomic masses.
Solution 26
(a) Eka-aluminium and gallium are the two names of the same element as Eka -Aluminum has almost exactly the same properties as the actual properties of the gallium element. The properties: atomic mass, density, melting point, formula of chloride and formula of oxide are almost the same.
(b) (i) Eka boron.
(ii) Eka aluminum.
(iii) Eka -silicon.
Solution 27
(a) The elements are classified into groups so that the elements with similar properties fall in the same group and hence the study of a large number of elements is reduced to the study of a few group of elements.
(b) (i) Increasing atomic masses
(ii) Grouping together of elements having similar properties.
(c) In order to make sure that the elements having similar properties fell in the same vertical column or group, Mendeleev left some gaps in his periodic table.
(d) Out of eight groups in the original periodic table of Mendeleev, first seven groups are of normal elements and eighth group is of transition elements. Noble gases were not known at that time. So, there was no group of noble gases in Mendeleev's table.
(e) The isotopes of chlorine, Cl-35 and Cl-37 are placed in the same slot because they have similar chemical properties and same atomic number.
Solution 28
(a) Mendeleev's periodic law: The properties of elements are a periodic function of their atomic masses. It was the discovery of atomic number which led to a change in Mendeleev's periodic law which was based on atomic mass.
(b) The elements having similar chemical properties form oxides and hydrides having similar formulae. Mendeleev used these properties for creating his periodic table.
(c) Limitations of Mendeleevs classification of elements:
(i) The position of isotopes could not be explained.
(ii) Wrong order of atomic masses of some elements could not be explained.
(iii) A correct position could not be assigned to Hydrogen in the periodic table.
(d) Silicon and Germanium.
(e) Noble gases were missing from Mendeleev's original periodic table.
Solution 29
(a) The modern periodic law states that the properties of elements are a periodic fu nction of their atomic numbers.
(b) When elements are arranged according to increasing atomic numbers, there is a periodicity in the electronic configurations of the elements. The elements in a period have consecutive atomic numbers. The elements having same number of valence electrons in their atoms are placed in a group. All the elements in a group have similar electronic configurations and show similar properties.
(c) When the elements are arranged according to their atomic numbers on the basis of modern periodic law, then all the anomalies (or defects) of Mendeleev's classification disappear. This

is discussed below:
(i) Explanation for the Position of Isotopes: All the isotopes of an element have the same number of protons, so their atomic number is also the same. Since all the isotopes of an element have the same atomic number, they can be put at one place in the same group of the periodic table. For example, both the isotopes of chlorine, Cl-35 and Cl-37, have the same atomic number of 17, so both of them can be put at one place in the same group of the periodic table.
(ii) Explanation for the Position of Cobalt and Nickel: The atomic number of cobalt is 27 and that of nickel is 28. Now, according to modern periodic law, the elements are arranged in the order of increasing atomic numbers. So, cobalt with lower atomic number (27) should come first and nickel with higher atomic number (28) should come later, even if their atomic masses are in the wrong order.
(iii) Explanation for the Position of Hydrogen: Hydrogen element has been placed at the top of group 1, above the alkali metals because the electronic configuration of hydrogen is similar to those of alkali metals. Both, hydrogen as well as alkali metals have 1 valence electron each.
(d) Atomic number is always a simple whole number. It can either be 1 or 2. There can be no element with atomic number 1.5.
(e) The modern periodic table was prepared by Bohr.

********** END **********