M Prakash Institute   **29 January 2023**   **XI Entrance Test 2**
Each question carries five marks   **2pm to 5pm**   **Paper Type AD**

Chemistry

Useful information:
Atomic Masses: H : 1, He : 4, C : 12, O : 16, Na : 23, Al : 27, P : 31, Cl : 35.5, K : 39

Q.1 What is the molecular mass of the third homologue of ethylene?

Q.2 An element 'X' belonging to third period of the modern periodic table has tendency of forming amphoteric oxide. Identify the element and write the total number of electrons in its valance shell.

Q.3 Calculate the mass in grams of 18.066×10^{24} molecules of H_2 gas.

Q.4 Calculate the total number of neutrons in one atom of the element with the smallest atom from the following list:-
$_{12}(Mg)^{24}, \, _{13}(Al)^{27}, \, _{15}(P)^{31}, \, _{16}(S)^{32}, \, _{17}(Cl)^{37}$

Q.5 Identify from the following list the number of elements which will not react with $H_2O_{(l)}$ in the absence of air even at high temperatures.
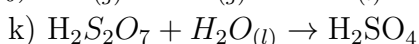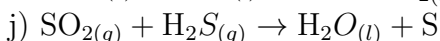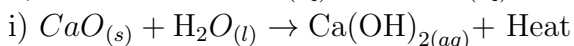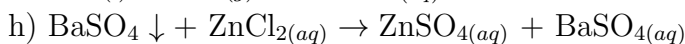Sodium, Gold, Silver, Mercury, Potassium, Calcium, Helium, Lithium, Argon

Q.6 What is the total number of hydrogen atoms present as methyl groups of isobutylene molecule?

Q.7 Scientist Mendeleev kept vacant places for the elements not discovered till his times. He named the undiscovered elements as 'eka' which show resemblance with the chemical and physical properties of some elements known to him. For example, element (X) kept in modern periodic table was named as eka-Aluminium by Mendeleev. Identify 'X' and write its atomic number as your answer.

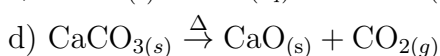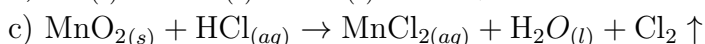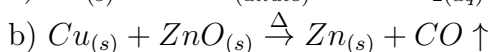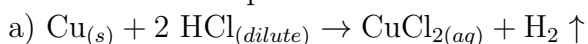**Q.8** How many $(-CH_2-)$ groups are present in pentan-2-one?

Q.9 Element 'X' is the most electropositive element of period 4 from Modern Periodic table. What is the total number of neutrons in the cation formed by 'X' to achieve the stable configuration of its nearest Noble gas?

Q.10 Identify the total number of possible chemical reactions from the following unbalanced chemical equations:
a) $Cu_{(s)} + 2\,HCl_{(dilute)} \rightarrow CuCl_{2(aq)} + H_2 \uparrow$
b) $Cu_{(s)} + ZnO_{(s)} \xrightarrow{\Delta} Zn_{(s)} + CO \uparrow$
c) $MnO_{2(s)} + HCl_{(aq)} \rightarrow MnCl_{2(aq)} + H_2O_{(l)} + Cl_2 \uparrow$
d) $CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}$
e) $Cu_{(s)} + FeSO_{4(aq)} \rightarrow Fe_{(s)} + CuSO_{4(aq)}$
f) $H_2O_{(l)} + CO_{2(g)} \rightarrow H_2CO_{3(aq)}$
h) $BaSO_4 \downarrow + ZnCl_{2(aq)} \rightarrow ZnSO_{4(aq)} + BaSO_{4(aq)}$
i) $CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)} +$ Heat
j) $SO_{2(g)} + H_2S_{(g)} \rightarrow H_2O_{(l)} + S$
k) $H_2S_2O_7 + H_2O_{(l)} \rightarrow H_2SO_4$
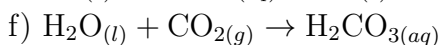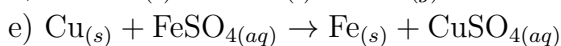
Physics

Use $g = 10 \ m/s^2$ wherever required.

Q.11 A large weather balloon is rising vertically up at a constant speed of $8 \ m/s$. When it was $132 \ m$ above the ground, a small steel part of mass $10 \ gm$ got detached from the balloon and fell to the ground. When the part hit the ground, the balloon was $D \ m$ away from it. Find $\frac{D}{2}$ and write that as your answer. Do not consider any air resistance/wind force.

Q.12 A block has $10 \ kg$ mass. A strong wind force of magnitude equal to half the weight of the block is acting towards east. At a certain moment, velocity of the block is $u \ m/s$ towards east and it is at point P. At that moment, another force towards west started acting on the block. Magnitude of that force is 1.3 times the weight of the block. The block came to a halt at point Q which is $4 \ m$ away from point P. Calculate u and write that as your answer.

**Q.13** Observe the diagram of the cone given below and answer the question.
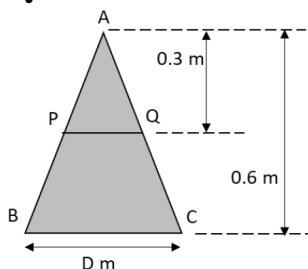
A solid metal cone ABC is stationary and it is floating in a liquid of density $16 \ g/cc$. The axis through A is vertical and the liquid surface is along line PQ. Find density d of the metal in unit g/cc.

Q.14 Q is a positive number. Charge on a single electron is $-Q$ Coulomb. There are two stationary and electrically neutral particles X and Y which are $1.5Q \ m$ apart. Later, n electrons move from X to Y. Now, the force between the X and Y is 288 Newton. Take the value of force constant in Coulomb's law as $18 \times 10^{-2} \ N-m^2/Coulomb^2$. Find number n. If the force is that of attraction write $(n+1)$ as your answer. If the force is repulsion, write $(n-1)$ as your answer.
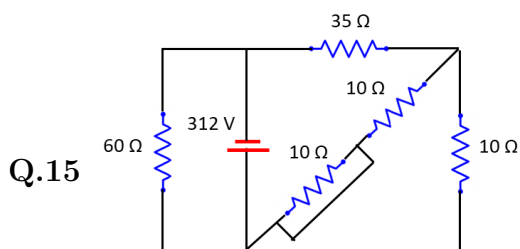
Q.15

Find current passing through the battery and express your answer in Ampere.
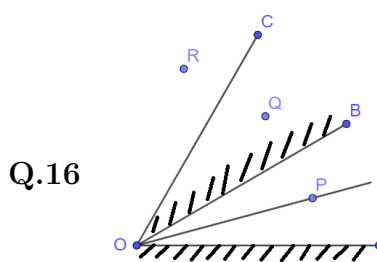
Q.16

As shown in the figure, OA and OB are two plane mirrors with their reflecting surfaces facing each other. $m\angle BOA = 30°$. An object P is exactly midway between the mirrors, i.e. $m\angle POA = 15°$. It is moving towards O at the uniform speed of $20 \ m/s$. Its image in the mirror OB is Q. OC is the image of the mirror OA in mirror OB. R is the image of Q in OC. Find the speed with wchich R is moving towards P.

Q.17 A convex lens is put between an object and a screen. A sharp inverted image of the object is formed on the screen. Focal length of the lens is $10 \ cm$. Now the lens is shifted

towards the object by 15 *cm*. Again a sharp inverted image of the object is formed on the screen. Find the initial distance (in *cm*) between the object and the lens.

Q.18 A solid block of Cobalt of mass 225 *gm* (specific heat 0.1 *cal/gm°C*) at temperature 410°*C* is put on 100 *gm* of ice at 0°*C*. All of this is kept in an insulated container. After some time, equilibrium temperature is reached. Calculate the equilibrium temperature in °*C*. Take latent heat of fusion of ice as 80 *cal/gm* and specific heat capacity of water as 1 *cal/gm°C*.

Q.19 A father of mass 70 *kg* is skating along a straight line at uniform speed of 3 *m/s*. His daughter (mass 35 *kg*) is skating towards him along the same from behind him at uniform speed of 6 *m/s*. She reaches him and holds him. They continue to move along the same line. Suppose the loss of kinetic energy in this collision is E joules. Then mark $\dfrac{E}{5}$ as your answer.

Q.20 Two cars A and B are parked on a straight road. Distance between them is 300 *m*. They start moving towards each other at the same time. Car A starts from rest at uniform acceleration of 1 *m/sec²* and continues with this acceleration for 5 *sec*. It then decelerates at 1 *m/sec²* for 5 *sec*. It continues moving in this cycle of acceleration and deceleration. Car B starts to move towards A with uniform acceleration of 2 *m/sec²* and continues with this acceleration for 5 *sec* and then decelerates at 2 *m/sec²* for 5 *sec*. It continues moving in this cycle of acceleration and deceleration. Find the time in seconds after which they meet.

Maths

Q.21 In equilateral triangle ABC of side length $\sqrt{45}+3$, suppose that M and N are the mid-points of AB and AC, respectively. The triangle is inscribed in a circle. Ray MN meets the circle at P. Determine the length of the line segment NP.
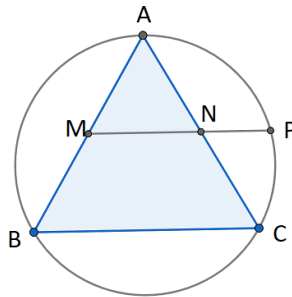
Q.22 When $a = 2022$ and $b = 2023$, the value of

$$\frac{a\sqrt{a}+b\sqrt{b}}{(\sqrt{a}+\sqrt{b})(a-b)} + \frac{2\sqrt{b}}{\sqrt{a}+\sqrt{b}} - \frac{\sqrt{ab}}{a-b}$$

Q.23 In the adjoining diagram D is the midpoint of AB. A line DE is drawn to cut BC at E. AF is parallel to DE. It is given that $EF = FC$ and area of $\triangle BDE$ is 12, the area of $\triangle AGD$ is
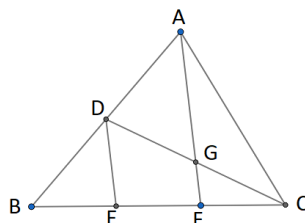
Q.24 Two sides of a triangle are 10 and 5 in length and the length of the median to the third side is $6\frac{1}{2}$. The area of the triangle is $6\sqrt{x}$. The value of x is

Q.25 The 12 numbers $a_1, a_2, \ldots, a_{12}$ are in arithmetical progression. The sum of all these numbers is 354 . Let $P = a_2 + a_4 + \cdots + a_{12}$ and $Q = a_1 + a_3 + \cdots + a_{11}$. If the ratio $P : Q$ is $32 : 27$, the common difference of the progression is

Q.26 Line $45x - 9y = 67$ divides segment joining $A(-1, 7)$ and $B(2, -3)$ in the ratio $\dfrac{m}{n}$ where m, n are coprimes. Find $m + n$

Q.27 $ABCD$ is a rectangle. Through C a variable line is drawn so as to cut AB at X and DA produced at Y. If area of rectangle $ABCD$ is 99, then $BX \times DY$ is

Q.28 x, y, z are distinct real numbers such that

$$x + \frac{1}{y} = y + \frac{1}{z} = z + \frac{1}{x}$$

The value of $x^2 y^2 z^2$ is

Q.29 In the following Figure O is the centre of the circle. $ABCO$ is a square with B on the circle. Through A a line parallel to OB is drawn to cut the circle at D nearer to B. Then $\angle AOD =$
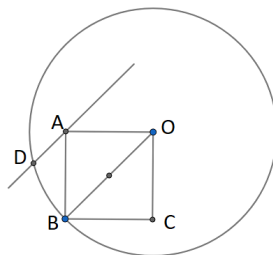
Q.30 a, b, c are digits of a 3 -digit number such that $64a + 8b + c = 403$, then the value of $a + b + c$ is

Key:

Q.No.	1	2	3	4	5	6	7	8	9	10
Answer	70	30	0	0	5	6	31	2	20	6
Q.No.	11	12	13	14	15	16	17	18	19	20
Answer	90	8	14	61	13	20	30	10	21	40
Q.No.	21	22	23	24	25	26	27	28	29	30
Answer	3	1	18	14	5	9	99	1	15	11