

M Prakash Institute

24 November 2024

XI Entrance Test 1

Each question carries five marks

10 am to 1 pm

Paper Type AD

Chemistry

Scientific data:

Atomic Number: $H = 1, Li = 3, Be = 4, B = 5, C = 6, N = 7, O = 8, Na = 11, Mg = 12, Al = 13, S = 16, Cl = 17, K = 19, Ca = 20, Sc = 21, Ti = 22, V = 23, Cr = 24, Mn = 25, Fe = 26, Cu = 29, Ga = 31, Ge = 32, In = 49, Cs = 55, Ba = 56, Tl = 81$

Atomic Mass : $H = 1, Li = 7, Be = 9, B = 11, C = 12, N = 14, O = 16, Na = 23, Mg = 24, Al = 27, K = 39, Ca = 40, S = 32, Cl = 35.5, K = 39, Sc = 45, Ti = 48, V = 51, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Ga = 70, Ge = 72, In = 115, Cs = 133, Ba = 137, Tl = 204$

Avogadro Number = 6×10^{23} per mole

Q.1 The total numbers of atoms present in 40 grams of CH_4 is ——— $\times 10^{23}$.

Q.2 How many of the followings are equal in their number of moles?

- (i) 22 grams CO_2 gas
- (ii) 14 grams CO gas
- (iii) 1.5×10^{23} O_3 molecules
- (iv) 10 grams $CaCO_3$
- (v) 19.6 grams H_2SO_4
- (vi) 30 grams $C_3H_6O_3$
- (vii) 15 grams C_2H_6
- (viii) 54 grams $C_2H_2O_4$
- (ix) 53 grams Na_2CO_3
- (x) 49 grams H_3PO_4
- (xi) 1 grams H_2 gas
- (xii) 56 grams NH_4NO_3

Q.3 The maximum amount of oxygen gas produced on complete electrolysis of 2.7 kg of acidified water is ——— mol of oxygen gas.

Q.4 The amount of ammonium nitrate is required to prepare 4 lit aqueous solution having molarity 0.05 molar is ——— grams.

Q.5 An element having atomic number 95 is present in group number 'X' and period number 'Y' in the modern periodic table. The value of $(X + Y)$ is ———

Q.6 Write the sum of number of protons present in the nucleus of largest and smallest elements from the following list:

Na, K, B, Ca, Mg, O, Li, Ba, Cs, C

Q.7 When some amount of sugar is heated with the help of Bunsen burner in an evaporating dish, then 16 g of a black residue is formed. The amount of pure sugar is required for the given experiment is ——— grams.

Q.8 In Aluminothermite process, the amount of iron oxide reacts with 27 g of aluminium is ——— grams

Q.9 Minimum molecular mass of an open chain alkene showing structural isomerism is ———

Q.10 The difference in the molar mass of diethyl ketone and acetone is ———.

Physics

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

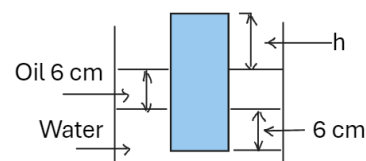
Q.11 Object A is thrown vertically upwards with speed of $\frac{7v}{6} \text{ m/sec}$ at time $t = 0 \text{ sec}$. Object B is thrown vertically upwards with speed of $v \text{ m/sec}$ at time $t = 1 \text{ sec}$. Both objects start from the same ground level. At $t = 6 \text{ sec}$, both objects are travelling upwards and the distance between them is 65 m . Calculate v .

Q.12 Object A is thrown vertically upwards at $2v \text{ m/sec}$ speed at $t = 0 \text{ sec}$. Object B is thrown vertically upwards at speed $v \text{ m/sec}$ at $t = 10 \text{ sec}$. Both objects start from the same ground level. Object A is vertically above object B at a distance of 250 meters at $t = 15 \text{ sec}$. Object A is coming down and object B is going up. Calculate v .

Q.13 Consider a circular horizontal track of length 200 meters . (i.e. the circumference of the circular track is 200 meters .) Ajay starts running at a constant acceleration of $a \text{ m/sec}^2$ from the northmost point of the track in the anticlockwise direction, i.e. north-west-south-east at $t = 0$. Akshay and Mohan start running at constant speed of $u \text{ m/sec}$ at $t = 0$ from the southmost point. Akshay starts running in clockwise direction. Mohan starts running in anticlockwise direction. Ajay crosses Akshay at $t = 10 \text{ sec}$. Ajay catches Mohan at $t = 20 \text{ sec}$. Calculate Ajay's acceleration a and mark $15a$ as your answer.

Q.14 Refer to the diagram.

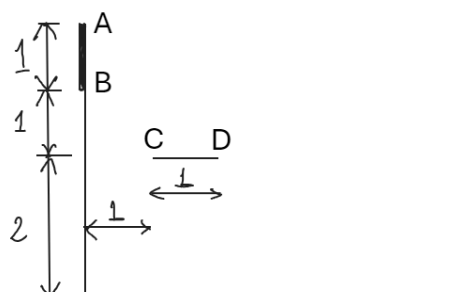
There is a container. There is a layer of water (density 1 gm/cc) at the bottom. There is a layer of oil of density 0.9 gm/cc of height 6 cm above water. A cylindrical solid of material of density 0.6 gm/cc is floating as shown. The height of the portion of the solid in water is 6 cm . The height of the portion of the solid in air is $h \text{ cm}$. Calculate h and write $10h$ as your answer.



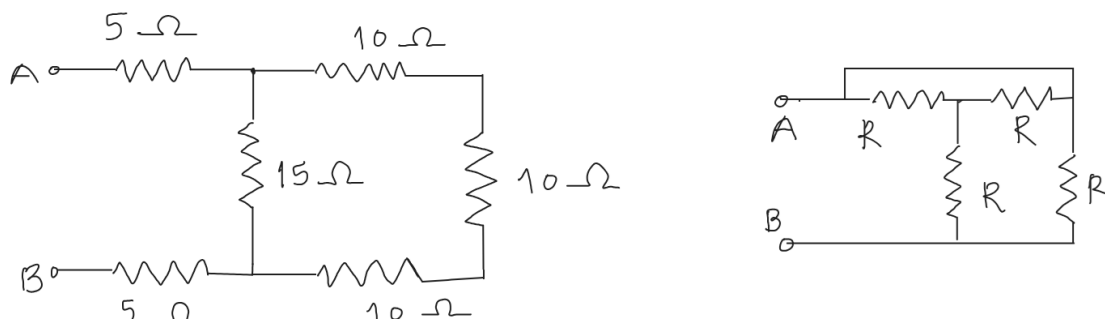
Q.15 There are four points A, B, C, D on a straight line in this order from left to right. Various distances are $AB = 3 \text{ cm}$, $BC = 1 \text{ cm}$, $CD = x \text{ cm}$. There are static point charges at A, B, C . Charge at A is $+Q_1$ coulombs. Charge at B is $+Q_2$ coulombs. Charge at C is $+Q_3$ coulombs. The net static force on $+Q_2$ due to $+Q_1$ and $+Q_3$ is zero. Now, the charge at A is replaced by a point static charge of $-Q_1$ coulombs. Charge at B is moved to point D . The net static force on $+Q_2$ due to $-Q_1$ and $+Q_3$ is zero. Calculate x and mark $10x$ as your answer.

Q.16 Refer to the diagram.

AB is a light source. B is at a height of 3 meters from ground. $AB = 1 \text{ meter}$. CD is a horizontal opaque object. Horizontal distance of C from the vertical wall is 1 meter . $CD = 1 \text{ meter}$. Height of CD from ground is 2 meters . A penumbra and an umbra is formed on the horizontal ground. The ratio of lengths of penumbra and umbra is k . Write $10k$ as your answer.



Q.17 Refer to the diagram. The equivalent resistances of the two circuits between points A and B are same. Calculate R -and mark $\frac{3R}{2}$ as your answer.



Q.18 A solid block of metal of mass x gm (specific heat $0.3 \text{ cal/gm}^\circ\text{C}$) at temperature 460°C , 250 gm of ice at 0°C and 50 gm of steam at 100°C are kept in an insulated container. After some time, equilibrium temperature of 60° is reached. Calculate x . Assume the following values: Latent heat of fusion of water: 80 cal/gm , latent heat of vaporisation of water = 540 cal/gm , specific heat of water = $1 \text{ cal/gm}^\circ\text{C}$.

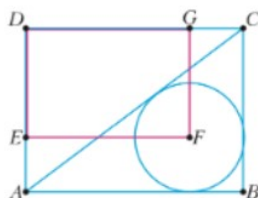
Q.19 A bullet of mass 30 gm is fired vertically upwards with initial speed of 400 m/sec from point A on the ground at $t = 0$. At the same time, a wooden ball of mass 370 gm is dropped from a cliff which is 400 meters directly above point A . (Initial speed of the ball is zero.) The bullet hits the wooden ball and gets stuck in the ball. What will be the height of the bullet and ball from ground at $t = 12 \text{ sec}$?

Q.20 An object is kept in front of a screen. A converging lens is kept between them so that a sharp image of the object is obtained on the screen. Distance between the object and the lens is 30 cm . Focal length of the lens is 15 cm . Now, the screen is moved away from the lens by 20 cm . By what distance should the lens be shifted from its original position so that a sharp reduced image is obtained on the screen?

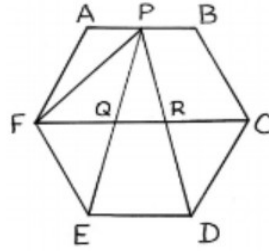
Maths

Q.21 Let $ABCD$ be a quadrilateral with coordinates $(2, 2)$, $(10, 2)$, $(12, 0)$, and $(0, 0)$. This quadrilateral is inscribed in a circle whose area is $K\pi$. Find K

Q.22 Let $ABCD$ and $DEFG$ be two rectangles so that the point E lies on the side AD , the point G lies on the side CD and the point F is the incentre of $\triangle ABC$. What is the ratio of the area of $ABCD$ and the area of $DEFG$?



Q.23 In the figure, $ABCDEF$ is a regular hexagon and P is the midpoint of AB . Find the ratio $\frac{\text{Area}(DEQR)}{\text{Area}(FPQ)}$.



Q.24 Suppose that a, b, c and d are positive integers that satisfy the equations

$$ab + cd = 38, \quad ac + bd = 34, \quad ad + bc = 43.$$

What is the value of $a + b + c + d$?

Q.25 Scalene triangle ABC is reflected through its own centroid G , the image being triangle $A'B'C'$. If $AB = 2BC$ and the area of triangle $A'B'C'$ is 72 , compute the area of the hexagonal region common to both triangle ABC and triangle $A'B'C'$. (Note: the centroid of a triangle is the intersection of its medians.)

Q.26 Consider a convex quadrilateral $ABCD$. Let rays BA and CD intersect at E , rays DA and CB intersect at F , and the diagonals AC and BD intersect at G . It is given that the triangles DBF and DBE have the same area. Given that the area of triangle ABD is 4 and the area of triangle CBD is 6 , If the area of triangle EFG is α . Report $\frac{\alpha}{10}$

Q.27 The first term of an arithmetic progression is 2, and the common difference is d . If the sum of the squares of the first 5 terms is 5610 , find positive value of d .

Q.28 Find k if $x^6 + 3x^5 + 12x^4 + 19x^3 + 36x^2 + 27x + k$ is perfect cube of a polynomial.

Q.29 The expression $n!$ denotes the product $1 \cdot 2 \cdot 3 \cdots n$ and is read as n factorial. For example, $5! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 = 120$. The product $(2!)(3!)(4!)(5!)(6!)(7!)(8!)(9!)(10!)(11!)(12!)$ can be written in the form $M^2(N!)$, where M, N are positive integers. Find smallest suitable value of N .

Q.30 Find the positive integer n such that

$$\frac{1}{6} + \frac{1}{7} + \frac{1}{8} + \frac{1}{9} + \frac{1}{10} + \frac{1}{12} + \frac{1}{15} + \frac{1}{18} + \frac{1}{24} + \frac{1}{42} + \frac{1}{n} = 1$$