

## MATHEMATICS

**NOTE:-**

1. Attempt all questions.
2. Rough work must be enclosed with answer book.
3. There is no negative marking.
4. Answer each of Sections A, B, C at one place.
5. Use of calculators, slide rule, graph paper and logarithmic, trigonometric and statistical tables is not permitted.

**Note:-** All answers to questions in **Section-A**, **Section-B** and **Section-C** must be supported by mathematical arguments. In each of these sections order of the questions must be maintained.

**SECTION-A**

**This section has Four Questions. Each question is provided with 4 alternative answers. Exactly one of them is the correct answer. Indicate the correct answer by A, B, C, D.** (4x3=12 MARKS)

1. If  $x$  and  $y$  are two positive integers such that  $xy = 2015$  then the number of distinct values  $x$  can take is  
A) 2                                      B) 4                                      C) 8                                      D) 16
2. The number of values of 'a' such that the nine digit number 8544a5894 is divisible by 7 is  
A) 1                                      B) 2                                      C) 3                                      D) 7
3. A table is filled with integers as shown below:
 

ODD	EVEN	ODD
EVEN	ODD	EVEN
ODD	EVEN	ODD

 A) The sum of the entries of any row or column is always odd  
 B) The sum of the entries of any row or column is always even  
 C) The sum of the entries of the second row or second column is even  
 D) The sum of the entries of the second row or second column is odd
4. If  $x > y > 0$ ,  $x^2 + y^2 = 6xy$  then  $\frac{x+y}{x-y}$  is equal to  
A)  $\sqrt{3}$                                       B)  $\sqrt{2}$                                       C)  $1/\sqrt{2}$                                       D)  $-\sqrt{2}$

**SECTION-B**

**This section has Four Questions. In each question a blank is left. Fill in the blank.** (4x3=12 MARKS)

5.  $\sqrt{144} + \sqrt[3]{216} = \sqrt{a} = 6\sqrt{b}$  then  $\frac{a}{4b}$  is equal to \_\_\_\_\_
6. A is a two digit positive integer. B is the two digit number obtained by reversing(inter-changing) the digits of A. If A and B are such that  $A : B = 4 : 7$  then the number of such A is \_\_\_\_\_
7. In a trapezium PQRS, the side PQ is perpendicular to the parallel sides QR, PS whose lengths are  $x$  and  $y$ . If the diagonals PR and QS intersect in M, then the perpendicular distance from M to the side PQ is \_\_\_\_\_
8. ABCD is a convex quadrilateral. Angles BAC, CAD, CBD, BDC are  $50^\circ, 60^\circ, 30^\circ, 25^\circ$  respectively. If E is the point of intersection of the line segments AC, BD then angle AEB is \_\_\_\_\_

**SECTION-C**

**State True or False in each of the following statements.** (4x3=12 MARKS)

9. Coordinates of three points are A(-3, 2), B(25, 10), C(k, k). If the value of AC + BC is minimum then  $k = 6$ .
10. If  $a, b$  are real numbers such that  $(a-b) : (a+b) : ab = 1 : 5 : 24$  then  $(a, b) = (12, 8)$ .
11. In a circle with Centre O, AB, BC are two chords each of length 3 units. If the area of the quadrilateral OABC is 6 sq.units then the radius of the circle is 5 units.
12. The function  $f: (-\infty, 2] \rightarrow [1, \infty)$  defined as  $f(x) = x^2 - 4x + 5$  is a bijection.

**SECTION-D**

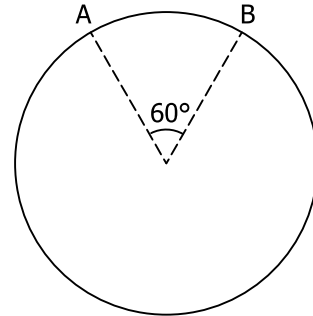
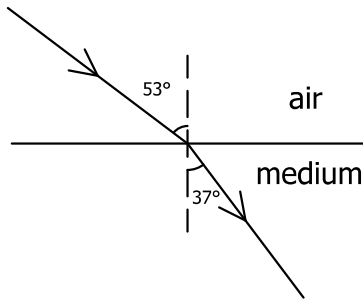
(4x6=24 MARKS)

13. In a square ABCD of side 6 units P, Q are mid points of BC, CD respectively. The line segments BQ, DP intersect in R then find the area of the quadrilateral ABRD.
14. Solve the system of equations in  $x, y$ :  $x^2 + xy = p^2 + pq$ ,  $y^2 + xy = p^2 - pq$ , where  $p, q$  are real numbers,  $p \neq 0$ .
15. ABCD is a square of side length 1 unit. Two circles  $C_1, C_2$  of equal radii are drawn inside the square such that they are touching each other and  $C_1$  touching the sides AB, BC and  $C_2$  touching the sides CD, DA. Then find the radius..
16. Solve  $3^{2x+1} - 3^{x+3} - 3^x + 3^2 = 0$

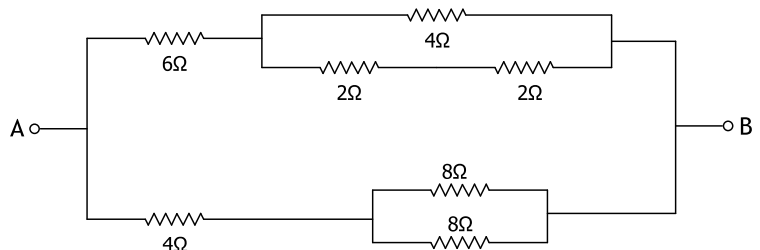
**PHYSICS (10 × 6 = 60 Marks)**

*Attempt all questions*

17. 27 spherical drops of a liquid are merged to form a single large spherical drop. If the radius of the smaller drop is 1 mm, find the radius of the larger drop. Also find the ratio surface area of the larger drop to the total surface area of all the drops.
18. Equal volumes of two miscible liquids of relative densities 6 and 2 are mixed to form a homogenous mixture. A cube floats on this liquid mixture with half its volume submerged. If instead equal masses of these liquids were mixed, find the fraction of the volume of the cube that would submerge in the mixture.
19. A car travels between places A and B covering part of the distance at 40 kmph in 1 hour and the remaining distance at 30 kmph in 2 hours. In the return journey from B to A along a different path which is  $\frac{3}{2}$  times longer the speed is 75 kmph for the entire journey. Find the average speed of the car for the round trip.
20. An electric train is moving at 36 kmph. When its power is turned off, it stops in 20 s. If the train were moving at 54 kmph, find how far ahead of the station should the power be turned off, to halt the train at the station. Assume same uniform retardation in both the cases.
21. A ray of light passing from air in to a medium is incident at  $53^\circ$ . Angle of refraction in the medium is  $37^\circ$ . Find the sine of angle of refraction if the angle of incidence is changed to  $37^\circ$ . (Use  $\sin 37^\circ = \frac{3}{5}$  and  $\sin 53^\circ = \frac{4}{5}$ )



22. A uniform wire is made in to a circular ring. Equivalent resistance between points A and B on the ring which subtend an angle of  $60^\circ$  at the center of the ring is R. Find the equivalent resistance between A and B if the angle is increased to  $120^\circ$ .
23. Space above mercury in a barometric tube has a water column of 27.2 cm. If the atmospheric pressure is 76 cm of mercury, find the length of the mercury column above the mercury level in the trough of the barometer. What is the pressure at the top of the mercury column? Assume that space above water is vacuum. Atmospheric pressure is 76 cm of Hg and densities of mercury and water are  $13.6 \text{ g/cm}^3$  and  $1 \text{ g/cm}^3$ .
24. Potential difference between A and B is 16 V. Find the currents in the  $6 \Omega$  and  $8 \Omega$  resistances.



25. A car is moving on a highway at 34 m/s. A man is standing by the side of the highway a long distance ahead of the car. Car sounds its horn for a 5 s duration. The car passes the man sometime after the horn is sounded. Find the length of time during which the man hears the sound of the horn. (Speed of sound is 340 m/s.)
26. Energy released per fission of one uranium nucleus  $U^{235}$  is 200 MeV. Find the number of reactions taking place in one minute in a nuclear reactor producing a power of 800 MW. Assume 50% efficiency in the conversion process. Also find the mass lost in 1 hour.

# CHEMISTRY

Attempt all questions. Each question carries 3 marks.

**SECTION-A : Each question is provided with 4-alternative answers. One or more than one of them are correct answers. Indicate the correct answer by A,B,C,D.**

27.  $\text{NO}_3^-$  ion is detected by a popular test known as brown ring test. During this test  $\text{NO}_3^-$  ion acts as  
A) oxidant                      B) reductant                      C) both oxidant and reductant                      D) spectator ion
28. One of the phosphorus compound is popularly used as rat poison. The oxidation number of the phosphorus in this compound is  
A) zero                      B) -2                      C) -3                      D) +2
29. If there were 9-periods in the periodic table then how many elements would 9<sup>th</sup> period can maximum comprise of  
A) 72                      B) 32                      C) 50                      D) 56
30. Energy is emitted when electron jumps from higher energy level to lower energy. In which transition the wave length emitted is minimum  
A) an electron jumps from 2<sup>nd</sup> to 1<sup>st</sup> level                      B) an electron jumps from 3<sup>rd</sup> to 2<sup>nd</sup> level  
C) an electron jumps from 4<sup>th</sup> to 3<sup>rd</sup> level                      D) an electron jumps from 5<sup>th</sup> to 4<sup>th</sup> level
31. Which of the following is the correct set of quantum numbers for differentiating electron between calcium and scandium  
A)  $n = 4$   $l = 0$   $m = 0$   $s = +\frac{1}{2}$                       B)  $n = 4$   $l = 2$   $m = 0$   $s = +\frac{1}{2}$   
C)  $n = 3$   $l = 2$   $m = -2$   $s = +\frac{1}{2}$                       D)  $n = 4$   $l = 2$   $m = -2$   $s = +\frac{1}{2}$

**SECTION-B : In each question a blank or blanks are left. Fill in the blank(s) with relevant answer(s).**

32. As safety measure in public places fire extinguishers are arranged. What compounds are there in fire extinguishers? \_\_\_\_\_ , \_\_\_\_\_
33. On Dewali day while burning a cracker a brilliant green light emitted. Which metal you expect in the cracker \_\_\_\_\_
34. 1 mole of radioactive substance 'X' disintegrates by  $\alpha$ -emission. Its half life time is 10 days. After 20-days the amount of Helium gas liberated at STP is \_\_\_\_\_
35. Silica on reaction with sodium hydroxide produces a compound. The common name of the compound formed is \_\_\_\_\_ and its chemical formula is \_\_\_\_\_
36. In metallurgy in the isolation of metals, in calcinations/roasting process usually ore is finally converted into \_\_\_\_\_ form
37. Among  $\text{Ni}^{+4}$ ,  $\text{Cu}^{+2}$ ,  $\text{Mn}^{+4}$ ,  $\text{Co}^{+3}$ ,  $\text{Cr}^{+1}$  the species having same number of unpaired electrons \_\_\_\_\_
38. The concentration of the hydrogen ion in a sample of soft drink is  $2 \times 10^{-3} \text{M}$ . The pOH of the solution is \_\_\_\_\_ and its  $p^{kw}$  is \_\_\_\_\_
39. Arrange in the increasing order of ionic radii for isoelectronic species  $\text{K}^+$ ,  $\text{S}^{2-}$ ,  $\text{Ca}^{+2}$ ,  $\text{Cl}^-$  \_\_\_\_\_
40. What is the starting material for the preparation of propane by decarboxylation method \_\_\_\_\_
41. The solubility product of an electrolyte  $\text{A}_3\text{B}_2$  if its solubility is 'S' \_\_\_\_\_
42. In the extraction of Mg metal from  $\text{MgCl}_2$ , the NaCl and KCl are added. This is to decrease \_\_\_\_\_ and increase \_\_\_\_\_.
43. The pH of the pure water at 25<sup>0</sup>C is 7. The pH of the solution after addition of 1 gm of KCl per liter of water is \_\_\_\_\_
44. Hot and conc. NaOH is treated with chlorine gas. The gas undergoes disproportionation. The balanced equation for this reaction is \_\_\_\_\_
45. The valencies of carbon in alkane, alkene and alkyne respectively are \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
46. Ammonia and air mixture is passed over heated platinum gauze at 800<sup>0</sup>C under high pressure conditions. Write balanced equation \_\_\_\_\_