SRI GURUDATTA COACHING CENTRE (SARMA INST.)
MATHEMATICS

1. Given that r and s are relatively prime positive integers such that $\frac{r}{s} = \frac{2(\sqrt{2}+\sqrt{10})}{5(\sqrt{3+\sqrt{5}})}$, find $202s + 251r$.

2. Find the greatest possible value of $\frac{d}{a}$ where $a^2 - 6ad + 8d^2 = 0$, $a \neq 0$

3. Three congruent isosceles triangles are constructed with their bases on the sides of an equilateral triangle of side length $\sqrt{3}$. The sum of the areas of the three isosceles triangles is the same as the area of the equilateral triangle. What is the length of one of the two congruent sides of one of the isosceles triangles?

4. When counting from 3 to 2014, 53 is the 51st number counted. When counting backwards from 2014 to 3, 53 is the nth number counted. What is n?

5. Find at least one solution of the simultaneous system of equations $x^2 - 4y + 7 = 0$, $y^2 - 6z + 14 = 0$ and $z^2 - 2x - 7 = 0$ where x, y, z are reals.

6. Let ABCDEF be a hexagon all of whose sides are equal in length and all of whose angles are equal. The area of the hexagon ABCDEF is exactly **r** times the area of the triangle ACD. Determine the value of **r**.

7. The roots of the equation $x^2 + 4x - 5 = 0$ are also the roots of the equation $2x^3 + 9x^2 - 6x - 5 = 0$. What is the third root of the second equation?

8. If your <u>average</u> score on your first six mathematics tests was 13 and your average score on your first seven mathematics tests was 14, then your score on the seventh test was_____.

9. A square and a triangle have equal perimeters. The lengths of the three sides of the triangle are $\frac{61}{10}$cm, $\frac{41}{5}$cm and $\frac{97}{10}$cm. What is the area of the square in square centimeters?

10. Find the smallest perfect square 'n' such that the product of the first n positive integers is divisible by 2014.

11. Let O be the centre of a sphere and OP(=R) be a radius. A plane is passing through P making an angle of 30^0 with OP. The area of the circle yielded by this cutting plane is equal to $\lambda\pi R^2$. Then λ = _____.

12. Solve the system of equations

$$\log_5 x + 3^{\log_3 y} = 7 \quad , x^y = 5^{12}$$

13. The ratio $\frac{10^{2012} + 10^{2014}}{2(10^{2013})}$ is closest to the integer N, then N=_____.

14. Let A(2,0) and B(−1,4) be two points in a plane. How many points P(x,y) are there in the same plane such that PA + PB = 5 and x, y are integers.

PHYSICS

SECTION A

1. A body is allowed to fall freely from a height of 20m. If g=10m/s^2 ,with what velocity it reaches the ground. Solve the problem by one method and verify the result by another method.

2. At a distance of 400m from traffic light, brakes are applied to a car moving with a velocity of 54KmPH. Determine the position of the car, relative to the traffic light, 1 minute after application of brakes, if the car retards at 0.3m/s^2.

3. A body of mass 500gm, which is at rest, is acted upon by a force of 1N for 4 seconds and then ceases to act. The body then continues to move with the constant speed for 2sec. Calculate the total distance moved by the body.

4. A body of mass 4Kg moving with a velocity of 5m/s collides another body of mass 2Kg which is at rest. After collision, if the 1st body moves along the same line with a velocity of 2m/s, find the velocity of the 2nd body.

5. A running man has half the kinetic energy of that of a boy of half his mass. If the kinetic energies of both are to be equal, by what value the man has to increase his speed.

6. A piece of silver has a cavity inside it. The mass of silver in air is 367.5gm. and that in water is 315gm.   If the density of silver is 10.5gm/cc, find the volume of the cavity.

7. Water and oil are poured into the two limbs of a U-tube containing mercury. The interfaces between the mercury and the liquids are at the same height in both the limbs, determine the height of water column, if the length of the oil column is 20cm.(density of oil is 0.9gm/cc).

8. Two sound waves of wave lengths 1m and 1.01m are travelling in a medium. If their frequencies differ by 3Hz, find the velocity of sound in the medium.

9. At what temperature the velocity of sound in a gas of density 'd', at a temperature 27^{0}C is double that the velocity in another gas of density'd/3'.

10. A concave mirror of focal length 15cm.gives an image of double the size of the object. Find the possible distance/s of the object.

SECTION B

11. A stone allowed to fall freely reaches the ground in 4s.The ratio of distances travelled in the 1st second to that in the last second is ____.

12. The area under the curve drawn between velocity and time of a moving body on a graph represents ____.

13. 1Kgf = ____ dynes.

14. A person sitting in a moving train throws a ball vertically up. For an observer, out side the train, the ball appears to move along _____ path.

15. The ratio of angular velocities of hours hand to that of minutes hand of clock is ____.

16. If 'g' is the acceleration due to gravity on earth, the acceleration due to gravity at a height R(R is the radius of the earth) from the surface of earth is ____.

17. The density of the mixture of two liquids of equal masses and densities 0.9gm/cc and 0.8gm/cc is ____gm/cc.

18. The reading of Lactometer in pure milk will be ____ Kg/m^3.

19. When a fan turns through an integral number of revolutions, the angle in radians is an even multiple of ____ .

20. A string of length 30cm. fixed at both ends, vibrate in three loops. The wave length of wave travelling in the string is ____cm.

21. A person walking on a road notices a cloud at 30^0elevation at one instance. He heard the sound of a thunder after 5sec the flash is seen. If the velocity of sound in air is 340m/s, the vertical height of the cloud is ____m.

22. Sound travels in media viz.,Oxygen,Water,Hydrogen and Steel. Arrange the media in the ascending order of velocities of sound in the respective media.____ , ____, ____ and ____.

23. Two points on a wave differ by **0.6λ** where '**λ**' is the wave length of the wave. The corresponding phase difference between the two points is ____ .

24. The charge of an electron is ____ Coul.

25. The mass of an electron is ____kg.

CHEMISTRY

SECTION-A

I   Multiple choice questions with one or more option(s). Choose the option(s) as given in the question

(1). which of the following statement(s) is/are correct?

    a. Changes in temperature, surface area and wind speed effect rate of evaporation

    b. Mass of 1 mole of a substance is called its molar mass

    c. Valency is the combining capacity of an atom

    d. The chemical change is permanent and irreversible

(2). Atomic number

    a.   controls chemical properties of an element

    b.   is equal to the number of protons present in the nucleus of an atom

    c.   is denoted by the letter Z

    d.   is different for different elements

(3). which of the following statement(s) is/are incorrect?

    a.   Humidity is the amount of air present in water vapour

    b.   Electron is a positively charged particle of the atom

    c. KNO_3 on decomposition gives NO_2 gas

d. Water is a compound of hydrogen and oxygen atoms combined together in the ratio of 1:2

(4). Which of the following is a/are physical change(s) ?
   a. A rock rolling down a hill
   b. Sublimation of camphor
   c. Breaking of glass pane
   d. Heating of sugar

(5). Diffusion
   a. Is possible only when particles of matter move continuously
   b. of gases is higher than that of liquids
   c. of gases is higher due to the high speed of gas particles and also greater space between the particles
   d. of hydrogen gas is less than that of oxygen

II Fill in the blanks

(6). The phenomenon of change of a liquid into vapours at any temperature below its boiling point is called _____.

(7). An atom has the mass number 35 and atomic number 17. The numbers of neutrons in its nucleus are _____.

(8). The particles in a colloidal solution can easily scatter a beam of visible light. This phenomenon is known as _____.

(9). Rutherford's alpha-particle scattering experiment led to the discovery of the _____.

(10). The atoms of the same element which have the same number of protons but have different number of neutrons are called_____.

SECTION-B

III Give the formulae of the following compounds and calculate their molecular masses
(Atomic weights Ag=108U,N=14U,P=31U,Al=27U,Na=23U,Cu=63.5U,Mg=24U,S=32U,Cl=35.5U,O=16U,Ca=40U)

(11). Silver nitrate	(12). Aluminium sulphate	(13).Sulphuric acid	(14).Sodium bicarbonate
(15).Copper sulphate	(16).Magnesium chloride	(17).Phosphoric acid	(18).Caustic soda
(19).Nitric acid	(20).Calcium hydroxide.		

IV Give the balanced equations for the following chemical changes

(21).Lead nitrate is strongly heated	(22). Potassium chlorate is strongly heated
(23). Steam is passed over red hot iron	(24). Hydrogen gas is passed over cupric oxide
(25). Lime stone is decomposed	(26). A piece of iron is added to copper sulphate solution
(27). Ammonium Dichromate is heated	(28). A piece of zinc is added to dilute sulphuric acid
(29). Sodium is dropped in water.	(30). Chlorine gas is passed through potassium iodide solution

SECTION-C

V Match the following (choose column A options a, b, c, d, e for answering.)

Column-A		Column-B
31 (a). Conversion of liquid into gas	( )	(i) gas
(b). Non compressible	( )	(ii) solid
(c). Maximum expansion	( )	(iii) particle

(d). Constituents of matter   (   )   (iv)   fusion

(e). changing of liquid to solid   (   )   (v) evaporation

VI solve the following(Atomic weights of C=12U,O=16U,Ca=40U)

32. A solution contains 50gms of common salt in 200g of water. Calculate percentage by mass of solution.

33. An element X has 2 isotopes with masses 35U (75% abundance) and 37U (25% abundance).

Find the average atomic mass of the element X.

34. Carbon dioxide is added to 112gms of calcium oxide. The product formed is 200gms of lime stone. Find the mass of carbon dioxide used.