PART I - PHYSICS

1. A ball is dropped from a bridge 122.5 m above a river. After the ball has been falling for two second, a second ball is thrown straight down after it. What must its initial velocity be so that both hit the water at the same time? [g = 9.8 m/s²]

   1) 49 m/s   2) 55.5 m/s   3) 26.1 m/s   4) 9.8 m/s

Ans. 3

For the dropped ball t = $\sqrt{\dfrac{2h}{g}} = \sqrt{\dfrac{2 \times 122.5}{9.8}} = 5s$

For the second ball t = 5 – 2 = 3s

$s = ut + \dfrac{at^2}{2}$, $122.5 = u \times 3 + \dfrac{9.8}{2} \times 9$; $u = 26.1 \text{ m/s}$

2. When we catch a cricket ball then after catching it, we keep moving the hands in the same direction for a while. Why is it done?

   1) To increase the impulse on ball

   2) To decrease the impulse on the ball

   3) To increase the time of contact so that force magnitude may increase

   4) To increase the time of contact so that force magnitude may decrease

Ans. 4

Impulse, Ft = change in momentum = ΔP ; $t = \dfrac{\Delta P}{F}$

3. What is the workdone in displacing the body from x = 1m to x = 7m?
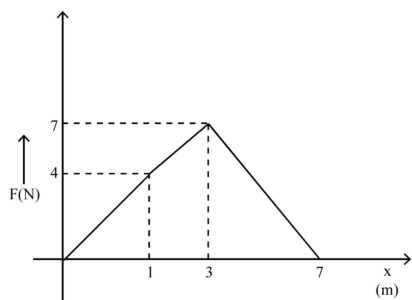
1) 7 J   2) 14 J   3) 49 J   4) 25 J

Ans. 4

W = area under graph $W = 2 \times 4 + \dfrac{1}{2} \times 3 \times 2 + \dfrac{1}{2} \times 4 \times 7 = 8 + 3 + 14 = 25$ J

4. 1 ampere current is equivalent to

1) 6.25×10^{18} electrons s^{-1}

2) 2.25×10^{18} electrons s^{-1}

3) 6.25×10^{14} electrons s^{-1}

4) 2.25×10^{14} electrons s^{-1}

Ans. 1

$$I = \dfrac{Q}{t} = \dfrac{ne}{t}; \; n = \dfrac{It}{e} = \dfrac{1 \times 1}{1.6 \times 10^{-19}}; \; n = 6.28 \times 10^{18}$$

5. The diameter of two planets are in the ratio 4 : 1 and their mean densities are in the ratio 1:2. The acceleration due to gravity on the planets will be in the ratio
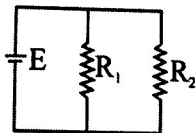
1) 1 : 2   2) 2 : 3   3) 2 : 1   4) 4 : 1

Ans. 3

$$g = \dfrac{GM}{R^2} = \dfrac{G}{R^2} \dfrac{4}{3} \pi R^3 \rho = \dfrac{4}{3} \pi G R \rho; \; \dfrac{g_1}{g_2} = \dfrac{R_1}{R_2} \dfrac{\rho_1}{\rho_2} = \dfrac{4}{1} \times \dfrac{1}{2} = 2$$

6. In the given circuit, if the resistance R_2 is decreased:

1) The current through R_1 increases

2) The current through R_1 is constant

3) The voltage drop across R_2 decreases

4) The power dissipation by R_2 decreases

Ans. 2 $I_1 = \dfrac{E}{R_1}, \ I_2 = \dfrac{E}{R_2}$; Power $P_1 = \dfrac{E^2}{R_1}$; $P_2 = \dfrac{E^2}{R_2}$

When R_2 is decreased I_1 = constant, P_1 = constant

I_2 and P_2 increases

7. A positive charge is moving upward in a magnetic field which is towards north. The particle will be deflected towards

1) East   2) West   3) North   4) South

Ans. 2

8. A stone is dropped into a well. If the depth of the water below the top be 200m and velocity of sound in air is 340 m/s, then after what time the splash of sound is heard. $(g = 10 \ m/s^2)$

1) 6s   2) 7s   3) 8s   4) 5s

Ans. 2 $t = \sqrt{\dfrac{2h}{g}} + \dfrac{h}{v} = \sqrt{\dfrac{2 \times 200}{10}} + \dfrac{200}{340} = \sqrt{40} + \dfrac{20}{34} = 7s$

9. A cube of ice is floating in a liquid of relative density 1.25 contained in a beaker. When the ice melts, the level of the liquid in the beaker?

1) Rises

2) Falls

3) Remains unchanged

4) Falls at first and then rises to the same height as before

Ans. 1

10. If the frequency of human heart beat is 1.25 Hz, the number of heart beats in 1 minute is

   1) 80   2) 65   3) 48   4) 75

Ans. 4 $N = ft = 1.25 \times 60 = 75$

11. A wavelength 0.60 cm is produced in air and it travels at a speed of 300 ms^{-1}. It will be an

   1) Audible wave

   2) Infrasonic wave

   3) Ultrasonic wave

   4) None of the above

Ans. 3   Frequency $v = \dfrac{V}{\lambda} = \dfrac{300}{0.6 \times 10^{-2}} = 50000$ Hz

12. An object is placed at a distance of 10 cm from a convex lens of power 5D. Find the position of the image
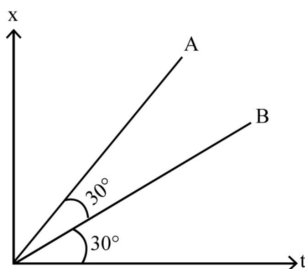
   1) –20 cm   2) 30 cm   3) 20 cm   4) –30 cm

Ans. 1   Focal length $f = \dfrac{100}{P} = \dfrac{100}{5} = 20$ cm; $\dfrac{1}{V} = \dfrac{1}{f} + \dfrac{1}{u} = \dfrac{1}{20} - \dfrac{1}{10}$; $V = -20$ cm

13. Find the ratio of velocity V_A/V_B from the given position time graph

   1) 3   2) $\dfrac{1}{3}$ 3) 2   4) $\dfrac{1}{2}$

Ans. 1   V = slope of the graph; $V = \tan \theta$; $\dfrac{V_A}{V_B} = \dfrac{\tan 60}{\tan 30} = \dfrac{\sqrt{3}}{\dfrac{1}{\sqrt{3}}} = 3$

14. The force experienced by a charge in a magnetic field is

    1) Directly proportional to square of the charge

    2) Independent of velocity of the charge

    3) Perpendicular to velocity of the charge

    4) Directly proportional to mass of the charge

Ans. 3 $\vec{F} = q(\vec{V} \times \vec{B})$ ∴ force is perpendicular to $\vec{V}$ and $\vec{B}$

15. A particle is moving from A to B along three different paths as shown in figure. If the work done against conservative forces along the paths are W_1, W_2 and W_3, then
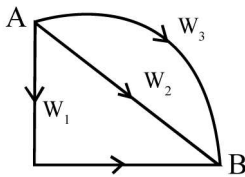
    1) $W_1 \neq W_2 = W_3$ 2) $W_3 > W_1 > W_2$ 3) $W_1 = W_2 \neq W_3$ 4) $W_1 = W_2 = W_3$

Ans. 4   Work done gainst conservative force is independent of the path

SECTION B - PHYSICS

16. A train 200m long moving at constant acceleration crosses a bridge 300 m long. It enters the bridge with a speed of 3 m/s and leaves it with a speed of 5 m/s. The time taken to cross the bridge in second is

Ans. 125   Average velocity $V_{av} = \dfrac{u + v}{2} = \left[\dfrac{3 + 5}{2}\right] = 4 \text{ m/s}; \ t = \dfrac{\text{displacement}}{\text{time}} = \dfrac{300 + 200}{4} = 125 \text{ s}$

17. A particle of mass 2kg is stationary under the action of three forces $F_1 = 3N$, $F_2 = 5N$ and $F_3 = 10$ N. If the force F_3 is removed, then the magnitude of acceleration of the particle in m/s^2 is

Ans. 5

    When the particle is stationary net force is zero. So F_3 is equal and opposite to the resultant of F_1 and F_2. When F_3 is removed, the only forces are F_1 and F_2 therefore net force = resultant of F_1 and F_2 which is equal to F_3

    $$\therefore a = \dfrac{F_3}{m} = \dfrac{10}{2} = 5 \text{ m/s}^2$$

18. A mass of 25 kg is lifted to a height 1m. Work done against gravity in J is ($g = 10 \text{ m/s}^2$)

Ans. 250 $\quad W = mgh = 25 \times 1 \times 10 = 250 \text{ J}$

19. An object is placed infront of a concave mirror of focal length 30cm and its image three times the size of the object is formed on the same side. The magnitude of object distance in cm is
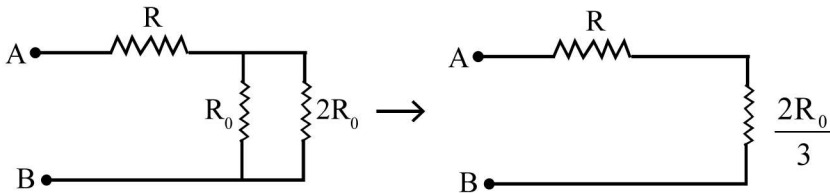
Ans. 40 $\quad$ Image is real and inverted $\therefore$ magnification $m = -3$; $m = \dfrac{f}{f-u}$

$$-3 = \dfrac{-30}{-30-u}, \; -30 - u = 10; \; u = -40 \text{ cm}; \; |u| = 40 \text{cm}$$

20. In the circuit shown in figure, the total resistance between points A and B is R_0. The value of resistance R is $\dfrac{R_0}{x}$. The value of x is
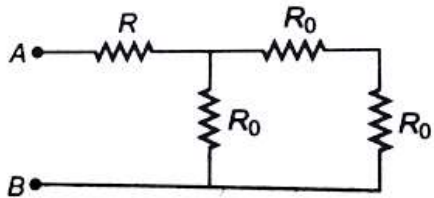
Ans. 3

$$R_{AB} = R + \dfrac{2R_0}{3} = R_0; \; R = R_0 - \dfrac{2R_0}{3} = \dfrac{R_0}{3}$$

21. A boy is standing at a distance 50cm infront of a plane mirror. The distance of image of the boy from the boy in cm is

Ans. 100 $\quad$ Image distance from the mirror $V = 50$ cm; $\therefore$ distance of image from boy $= 50 + 50 = 100$ cm

22. The minimum distance of reflector surface from the source for listening the echo of sound is Speed of sound is 300 m/s. [Answer should be in meter]

**Ans. 15** $\quad 2d = Vt; \; d = \dfrac{Vt}{2} = \dfrac{300}{2} \times \dfrac{1}{10}; \; d = 15 \text{ m}$

23. A car accelerates from rest at constant rate for first 10 seconds and covers a distance x. It covers a distance y in next 10s at the same acceleration. If y = ax, then value of a is

Ans. 3   In first 10 second, $x = \dfrac{at^2}{2} = \dfrac{a}{2} \times 100 = 50\ a$

In 20 seconds $x' = \dfrac{a}{2} \times 20^2 = 200\ a$

$y = x' - x = 200a - 50a = 150a = 50\ a \times 3;\ \ y = 3x$

24. A particle of mass 5kg is taken from A to B as shown in the figure. The change in potential energy of the mass in joule is [g = 10m/s^2]
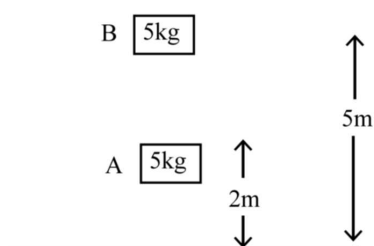
Ans. 150 $W = mg(h_2 - h_1) = 5[5 - 2]\ 10 = 150\ J$

25. Traffic signals are installed at every s = 1.00 km on a long straight road. A signal remains red for $\tau = 30\,s$ and green for next $\tau = 30\,s$. The signals are synchronized in such a way that at a time, alternate signals remain red and the other remain green. The scheme is shown in the following figure.
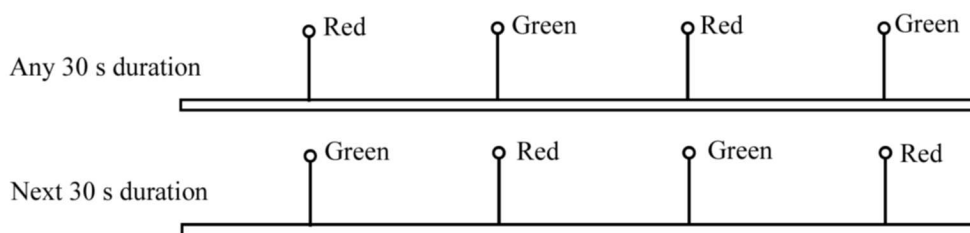
The maximum possible constant speed at which a vehicle can run on this road without a stop is x km/h. The value of x is

Ans. 120

Suppose,

Case-I : A car crosses a green signal just when its duration is started. Then if in 30 sec it covers 1km and by this time the next signal which was in red turns to be in green. The car when approaches to the next signal will find it in green.

Case-II : A car crosses a green signal just when its duration is started. Then if in 90 sec (3 * 30) it covers 1km and by this time the next signal which was in red turns to be in green. The car when approaches to the next signal will find it in green. Explanation : In the interval of 90 sec, in first 30 sec the next signal will be in red, the next 30 sec it will be in green, then the next 30 sec it will be red and when the car just approaches the next signal, it will turn into green.

So, in summary we found that all signals will be in green if the car travels the 1km distance in odd multiple of r (=30 sec) i.e.

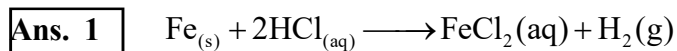Velocity, $v = \dfrac{s}{[r(2n+)]} = 120 \text{ Km/h, } 40 \text{ Km/h, } 24 \text{ km/h}..........$

where, n = 0, 1, 2, 3.............

PART II - CHEMISTRY

26. When dilute hydrochloric acid is added to iron filings

    1) Hydrogen gas and iron chloride are formed

    2) Chlorine gas and iron hydroxide are formed

    3) Iron chloride and water are formed

    4) No reaction takes place

Ans. 1 $Fe_{(s)} + 2HCl_{(aq)} \longrightarrow FeCl_2(aq) + H_2(g)$

27. Which among the following will not displace silver from silver nitrate solution?

    1) Copper (Cu)   2) Gold (Au)   3) Lead (Pb)   4) Zinc (Zn)

Ans. 2   Gold is less reactive than silver

28. Mixing of an acid with water results in

    1) Decrease in concentration of H_3O^+ ions per unit volume

    2) An increase in concentration of H_3O^+ ions per unit volume

    3) No change in concentration of H_3O^+ ions per unit volume

    4) Cooling of the solution since the process of dilution of acid is endothermic in nature

Ans. 1   Dilution of acid leads to decrase in concentration of H_3O^+

29. Match List-I (Position of metal in the activity series) with List-II (Related reduction process) and select the correct option using codes given below

List-I (Position of metal in the activity series)	List-II (Related reduction process)
A) the bottom of the series	I) Electrolysis
B) the top of the series	II) Found in native state
C) the lower region of the series	III) Reduction using carbon or some other reducing agent
D) the middle of the series	IV) Reduction by heat alone

1) $A \rightarrow II; B \rightarrow III; C \rightarrow IV; D \rightarrow I$ 2) $A \rightarrow II; B \rightarrow I; C \rightarrow IV; D \rightarrow III$

3) $A \rightarrow III; B \rightarrow I; C \rightarrow II; D \rightarrow IV$ 4) $A \rightarrow III; B \rightarrow I; C \rightarrow IV; D \rightarrow II$

Ans. 2   Metal at the bottom of the activitity series-least reactive : Found in free state

Metal at the top of the activity series-highly reactive : Electrolysis

Metal at the middle of the activity series - moderately reactive : Reduction using carbon

Metals at lower region of the activity series (eg Cu, Hg) : Reduction by heat

30. Which metal among the following do not react either with cold or hot water but react with steam to form metal oxide and hyrogen?

1) Calcium (Ca)   2) Magnesium (Mg)   3) Copper (Cu)   4) Iron (Fe)

Ans. 4   Metals like Al, Fe and Zn do not react with cold or hot water but react with steam
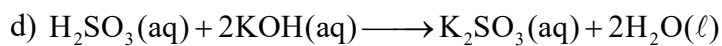
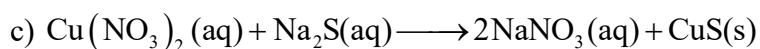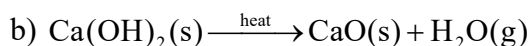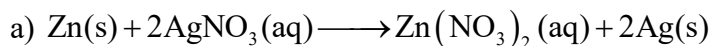$$3Fe(s) + H_2O(g) \longrightarrow Fe_3O_{4(s)} + 4H_{2(g)}$$
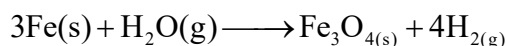
31. Which among the following aqueous solution has the lowest pH value at 298 K?

1) 0.1 Molar sodium chloride (NaCl) solution

2) 0.1 Molar sodium hyrogen carbonate ($NaHCO_3$) solution

3) 0.1 Molar sodium carbonate (Na_2CO_3) solution

4) 0.1 Molar sodium hydroxide (NaOH) solution

Ans. 1   pH of NaCl is 7. All other solutions have pH > 7

32. Consider the following reactions

    a) $Zn(s) + 2AgNO_3(aq) \longrightarrow Zn(NO_3)_2(aq) + 2Ag(s)$

    b) $Ca(OH)_2(s) \xrightarrow{\text{heat}} CaO(s) + H_2O(g)$

    c) $Cu(NO_3)_2(aq) + Na_2S(aq) \longrightarrow 2NaNO_3(aq) + CuS(s)$

    d) $H_2SO_3(aq) + 2KOH(aq) \longrightarrow K_2SO_3(aq) + 2H_2O(\ell)$

    Identify the choice where type of each reaction is related correctly

(a)	(b)	(c)	(d)
1) Precipitation	Neutralisation	Decomposition	Redox reaction
2) Neutralisation	Precipitation	Redox reaction	Decomposition
3) Redox reaction	Decomposition	Precipitation	Neutralisation
4) Decomposition	Redox reaction	Neutralisation	Precipitation

Ans. 3　　(a) = Redox reaction; (b) = Decomposition reaction; (c) = Precipitation reaction; (d) = Neutralisation

33. In the combustion reaction $C_nH_{2n+2} + xO_2 \longrightarrow zCO_2 + yH_2O$

    The values of x, y and z in the given balanced equation are

    1) $x = 2n$; $y = (n+1)$; $z = n$

    2) $x = (3n + 2)$; $y = (n - 1)$; $z = \dfrac{n}{2}$

    3) $x = \left(\dfrac{3n+1}{2}\right)$; $y = (n+1)$; $z = n$

    4) $x = \left(\dfrac{3n-1}{2}\right)$; $y = (n-1)$; $z = n$

Ans. 3　　The balanced equation is $C_nH_{2n+2} + \left(\dfrac{3n+1}{2}\right)O_2 \longrightarrow nCO_2 + (n+1)H_2O$

34. Which among the following statement is incorrect?

    1) 473 K temperature corresponds to 273°C

    2) The physical state of water at 298 K is liquid

    3) Naphthalene balls disappear with time without leaving any solid

    4) Ice at 273 K is more effective in cooling than water at the same temperature

Ans. 1   473 K = 473 – 273 = 200°C

35. Which among the following is not true regarding Dalton's atomic theory?

    1) All matter whether an element a compound or a mixture is composed of small particles called atoms

    2) Atoms cannot be created but can be destroyed in a chemical reaction

    3) Atoms of a given element are identical in mass and chemical properties

    4) Atoms of different elements have different mass and chemical properties

**Ans. 2**   Atoms cannot be created or destroyed in a chemical reaction

36. For an element with atomic number 19, the 19th electron will occupy

    1) L shell   2) M shell   3) K shell   4) N shell

Ans. 4   The E.C. of the atom is 2, 8, 8, 1. The last electron occupy N shell

37. Select the correct options from the following statements:-

    i) $_6^{12}C$ and $_6^{14}C$ are isotones to each other

    ii) $_6^{12}C$ react with $_8^{16}O$ to form a product which dissolves in water to form a solution of pH $>$ 7

    iii) $_{20}^{40}Ca$ and $_{18}^{40}Ar$ are isobars to each other

    iv) $_{20}^{40}Ca$ reacts with $_8^{16}O$ to form a compound whose aqueous solution is known as lime water

   1) i and ii   2) i and iii   3) iii and iv   4) i and iv

Ans. 3   C–12 and C-14 are isotopes

    CO_2 dissolves in water to form carbonic acid. Here pH $<$ 7

    Ca-40 and Ar-40 are isobars

    $2Ca + O_2 \longrightarrow 2CaO$

    $CaO + H_2O \longrightarrow \underset{\text{lime water}}{Ca(OH)_2}$
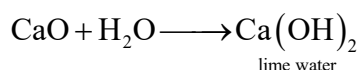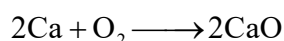
38. When aqueous solutions of Lead (II) nitrate and potassium iodide are mixed together. The colour of the precipitate formed and the compound precipitated are respectively

    1) Yellow : Potassium nitrate

    2) Yellow : Lead iodide

    3) White : Lead iodide

    4) Green : Potassium nitrate

Ans. 2 $Pb(NO_3)_2(aq) + 2KI(aq) \longrightarrow 2KNO_3(aq) + \underset{(yellow)}{PbI_2(s)}$
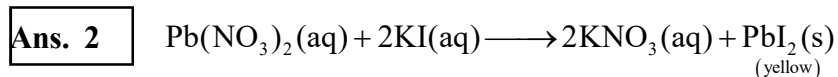
39. Based on his experiments, Rutherford concluded that positive charge on an atom is

    1) Spread over the atom

    2) Revolves around the atom in orbits

    3) Exists within the atom in empty space between orbits

    4) Present in the nucleus

Ans. 4   According to Rutherford, the positively charged centre in an atom is called nucleus

40. Which among the following elements form basic oxides

    a) element with atomic number 10

    b) element with atomic number 12

    c) element with atomic number 16

    d) element with atomic number 19

    1) a and c   2) b and c   3) c and d   4) b and d

Ans. 4   Atomic number 10 = Ne, At. No. 12 = Mg

    At number 16 = S; At. No. 19 = K

    Both MgO and K_2O are basic oxides

SECTION B - CHEMISTRY

41. How many of the following do not conduct electricity?

    i) Aqueous solution of glucose

    ii) Ethyl alcohol

    iii) Hydrochloric acid

    iv) Dilute sulphuric acid

    v) Aqueous saturated solution of calcium hydroxide

    vi) Cane sugar dissolved in water

    vii) Water solution of sodium chloride

Ans. 3   Glucose solution, cane sugar solution and ethylalcohol do not conduct electricity

42. Tooth decay starts when the pH of the mouth is lower than 'y'. Give the value of 10y

Ans. 55 $y = 5.5$; $10y = 55$

43. How many of the following are obtained when electricity is passed through an aqueous solution of sodium chloride?

    i) Sodium hydroxide   ii) Oxygen gas   iii) Sodium metal

    iv) Hydrogen gas   v) Chlorine gas

Ans 3 $2NaCl(aq) + 2H_2O(\ell) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

44. How many atoms are there in one formula unit of calcium hydrogen carbonate (Calcium bicarbonate)?

Ans. 11   Calcium hydrogen carbonate is $Ca(HCO_3)_2$

    There are 6 oxygens, 2 carbons, 2 hydrogens and 1 Ca atom in one formula unit

45. Hydrated copper sulphate is $CuSO_4.xH_2O$, washing soda is $Na_2CO_3.yH_2O$ and Gypsum $CaSO_4.zH_2O$. Give the value of $x + y + z$

Ans. 17 $CuSO_4.5H_2O$, $Na_2CO_3.10H_2O$ and $CaSO_4.2H_2O$ are the hydrated species considered

46. A solution contains 48g common salt in 352 g water. The concentration of common salt in terms of mass by mass percentage of the solution is ....

Ans. 12

Mass of solute = 48g

Mass of solvent = 352 g

Mass of solution = 400 g

Mass % of salt = $\dfrac{48}{400} \times 100 = 12\%$

47. The ion of an element has three (3) positive charges. Mass number of the atom is 27 and number of neutrons present is 14. What is the number of electrons in the ion?

Ans. 10

The ion is $\left[{}_{13}^{27}M \right]^{3+}$

Atomic number = 13

No. of electrons in neutral atom = 13

No.of electrons in tripositive ion = 10

48. If K, L, M and N shells of an atom are completely filled. The total number of electrons in the atom would be ....

Ans. 60

No.of electrons in K shell = 2

No.of electrons in L shell = 8

No.of electrons in M shell = 18

No.of electrons in N shell = 32

Total   = 60

49. How many of the following metals are more reactive than Iron (Fe) as per activity series?

A) Zinc(Zn)   B) Lead (Pb)   C) Copper (Cu)   D) Magnesium (Mg)

Ans. 2   Mg, Zn, Fe, Pb, Cu is the decreasing order of reactivity of the metals given

50. How many of the following are metalloids?

i) Gold (Au)   ii) Mercury (Hg)   iii) Boron (B)

iv) Oxygen (O)   v) Silicon (Si)   vi) Carbon (C)

vii) Iodine (I)   viii) Silver (Ag)   ix) Bromine (Br)

x) Germanium (Ge)   xi) Gallium (Ga)   xii) Iron (Fe)

xiii) Copper (Cu)   xiv) Caesium (Cs)

Ans. CANCELED

Boron is a typical non metals which is not updated in your school textbooks. But it is already updated in NCERT 11 and 12. Those students who strictly follow 8, 9 and 10 classes NCERT got confused. So in order to maintain equality we cancelled the respective question.
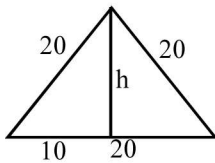
PART III - MATHEMATICS

Instruction: For calculations you can use following values $\left(\sqrt{2} = 1.41; \; \sqrt{3} = 1.73; \; \pi = \frac{22}{7} \text{ or } 3.14 \right)$

51. Altitude of an equilateral triangle having side of length 20cm is

    1) 14.1 cm   2) 17.3 cm   3) 18.6 cm   4) 21.3 cm

    Ans. 2

    $20^2 = 10^2 + h^2; \; h^2 = 20^2 - 10^2; \; h^2 = 300; \; h = 10\sqrt{3} = 17.3$

52. If $\sqrt{m} = 9$, then the value of $\sqrt{2m + 38}$, is

    1) 14.1   2) 17.3   3) 18.6   4) 21.3

    Ans. 1

    $\sqrt{m} = 9 \Rightarrow m = 81; \; \therefore \; \sqrt{2m + 38} = \sqrt{200} = 14.1$

53. Area of a semi circular plate having diameter 42 cm, is

    1) 936 cm²   2) 639 cm²   3) 369 cm²   4) 693 cm²

    Ans. 4

    $2r = 42 \Rightarrow r = 21$

    $\text{Area} = \frac{1}{2} \pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 21 \times 21 = 693$

54. Which of the following is a polynomial

    1) $2x + \dfrac{1}{2x}$ 2) $\dfrac{3}{2}x^2 + \dfrac{x}{\pi} + \sqrt{3}$ 3) $\left(\sqrt{3x} + \dfrac{1}{\sqrt{2}} \right)^2$ 4) $5x^2 + 3x^{-2} + 7$

    Ans. 2   Power of the variable should be a whole number

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55. Age of three persons A, B and C are 26 years, 27 years and 28 years respectively. In what ratio of amount they must invest in a Bank, at which compound interest may compute annually at 10%, so that each of them will get same sum of amount at the age of 60, when they will retair from a company?

1) 10 : 11: 12   2) 110 : 111 : 112   3) 100 : 110 : 111   4) 100 : 110 : 121

Ans. 4

Amount of $A = A(1+r)^{34}$

Amount of $B = B(1+r)^{33}$

Amount of $C = C(1+r)^{32}$; where $r = 0.1$

Given $A(1+r)^{34} = B(1+r)^{33} = C(1+r)^{32}$

$\Rightarrow A(1+r)^2 = B(1+r) = C$

$A(1.1)^2 = B(1.1) = C$

$A.121 = B\,110 = C.100$

$A : B : C = \dfrac{1}{121} : \dfrac{1}{110} : \dfrac{1}{100}$

$A : B : C = 100 : 110 : 121$ (multiply by 12100)

56. If the diagonal of a rectangle is 61 cm and its perimeter is 142 cm, then the area of the rectangle is

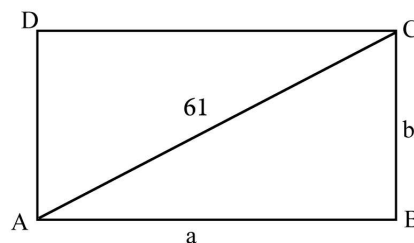1) 660 cm²   2) 600 cm²   3) 661 cm²   4) 666 cm²

Ans. 1

Given $a^2 + b^2 = 61^2$ and $2(a+b) = 142$

$\therefore a + b = 71$

$(a+b)^2 = a^2 + b^2 + 2ab = 71^2$

$\therefore 2ab = 71^2 - 61^2 = (71+61)(71-61)$

$2ab = 132 \times 10;\ ab = 660$

57. How many zeroes are required to write all natural members between 100 and 1000 in order on a paper?

    1) 171   2) 178   3) 168   4) 169

Ans. 2   No. having only 'one' zero between 100 and 1000 are listed below

$$
\left.
\begin{array}{l}
101,102................109,110,120.............190............... \quad 18 \\
201,202................209,210,220.............290............... \quad 18 \\
.... \\
.... \\
901,902................909,910,920.............990............... \quad 18
\end{array}
\right\} \quad \text{Total} = 9 \times 18 = 162
$$

No having two zero\s between 100 and 1000 are

200, 300, 400 .... 900 $\Rightarrow$ 8; $\therefore$ Total zero = 8 × 2 = 16

$\therefore$ No.of zeros requried = 162 + 16 = 178

58. If 75% of y is x, then what percentage of 3x is y?

    1) 60%   2) $66\frac{1}{3}\%$ 3) $44\frac{4}{9}\%$ 4) 45%

Ans. 3   Given 75% of y = x

ie $y \times \frac{75}{100} = x \Rightarrow \frac{3y}{4} = x$; $\therefore 3x = \frac{9}{4}y$

Let K% of $3x = y$; $\therefore 3x \times \frac{K}{100} = y$; ie $\frac{9}{4}y \times \frac{K}{100} = y$

$\therefore K = \frac{400}{4} = 44\frac{4}{9}$

59. If $\frac{3}{4} + x + \frac{7}{5} = \frac{13}{14}$, then 140x is

    1) –157   2) –137   3) –179   4) –171

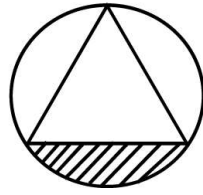**Ans. 4**   LCM = 140;

$\therefore 140 \times \frac{3}{4} + 140x + 140 \times \frac{7}{5} = 140 \times \frac{13}{14}$

$105 + 140x + 196 = 130$

$140x = -171$

60. An equilateral triangle of perimeter 36 cm is incribed in a circle as in the figure. Then the area of the shaded region in the figure, is
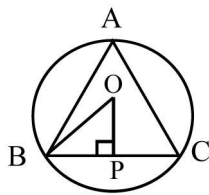

1) 19.48   2) 29.48   3) 30.48   4) 31.48

Ans. 2   Length of the side of triangle, $a = \dfrac{36}{3} = 12 \, cm$

$\therefore$ Area of triangle $\dfrac{\sqrt{3}a^2}{4} = \sqrt{3} \times \dfrac{12^2}{4} = 36\sqrt{3}$

Draw $OP \perp BC$, the OB is radius of the circle

In triangle OBP, $\angle O = 60°$, $\angle B = 30°$, $\angle P = 90°$

$\therefore$ Opposite sides are in the ratio $1 : \sqrt{3} : 2$
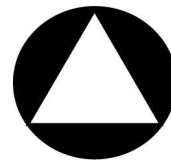
$OP : PB : OB = 1 : \sqrt{3} : 2$

$\Rightarrow \dfrac{PB}{OB} = \dfrac{\sqrt{3}}{2}$; $PB = \dfrac{1}{2} \times 12 = 6$

$\dfrac{6}{OB} = \dfrac{3}{2} \Rightarrow OB = \dfrac{12}{\sqrt{3}} = 4\sqrt{3} = r$

$\therefore$ Area of Circle $= \pi r^2 = \pi \left(4\sqrt{3}\right)^2 = 48\pi$

$\therefore$ Area of shaded reion $= 48\pi - 36\sqrt{3}$

$\therefore$ required area $= 16\pi - 12\sqrt{3} = 16 \times 3.14 - 12 \times 1.73 = 29.48$

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61. If a, b, c are relative prime integers (there is no common factor between a, b and c), and $4 + \sqrt{3}$ is one of the root of $ax^2 + bx + c = 0$, then which of the following relation provide a perfect square?

    1) $a + b - c$ 2) $b - c - a$ 3) $b + c - a$ 4) $c - a - b$

Ans. 3 One root is $4 + \sqrt{3}$ then other root is $4 - \sqrt{3}$ since a, b, c are integers

$\therefore$ sum of roots $= 4 + \sqrt{3} + 4 - \sqrt{3} = 8$

Product of roots $\left(4 + \sqrt{3}\right)\left(4 - \sqrt{3}\right) = 13$

$\therefore$ equation is $x^2 - 8x + 13 = 0$

a = 1, b = –8, c = 13, since a, b, c are co-primes

$\therefore$ a + b – c = –20, b – c – a = –22

b + c – a = 4, c – a – b = 20

62. If A (3, –5) and B (–2, 7) are end points of a diameter of a circle. Then circumference of the circle is

    1) 38.46   2) 42.32   3) 40.82   4) 36.42

Ans. 3 $AB = \sqrt{(3-2)^2 + (-5-7)^2} = \sqrt{25 + 144} = \sqrt{160} = 13 = 2r; \therefore r = \dfrac{13}{2}$

Circumference $= 2\pi r = 13\pi = 40.82$ units

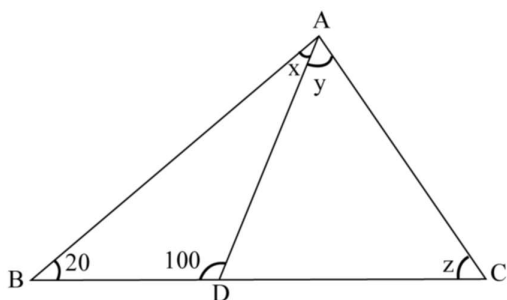63. Value of $20^2 - 19^2 + 18^2 - 17^2 + 16^2 - 15^2 + \ldots\ldots\ldots + 2^2 - 1^2$ is

    1) 210   2) 220   3) 230   4) 240

Ans. 1 $a^2 - b^2 = (a+b)(a-b)$

$S = 39.1 + 35.1 + 31.1 + \ldots\ldots 7.1 + 3.1 = 3 + 7 + 11 + \ldots\ldots + 35 + 39$

$= \dfrac{10}{2}[3 + 39] = 5 \times 42 = 210$

64. Find $x + y + z$ from the $\triangle ABC$

     1) 160   2) 140   3) 100   4) 130

Ans. 1 $x + y + z + 20 = 180 \Rightarrow x + y + z = 160$

65. Largest number which divide both 444 and 1295 is

     1) 74   2) 35   3) 37   4) 44

Ans. 3   Find HCF

SECTION B - MATHEMATICS

Instruction: For calculations you can use following values $\left(\sqrt{2} = 1.41; \ \sqrt{3} = 1.73; \ \pi = \dfrac{22}{7} \text{ or } 3.14 \right)$

66. Sum of all prime numbers between 10 and 50

Ans. 311 $11+13+17+19+23+29+31+37+41+43+47$

67. If A (2, 3) and B($-1, -1$) then AB = ...

Ans. 5 $AB = \sqrt{(2-1)^2 + (3-1)^2} = \sqrt{3^2 + 4^2} = 5$

68. A truck has a container having dimensions of size 1.5 m $\times$ 3m $\times$ 2m. How many bricks can be loaded inside the container so that the length, breadth and width of the bricks are 45 cm, 25 cm and 16 cm respectively?

Ans. 500   No. of bricks $= \dfrac{150 \times 300 \times 200}{45 \times 25 \times 16} = 500$

69. If $P(x) = Q(x) + R(x) - S(x)$ where

$Q(x) = 7 + 2x - 3x^2 + 8x^3$

$R(x) = 11 - 5x + x^2 - 5x^3$

$S(x) = 21 + 15x - 8x^2 + 3x^3$

Then the degree of $P(x)$ is

Ans. 2

$$Q(x) = 7 + 2x - 3x^2 + 8x^3$$
$$\underline{R(x) = 11 - 5x + x^2 - 5x^3}$$
$$Q(x) + R(x) = 18 - 3x - 2x^2 + 3x^3$$
$$\underline{S(x) = 21 + 15x - 8x^2 + 3x^3}$$
$$P(x) = -3 - 18x + 6x^2 + 0x^3$$

70. Coefficient of largest powered term in the expansion of $(2x^3 - 4x^2 + 2x - 1)^4$ is

Ans. 16

Largest powered term in the expansion is $(2x^3)^4 = 2^4 \cdot x^{12} = 16x^{12}$

71. An isosceles triangle ABC with base BC is incribed in a circle of centre 'O'. If $\angle B = 50°$, then degree measure of $\angle A + \angle BOC$ is equal to
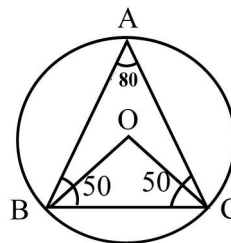
Ans. 240

$\angle B = \angle C = 50$

$\therefore \angle A = 180 - (50 + 50) = 80$

$\therefore \angle BOC = 2 \times \angle A = 2 \times 80 = 160$

$\therefore \angle A + \angle BOC = 80 + 160 = 240°$

72. Constant term in the expansion of $\left(x + \dfrac{1}{x}\right)^2 - \left(x - \dfrac{1}{x}\right)^2$ is

Ans. 4

$\left(x + \dfrac{1}{x}\right)^2 - \left(x - \dfrac{1}{x}\right)^2 = \left(x^2 + \dfrac{1}{x^2} + 2\right) - \left(x^2 + \dfrac{1}{x^2} - 2\right) = 2 - -2 = 4$

73.   Last digit of 3^{11} is

Ans. 7   Last digit of $3^1 = 3$

Last digit of $3^2 = 9$

Last digit of $3^3 = 7$

Last digit of $3^4 = 1$

$\therefore$ last digit repeats in the order 3, 9, 7, 1 etc

74.   Value of x satisfying $3x - 2y = 1$ and $7x + y = 25$ is

Ans. 3   Solving $x = 3$

75. 12th term in the sequence 7, 18, 29 .... is

Ans. 128 $t_{12} = 7 + 11 \times 11 = 128$