FIITJEE Talent Reward Exam

for student presently in
Class 10

A

PAPER–2

Time: 3 Hours | **CODE A10** | ***Maximum Marks: 270***

Instructions:

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

1. **You are advised to devote 1 Hour on Section-I and 2 Hours on Section-II and Section-III.**
2. This Question paper consists of 3 sections. **All questions will be multiple choice single correct out of four choices with marking scheme in table below:**

Section			Question no.	Marking Scheme for each question	
				correct answers	wrong answers
SECTION – I (IQ)			Q. 1 to 8	**+3**	**–1**
			Q. 9 to 16	**+6**	**–2**
SECTION – II (PCM)	Part –A	Physics	Q. 17 to 25	**+4**	**–1**
	Part –B	Chemistry	Q. 26 to 34	**+4**	**–1**
	Part –C	Mathematics	Q. 35 to 43	**+4**	**–1**
SECTION – III (PCM)	Part –A	Physics	Q. 44 to 48	**+6**	**–2**
	Part –B	Chemistry	Q. 49 to 53	**+6**	**–2**
	Part –C	Mathematics	Q. 54 to 58	**+6**	**–2**

3. Answers have to be marked on the OMR sheet.
4. The Question Paper contains blank spaces for your rough work. No additional sheets will be provided for rough work.
5. Blank papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.
6. **Before attempting paper write your Name, Registration number** and **Test Centre** in the space provided at the bottom of this sheet.

Note:

Check all the sheets of this question paper. Please ensure the same SET is marked on header of all the sheets inside as indicated above 'Maximum Marks' of this page. In case SET marked is not the same on all pages, immediately inform the invigilator and CHANGE the Questions paper.

Registration Number : ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Name of the Candidate : _____

Test Centre : _____

Section-I

IQ

Directions (Q. 1 to 4): Find the missing number.

1. 2, 9, 28, 65, _____
   (A) 121 (B) 195
   (C) 126 (D) 103

2. 2, 6, 14, 26, _____, 62
   (A) 52 (B) 54
   (C) 44 (D) 42

3. 4, 18, 48, 100, _____
   (A) 180 (B) 200
   (C) 192 (D) 186

4. 0, 2, 24, 324, _____
   (A) 4620 (B) 5120
   (C) 3072 (D) 5136

Directions (Q. 5 to 6): Find the odd one which is different from rest.

5. (A) 529 (B) 676
   (C) 729 (D) 814

6. (A) KP (B) HS
   (C) FW (D) MN

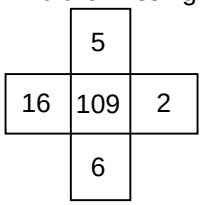
Space for Rough Work

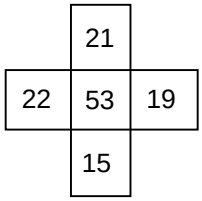
7. Introducing a man, a woman said, “He is the only son of my mother’s mother.” How is the woman related to that man?
(A) Mother (B) Niece
(C) Aunt (D) Sister

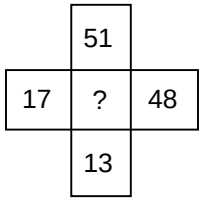
8. Ram starts walking towards south. After walking 15 m he turns towards north. After walking 20 m, he turns towards east and walks 10 m. He then turns towards south and walks 5 m. How far is he from his initial position?
(A) 10 m (B) 5 m
(C) 15 m (D) 7 m

9. If GO = 32, RAM = 49, then PANKAJ = ?
(A) 119 (B) 129
(C) 109 (D) 91

10. Find the missing number.







(A) 25 (B) 129
(C) 7 (D) 49

11. Find the missing number.
4 5 6
2 3 7
1 8 3
21 98 ?
(A) 16 (B) 73
(C) 76 (D) 94

Space for Rough Work

Direction (Q. 12 to 14): Read the passage given below and solve the questions based on it.
There is a cube in which one pair of opposite faces is painted red; another pair of opposite faces is painted blue and the third pair of opposite faces is painted pink. This cube is now cut into 216 smaller but identical cubes.

12. How many small cubes will be there with no red paint at all?
(A) 121 (B) 144
(C) 169 (D) 100

13. How many small cubes will be there with at least two different colours on their faces?
(A) 49 (B) 64
(C) 56 (D) 81

14. How many small cubes will be there without any face painted?
(A) 64 (B) 49
(C) 36 (D) 25

Directions (Q.15 to 16): Study the information given below and answer the questions that follow:
Six lectures A, B, C, D, E and F are to be organized in a span of seven days from Sunday to Saturday, only one lecture on each day in accordance with the following:

(i) A should not be organized on Thursday,
(ii) C should be organized immediately after F.
(iii) There should be a gap of two days between E and D.
(iv) One day there will be no lecture (Friday is not that day), just before that day D will be organized.
(v) B should be organized on Tuesday and should not be followed by D.

15. On which day there is no lecture?
(A) Monday (B) Friday
(C) Sunday (D) None of these

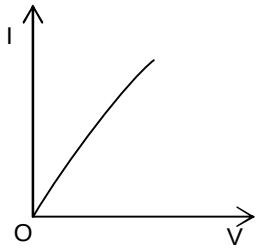
16. How many Lectures are organized between C and D?
(A) None (B) Four
(C) Two (D) Three

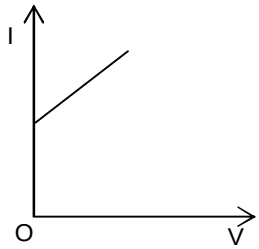
Space for Rough Work

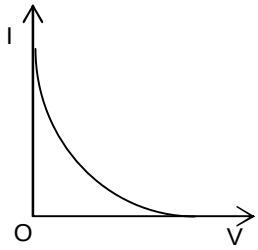
Section-II Science and Mathematics (PCM)

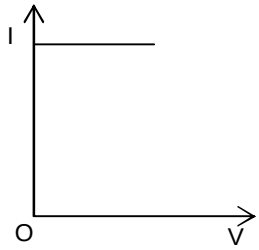
Physics (Part – A)

17. Which of the following graphs best represents the current voltage relationship of an incandescent light bulb?

(A) 

(B) 

(C) 

(D) 

18. An image of small size can be obtained on a screen placed at 2.0 m from object. It can be done by using.
(A) concave mirror of focal length 0.5 m
(B) concave mirror of focal length greater than 0.5 m
(C) concave mirror of focal length less than 0.5 m
(D) concave lens of focal length less than 0.5 m.

Space for Rough Work

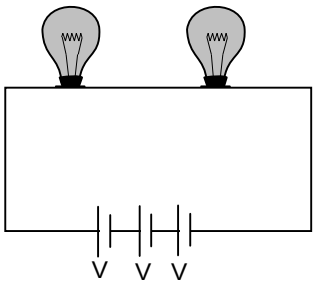
19. Some statements are given as
(i) The phenomenon of electromagnetic induction is producing electric current in a coil due to relative motion between a magnet and the coil.
(ii) An electric motor converts mechanical energy into electrical energy.
(iii) An electric generator works on the principle of electromagnetic induction.
(iv) The field at the centre of a long circular coil(solenoid) carrying current will be parallel straight lines.

Now choose the correct option.

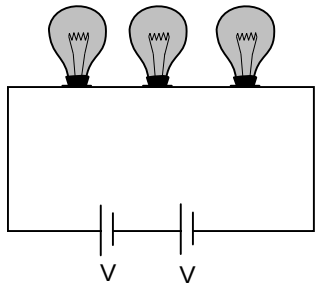
(A) Statements (i), (ii) and (iii) are correct.
(B) Statements (ii), (iii) and (iv) are correct.
(C) Statements (i) and (iv) are correct.
(D) Statements (i), (iii) and (iv) are correct.

20. In the given diagrams, all light bulbs are identical and all emf devices are identical. In which circuit (A, B, C, D) will the bulb be dimmest?

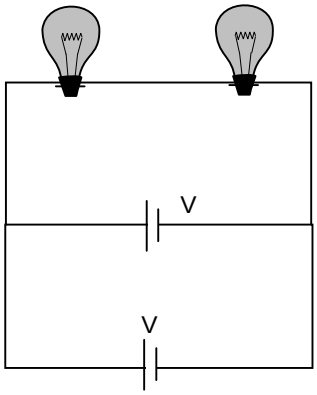
(A)



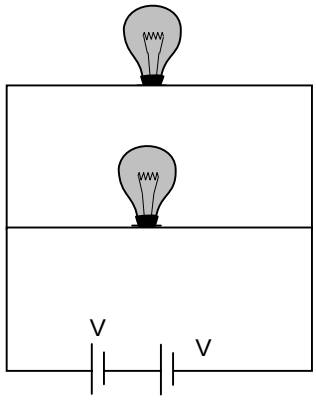
(B)



(C)

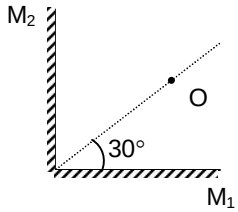


(D)



Space for Rough Work

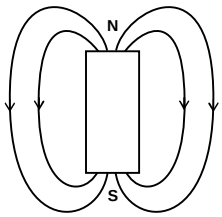
21. Two mirrors M_1 and M_2 are placed perpendicular to each other as shown. An object is placed at point 'O'. The total no. of images made by mirrors are



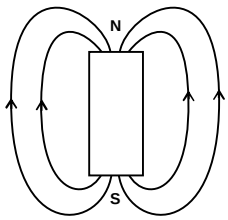
(A) 3
(B) 5
(C) 4
(D) 2

22. In which figure, the magnetic field lines due to a bar magnet are correctly shown.

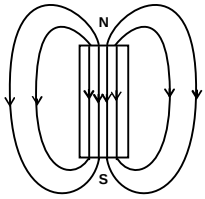
(A)



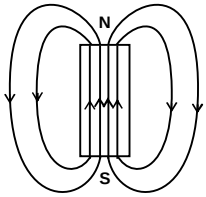
(B)



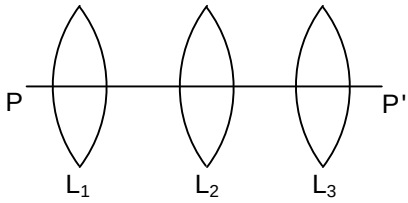
(C)



(D)



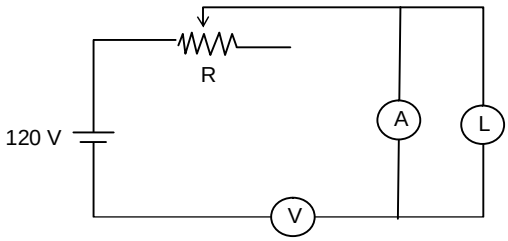
23. Three convex lenses of equal focal length 20 cm are placed along a common optical axis PP' as shown. An object is placed at a distance of 30 cm, towards left of lens L_1. If final image coincides with the focus of lens L_3 then choose the **INCORRECT** option.



(A) Image made by lens L_1 is at 20 cm left of L_2
(B) Distance between L_2 & L_3 must be 40 cm
(C) Distance between L_1 & L_2 must be 80 cm
(D) Distance between L_2 & L_3 may be 60 cm.

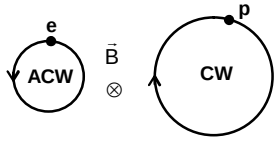
Space for Rough Work

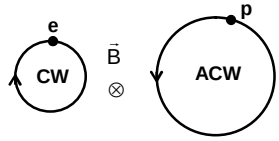
24. A student has to measure the resistance of lamp (L), using ammeter (A), voltmeter (V) and rheostat (R). He constructed a circuit as shown in the diagram. He shows his circuit to his teacher, and teacher said that circuit is wrong. His teacher advised to change the position of some electrical components. The advice of his teacher should be

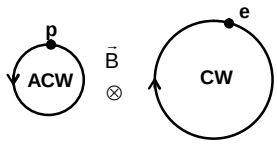


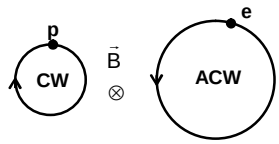
(A) Voltmeter (V) and rheostat (R) should be interchanged
(B) Lamp (L) and voltmeter (V) should be interchanged
(C) Voltmeter (V) and ammeter (A) should be interchanged
(D) The ammeter (A) should be in parallel with rheostat (R), not in parallel with lamp (L).

25. An electron and a proton, each travel with equal speeds around the circular orbits in the same uniform magnetic field. The field is into paper in each diagram (not to scale). The electron is less massive than proton. Electron is negatively charged and proton is positively charged. Choose the correct representation of their motion on the circular orbits. (ACW $\rightarrow$ anticlockwise and CW $\rightarrow$ clockwise)

(A)


(B)


(C)


(D)


Space for Rough Work

Chemistry (Part – B)

26. Which of the following statement is wrong about sodium hydroxide?
(A) It is a deliquescent substance
(B) It is corrosive
(C) It dissolves ferric oxide
(D) It releases hydrogen gas with aluminium

27. What kind of reaction is this?
$ZnO + H_2SO_4 \longrightarrow ZnSO_4 + H_2O$
(A) Combination reaction
(B) Neutralization reaction
(C) Dissociation reaction
(D) Redox reaction

28. The aqueous solution of aluminium sulphate is:
(A) Acidic
(B) Basic
(C) Amphoteric
(D) Both (B) and (C)

29. Among the following groups of oxides, the group that is not reduced by smelting is
(A) ZnO, Fe_2O_3
(B) SnO_2, PbO
(C) MnO_2, ZnO
(D) CaO, MgO

30. The oxidation number of sulphur is –2 in
(A) SO_4^{2-}
(B) SO_3^{2-}
(C) $S_2O_3^{2-}$
(D) HS^-

31. The product of complete neutralization of H_3PO_3 with NaOH is:
(A) NaH_2PO_3
(B) Na_2HPO_3
(C) Na_3PO_3
(D) $Na_3(HPO_3)_2$

32. Which of the following can dissolve limestone?
(A) $NH_3 + H_2O$
(B) $NaOH + H_2O$
(C) $CaO + H_2O$
(D) $CO_2 + H_2O$

33. At 25°C, pH of 10^{-3}M NaOH solution is
(A) 3
(B) 8
(C) 11
(D) 14

34. Which of the following reaction is not an example of thermite process?
(A) $3MnO_2 + 4Al \longrightarrow 3Mn + 2Al_2O_3$
(B) $Cr_2O_3 + 2Al \longrightarrow 2Cr + Al_2O_3$
(C) $Al_2O_3 + 2Fe \longrightarrow 2Al + Fe_2O_3$
(D) $B_2O_3 + Al \longrightarrow 2B + Al_2O_3$

Space for Rough Work

Mathematics (Part – C)

35. If $\Delta ABC \sim \Delta DEF$ such that BC = 2.1 cm and EF = 2.8 cm. If the area of triangle DEF is 16 cm^2, then the area of triangle ABC (in sq. cm) is
(A) 9 (B) 12
(C) 8 (D) 13

36. The expression $2x^3 + 3px^2 - 4x + p$ has a remainder of 5 when divided by x + 2, then the value of p is
(A) 0 (B) 1
(C) 2 (D) – 1

37. Two numbers are in the ratio 9 : 13. If their H.C.F. is 15, then the numbers are
(A) 135, 185 (B) 135, 195
(C) 195, 255 (D) 155, 255

38. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$, then $\cos\theta_1 + \cos\theta_2 + \cos\theta_3$ is equal to
(A) 0 (B) 1
(C) 2 (D) 3

39. A circular wire of radius 7 cm is cut and bent again into an arc of a circle of radius 12 cm. The angle subtended by the arc at the centre is
(A) 50° (B) 60°
(C) 100° (D) 210°

40. The value of k for which the system of equation kx – y = 2, 6x – 2y = 3 has unique solution is
(A) not equal to one (B) equal to three
(C) not equal to zero (D) not equal to three

41. Mean of 100 items is 49. It was discovered that three items which should have been 60, 70, 80 were wrongly read as 40, 20, 50 respectively. The correct mean is
(A) 48 (B) $82\frac{1}{2}$
(C) 50 (D) 80

42. A car completes first half of its journey with a velocity v_1 and the rest half with a velocity v_2. Average velocity of the car for the whole journey is
(A) $\frac{v_1 + v_2}{2}$ (B) $\sqrt{v_1 v_2}$
(C) $\frac{2v_1 v_2}{v_1 + v_2}$ (D) none of these

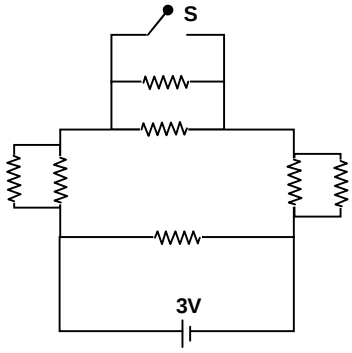
43. The number of positive integral solutions of 2x + 3y = 763 is
(A) 125 (B) 126
(C) 127 (D) 128

Space for Rough Work

Section-III Science & Mathematics (PCM)

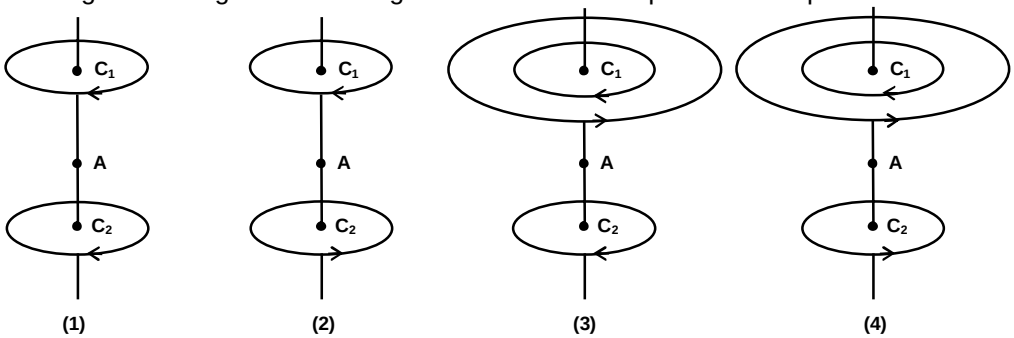
Physics (Part – A)

44. Seven equal resistors, each of resistance 2 Ω are connected with a battery of 3V in a circuit as shown in the figure. If 'i_1' is the current when switch S is open and i_2 is the current when switch S is closed, the ratio of i_1/i_2 is



(A) 4/3
(B) 5/6
(C) 6/5
(D) 3/4

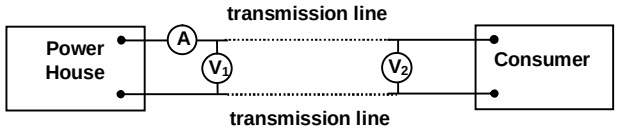
45. The diagram shows four arrangements of circular loops, centred at the vertical axis and carrying identical currents 10A in the directions indicated. The radius of smaller loop is 5 mm and larger loop is 10 mm. The separation between centre C_1 and C_2 is 10 mm. Rank the arrangements according to the magnitudes of magnetic field at the mid points the loop on the central axes.



(A) 1, 2, 3, 4
(B) 2, 1, 3, 4
(C) 2, 4, 3, 1
(D) 2, 4, 1, 3

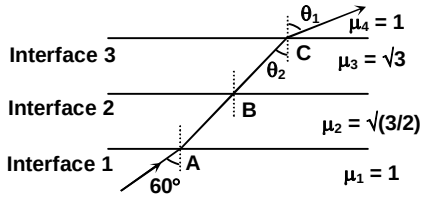
Space for Rough Work

46. In the figure, voltmeter V_1 reads 600 V, Voltmeter V_2 reads 580 V, and ammeter A reads 100 A. All the measuring devices are ideal. The power wasted in the transmission line connecting the power house to the consumer is



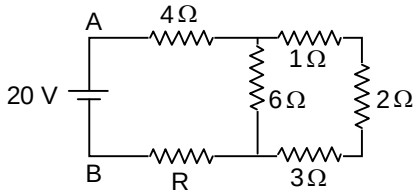
(A) 60 kW (B) 4 kW
(C) 58 kW (D) 2 kW

47. There are four mediums, separated by three parallel interfaces as shown in the figure. An incident ray strikes on the point A of first medium with angle of incidence 60° and emerges from point C as shown in the figure. Find the value of $\frac{\theta_1}{\theta_2}$,



(A) 4 (B) 3
(C) 2 (D) 1

48. An electrical circuit is shown in the figure. Find the value of R so that power developed in R is maximum.



(A) 8 Ω
(B) 7 Ω
(C) 6 Ω
(D) 4 Ω

Space for Rough Work

Chemistry (Part – B)

49. Chemical 'A' is used for water softening to remove temporary hardness. 'A' reacts with sodium carbonate to generate caustic soda. What is 'A'?
(A) Gypsum
(B) Slaked lime
(C) Quick lime
(D) Limestone

50. Which of the following statement/s are correct.
(i) Metals are good conductors of electricity and their conductivity increases as a temperature is lowered
(ii) Ionic solids are generally brittle.
(iii) Phosphorous is stored in water.
(iv) Metals are typically malleable and ductile due to large adhesive force that holds the structure together.
(A) I & II only
(B) I & II only
(C) II, III, IV only
(D) I, II, III only

51. HNO_2 can be used as
(A) A reducing agent
(B) An oxidizing agent
(C) Both (A) & (B)
(D) None of the above

52. The oxidation states of the most electronegative element in the products of the reaction of Na_2O_2 with dilute H_2SO_4, are
(A) -2 and -1
(B) -2 and $+1$
(C) -2 and 0
(D) -1 and 0

53. Melting point of magnesium halides decreases in the order. Choose correct option.
(A) $MgF_2 > MgCl_2 > MgBr_2 > MgI_2$
(B) $MgI_2 > MgBr_2 > MgCl_2 > MgF_2$
(C) $MgCl_2 > MgBr_2 > MgF_2 > MgI_2$
(D) $MgCl_2 > MgBr_2 > MgI_2 > MgF_2$

Space for Rough Work

Mathematics (Part – C)

54. The value of 'a' for which one root of the equation $(a^2 - 5a + 3)\,x^2 + (3a - 1)\,x + 2 = 0$ is twice the other, is
(A) 1 (B) 1/3
(C) 4/3 (D) 2/3

55. If $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ are the roots of equation $x^4 + \left(2-\sqrt{3}\right)x^2 + 2 + \sqrt{3} = 0$, then the value of $(1 - \alpha_1)(1 - \alpha_2)(1 - \alpha_3)(1 - \alpha_4)$ is
(A) $2\sqrt{3}$ (B) 5
(C) 1 (D) 4

56. If $\sin^2\theta = \dfrac{x^2 + y^2 + 1}{2x}$, then x must be
(A) 1 (B) – 2
(C) – 3 (D) 2

57. A number is successively divided by 8, 6 and 5 leaving 1, 5 and 4 as remainder respectively. The sum of remainders when order of divisors be reversed is
(A) 10 (B) 19
(C) 14 (D) 33

58. A triangle has side lengths 4, 6, 8. A tangent is drawn to the incircle parallel to side 4 cutting other two sides at M and N, then the length of MN is
(A) $\dfrac{10}{9}$ (B) $\dfrac{20}{9}$
(C) $\dfrac{5}{3}$ (D) $\dfrac{4}{3}$

Space for Rough Work

FIITJEE TALENT REWARD EXAM

(FTRE-2013)

CLASS X

HINTS (SET-A)
PAPER-2

1. (C) $1^3+1, 2^3+1, 3^3+1, 4^3+1$
$\therefore 5^3+1=126.$

2. (D) 2 6 14 26 ___ 62
4 8 12 16 20
$\therefore$ 26 + 16 = 42.

3. (A) $2^3-2^2, 3^3-3^2, 4^3-4^2, 5^3-5^2$
$\therefore\ 6^3-6^2=180.$

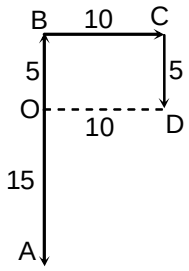
4. (B) $0^1+0^2, 1^2+1^3, 2^3+2^4, 3^4+3^5$
$\therefore\ 4^5+4^6=5120$

5. (D) Other three are perfect square.

6. (C) Sum of other three is 27.

7. (B) Niece

8. (A) $\therefore$ DO = BC = 10 m



9. (C) PANKAJ = 11 + 26 + 13 + 16 + 26 + 17 = 109.
$\therefore$ Sum of positional value of alphabets in reverse order.

10. (A) $(16-6)^2+(5-2)^2=109$
$(22-15)^2+(21-19)^2=53$
$\therefore (17-13)^2+(51-48)^2=25$

11. (D) $4^2+2^2+1^2=21, 5^2+3^2+8^2=98$
$\therefore\ 6^2+7^2+3^2=94$

Directions (Solution for Q. 12 to 14):

12. (B) Cube with no red paint at all = 216 – 72 = 144.

13. (C) Cube with at least two different colours on their faces = 2 different colours + 3 different colours = 48 + 8 = 56.

14. (A) The number of cubes without any face painted = $(6-2)^3=64$.

Directions (Solution Q.15 to 16):

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
D	X	B	E	F	C	A

15. (A) Monday

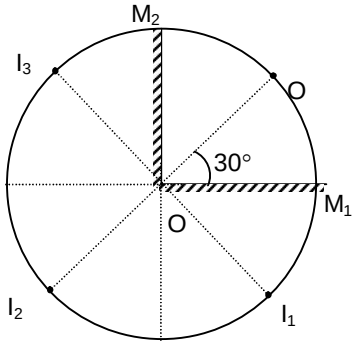
16. (D) Three lectures are organized between C and D.

17. Self explanatory

18. Concept: Ray diagram of concave lens (Refraction)

19. Concept: Electromagnetic induction

20. Self explanatory

21.


22. Properties of magnetic field lines.

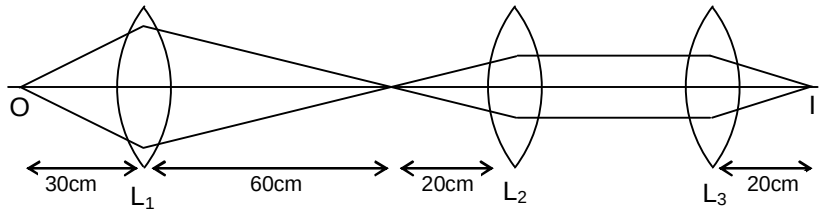
23. for image distance made by L_1

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{v}-\frac{1}{(-30)}=\frac{1}{20}$$

$$\frac{1}{v}=\frac{1}{20}-\frac{1}{30}$$

v = 60 cm



Concept – by using lens formula and ray tracing

24. Self explanatory

25. Self explanatory

26. Ferric oxide is basic in nature hence do not react with NaOH.

27. Zinc oxide is a base and H_2SO_4 is an acid.

28. $Al_2(SO_4)_3$ on hydrolysis gives $Al(OH)_3$ & H_2SO_4, and therefore will be acidic in nature.

29. Oxides of reactive metals like Ca & Mg forms very strong bond with oxygen which cannot be broken by smelting.

30. O. No. of S.
In $SO_4^{2-} = +6$
$SO_3^{2-} = +4$
$S_2O_3^{2-} = +2$
$HS^- = -2$

31. H_3PO_3 is a dibasic acid.

32. $\underset{\text{solid}}{CaCO_3} + CO_2 + H_2O \longrightarrow \underset{\text{dissolve}}{Ca(HCO_3)_2}$

33. $[OH^-] = 10^{-3}$
$pOH = -\log [10^{-3}]$
$= 3$
$pH + pOH = 14$
$pH + 3 = 14$
$pH = 11$

34. In thermite process the reducing agent is always Al.

35. $\dfrac{ar(\Delta ABC)}{ar(\Delta DEF)} = \dfrac{BC^2}{EF^2}$

$\Rightarrow$ ar $(\Delta ABC) = \left(\dfrac{2.1}{2.8}\right)^2 \times ar(\Delta DEF) = 9\,cm^2$

36. $2(-2)^3 + 3p(-2)^2 - 4(-2) + p = 5$
$\Rightarrow 13p = 13 \Rightarrow p = 1.$

37. Numbers are 9×15 and 13×15.

38. We have $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$
$\Rightarrow \sin\theta_1 = \sin\theta_2 = \sin\theta_3 = 1$
$\Rightarrow \theta_1 = \theta_2 = \theta_3 = \pi/2$
$\Rightarrow \cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$

39. $l = 14\pi$
$\theta = \dfrac{l}{r} = \dfrac{14\pi}{12} = \dfrac{7}{6} \times 180° = 210°$.

40. $\frac{k}{6} \neq \frac{-1}{-2} \Rightarrow k \neq 3.$

41. Correct mean = $\frac{4900 + (60 + 70 + 80) - (40 + 20 + 50)}{100} = 50.$

42. $v_1 = \frac{d}{t_1},\ v_2 = \frac{d}{t_2}$

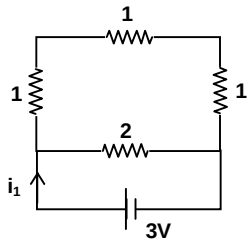
$v_{avg} = \frac{2d}{t_1 + t_2} = \frac{2d}{\frac{d}{v_1} + \frac{d}{v_2}} = \frac{2v_1v_2}{v_1 + v_2}.$

43. $x = \frac{763 - 3y}{2}, x \in I^+ \Rightarrow 1 \le y \le 254$

But when y is odd, $x \in I^+ \Rightarrow$ Number of positive integral solution = 127.

44. $R_{eq} = \frac{3 \times 2}{3 + 2} = \frac{6}{5}$

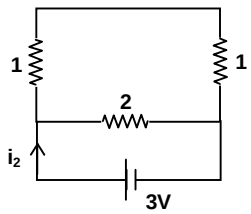
$i_1 = \frac{3}{6/5} = \frac{5}{2}$ A K



$\frac{i_1}{i_2} = \frac{\frac{5}{2}}{6} = \frac{5}{6}$ A

$R_{eq} = 1$

$i_2 = \frac{3}{1} = 3$ A



45. Self explanatory

46. Self explanatory

47. Using Snell's law at point C, we have

$\mu_4 \sin\theta_1 = \mu_3 \sin\theta_2$

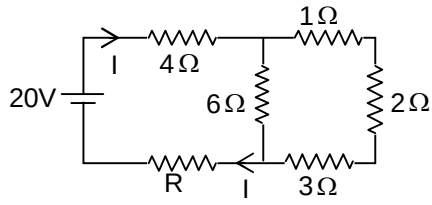
$\Rightarrow$ $1 \times \sin 60° = \sqrt{3} \sin \theta_2$

$\Rightarrow$ $\frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{3}} = \sin\theta_2$

$\Rightarrow$ $\sin\theta_2 = \frac{1}{2} \Rightarrow \theta_2 = 30°$

$\frac{\theta_1}{\theta_2} = \frac{60°}{30°} = 2$

48. $I = \dfrac{20}{R+7}$



P = Power developed in

$$R = RI^2 = \frac{400R}{(R+7)^2} = \frac{400R}{[(R-7)^2+28R]}$$

$$= \frac{400R}{\left[\sqrt{R}\left(\sqrt{R}-\frac{7}{\sqrt{R}}\right)\right]^2+28R} = \frac{400}{28+\left[\sqrt{R}-\frac{7}{\sqrt{R}}\right]^2}$$

For maximum P, Denominator should be minimum be

$$\sqrt{R}-\frac{7}{\sqrt{R}} = 0 \Rightarrow R = 7\Omega$$

49. Slaked lime $Ca(OH)_2$

$$\underset{\substack{\text{compound creating}\\ \text{temporary hardness}}}{Ca(HCO_3)_2} + Ca(OH)_2 \longrightarrow \underset{\text{insoluble}}{2CaCO_3\downarrow} + 2H_2O$$

$$Ca(OH)_2 + Na_2CO_3 \longrightarrow \underset{\text{Caustic Soda}}{2NaOH} + CaCO_3\downarrow$$

50. Metals are malleable & ductile due to large cohesive force b/w their particles that holds the structure together.

51. N in HNO_2 has oxidation number is = +3, hence can undergo further oxidation or reduction.

52. $Na_2O_2 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O_2$
Oxidation number of O in $Na_2SO_4 = -2$
Oxidation number of O in $H_2O_2 = -1$

53. As the size of the anion increases, the covalent character increases & M.PT. decreases.

54. $3\alpha = \dfrac{1-3a}{a^2-5a+3}$, $2\alpha^2 = \dfrac{2}{a^2-5a+3}$

$$\Rightarrow 2\frac{1}{9}\left(\frac{1-3a}{a^2-5a+3}\right)^2 = \frac{2}{a^2-5a+3}$$

$\Rightarrow 9a^2 - 45a + 27 = 9a^2 - 6a + 1$

$\Rightarrow a = \dfrac{2}{3}$.

55. $\sum\alpha_1 = 0,\ \sum\alpha_1\alpha_2 = 2-\sqrt{3},\ \sum\alpha_1\alpha_2\alpha_3 = 0,\ \alpha_1\alpha_2\alpha_3\alpha_4 = 2+\sqrt{3}$

$(1-\alpha_1)(1-\alpha_2)(1-\alpha_3)(1-\alpha_4)$

$= 1-\left(\sum\alpha_1\right)+\left(\sum\alpha_1\alpha_2\right)-\left(\sum\alpha_1\alpha_2\alpha_3\right)+\alpha_1\alpha_2\alpha_3\alpha_4$

$= 1 - 0 + 2-\sqrt{3} - 0 + 2 + \sqrt{3} = 5$.

56. $0 \le \sin^2\theta \le 1$

$$\Rightarrow 0 \le \frac{x^2+y^2+1}{2x} \le 1 \Rightarrow \frac{(x-1)^2+y^2}{2x} \le 0 \Rightarrow x = 1.$$

$\Rightarrow x > 0$

57. $N = 8p + 1$
$p = 6q + 5$
$q = 5r + 4$
$\Rightarrow N = 8(6q + 5) + 1$
$= 48q + 41 = 48(5r + 4) + 41 = 240r + 233$

5	240r + 233	3
6	48r + 46	4
8	8r + 7	7
	r	

Sum of remainders = 3 + 4 + 7 = 14.

58. $s = \frac{4+6+8}{2} = 9$

$\Delta = \sqrt{9 \cdot 1 \cdot 3 \cdot 5} = 3\sqrt{15} = \frac{1}{2} \cdot 4 \cdot h$

$\Rightarrow h = \frac{3}{2}\sqrt{15}$

$r = \frac{\Delta}{s} = \frac{\sqrt{15}}{3}$

$h_1 = h - 2r = \frac{3}{2}\sqrt{15} - \frac{2}{3}\sqrt{15} = \frac{5}{6}\sqrt{15}$

$\Delta AMN \sim \Delta ABC$

$\Rightarrow \frac{h_1}{h} = \frac{MN}{4} \Rightarrow MN = \frac{4h_1}{h} = \frac{4 \cdot \frac{5}{6}\sqrt{15}}{\frac{3}{2}\sqrt{15}} = \frac{20}{9}$.