BRILLIANT®
TUTORIALS

BITSAT 2008
MTP 4/QNS

BRILLIANT'S
MOCK TEST 4

FOR STUDENTS OF

OUR ONE/TWO-YEAR POSTAL COURSE

TOWARDS

BITSAT, 2008

Test Booklet Code

D

Time: 3 Hours | **Maximum Marks: 450**

Read the following instructions carefully:

1. Immediately fill in the particulars on the Answer Book with Blue/Black Ball Point Pen.
2. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
3. The candidate should write their Enrolment No. only in the space provided on the Test Booklet/Answer Sheet.
4. For each correct response, the candidate will get 3 marks. For each incorrect response, one mark will be deducted from the total score. No deduction from the total score, however, will be made if no response is indicated for an item in the Answer Sheet.
5. The test is of 3 hours duration.
6. The test consists of 150 questions.
7. The maximum marks are 450.
8. Use Blue/Black Ball Point Pen only for writing particulars/marking responses on Side – 1 and Side – 2 of the Answer Sheet.
9. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
10. Do not fold or make any stray marks on the Answer Sheet.
11. Use of Electronic/Manual Calculator is prohibited .

Name of the Candidate (in Capitals): ....

Enrolment Number:

PART I: MATHEMATICS

1. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $|\vec{c}| = \sqrt{3}$, then

(1) $\alpha = 1, \beta = -1$

(2) $\alpha = 1, \beta = \pm 1$

(3) $\alpha = -1, \beta = \pm 1$

(4) $\alpha = \pm 1, \beta = 1$

2. Let $h(x) = f(x) - (f(x))^2 + (f(x))^3$ for every real number x. Then

(1) h is increasing whenever f is increasing

(2) h is increasing whenever f is decreasing

(3) h is decreasing whenever f is increasing

(4) nothing can be said in general

3. Let n be an odd integer.

If $\sin n\theta = \sum_{r=0}^{n} b_r \sin^r\theta$,

for every value of θ, then

(1) $b_0 = 1, b_1 = 3$

(2) $b_0 = 0, b_1 = n$

(3) $b_0 = -1, b_1 = n$

(4) $b_0 = 0, b_1 = n^2 - 3n + 3$

4. Number of divisors of the form $4n + 2 (n \geq 0)$ of the integer 240 is

(1) 4 **(2)** 8 **(3)** 10 **(4)** 3

5. Let $h(x) = \min \{x, x^2\}$, for every real number of x. Then

(1) h is not continuous

(2) h is differentiable for all x

(3) $h'(x) = 0$ for all $x > 1$

(4) h is not differentiable at two values of x

SPACE FOR ROUGH WORK

6. If in a triangle PQR, sin P, sin Q, sin R are in A.P., then

(1) the altitudes are in A.P.

(1) the altitudes are in H.P.

(3) the medians are in G.P.

(4) the medians are in A.P.

7. If $f(x) = \frac{x^2 - 1}{x^2 + 1}$, for every real number x, then the minimum value of f

(1) does not exist because f is unbounded

(2) is not attained even though f is bounded

(3) is equal to 1

(4) is equal to – 1

8. Seven white balls and three black balls are randomly placed in a row. The probability that no two black balls are placed adjacently equals

(1) $\frac{1}{2}$ **(2)** $\frac{7}{15}$ **(3)** $\frac{2}{15}$ **(4)** $\frac{1}{3}$

9. If $a_n = \sum_{r=0}^{n} \frac{1}{{}^nC_r}$, then $\sum_{r=0}^{n} \frac{r}{{}^nC_r}$ equals

(1) $(n - 1)\, a_n$

(2) na_n

(3) $\frac{1}{2} n\, a_n$

(4) None of the above

10. The number of common tangents to the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y = 24$ is

(1) 0 **(2)** 1 **(3)** 3 **(4)** 4

11. If ω is an imaginary cube root of unity, then $(1 + \omega - \omega^2)^7$ equals

(1) $128\,\omega$ **(2)** $-128\,\omega$

(3) $128\,\omega^2$ **(4)** $-128\,\omega^2$

12. If $\int_0^x f(t)\, dt = x + \int_x^1 t\, f(t)\, dt$, then the value of f(1) is

(1) $\frac{1}{2}$ **(2)** 0 **(3)** 1 **(4)** $-\frac{1}{2}$

SPACE FOR ROUGH WORK

13. If P(1, 2), Q(4, 6), R(5, 7) and S(a, b) are the vertices of a parallelogram PQRS, then

(1) a = 2, b = 4 **(2)** a = 3, b = 4

(3) a = 2, b = 3 **(4)** a = 3, b = 0

14. For three vectors $\vec{u}, \vec{v}, \vec{w}$ which of the following expressions is not equal to any of the remaining three?

(1) $\vec{u} \cdot (\vec{v} \times \vec{w})$ **(2)** $(\vec{v} \times \vec{w}) \cdot \vec{u}$

(3) $\vec{v} \cdot (\vec{u} \times \vec{w})$ **(4)** $(\vec{u} \times \vec{v}) \cdot \vec{w}$

15. If f(x) = 3x – 5, then f^{-1} (x)

(1) is given by $\frac{1}{3x - 5}$

(2) is given by $\frac{x + 5}{3}$

(3) does not exist because f is not one-one

(4) does not exist because f is not onto

16. If from each of the three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls, one ball is drawn at random, then the probability that 2 white and 1 black ball will be drawn is

(1) $\frac{13}{32}$ **(2)** $\frac{1}{4}$ **(3)** $\frac{1}{32}$ **(4)** $\frac{3}{16}$

17. Let T_r be the r^{th} term of an A.P., for r = 1, 2, 3, ... If for some positive integers m, n, we have $T_m = \frac{1}{n}$, $T_n = \frac{1}{m}$, then T_{mn} equals

(1) $\frac{1}{mn}$ **(2)** $\frac{1}{m} + \frac{1}{n}$

(3) 1 **(4)** 0

18. If g (f(x)) = | sin x | and

$f(g(x)) = \left(\sin \sqrt{x}\right)^2$, then

(1) $f(x) = \sin^2 x,\ g(x) = \sqrt{x}$

(2) f(x) = sin x, g(x) = | x |

(3) $f(x) = x^2,\ g(x) = \sin \sqrt{x}$

(4) f and g cannot be determined

SPACE FOR ROUGH WORK

19. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$, ther

(1) $x = 3, y = 1$ **(2)** $x = 1, y = 3$

(3) $x = 0, y = 3$ **(4)** $x = 0, y = 0$

20. An n-digit number is a positive number with exactly n digits. Nine hundred distinct n-digit numbers are to be formed using only the three digits 2, 5 and 7. The smallest value of n for which this is possible is

(1) 6 **(2)** 7 **(3)** 8 **(4)** 9

21. If $\bar{E}$ and $\bar{F}$ are the complementary events of events E and F respectively and if $0 < P(F) < 1$, then

(1) $P(E \mid F) + P(\bar{E} \mid F) = 1$

(2) $P(E \mid F) + P(E \mid \bar{F}) = 1$

(3) $P(\bar{E} \mid F) + P(E \mid \bar{F}) = 1$

(4) $P(E \mid F) + P(\bar{E} \mid \bar{F}) = 1$

22. Let $f(x) = x - (x)$, for every real number x, where (x) is the integral part of x. Then $\int_{-1}^{1} f(x)\,dx$ is

(1) 1 **(2)** 2 **(3)** 0 **(4)** $\frac{1}{2}$

23. It the circle $x^2 + y^2 = a^2$ intersects the hyperbola $xy = c^2$ in four points $P(x_1, y_1)$, $Q(x_2, y_2)$, $R(x_3, y_3)$, $S(x_4, y_4)$, then which of the following is not true?

(1) $x_1 + x_2 + x_3 + x_4 = 0$

(2) $y_1 + y_2 + y_3 + y_4 = 1$

(3) $x_1 x_2 x_3 x_4 = c^4$

(4) $y_1 y_2 y_3 y_4 = c^4$

24. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is

(1) $\frac{1}{3}$ **(2)** $\frac{1}{6}$ **(3)** $\frac{1}{2}$ **(4)** $\frac{1}{4}$

SPACE FOR ROUGH WORK

25. The value of the sum $\sum_{n=1}^{13}(i^n + i^{n+1})$, where $i = \sqrt{-1}$, equals

(1) i **(2)** $i - 1$ **(3)** $-i$ **(4)** 0

26. Which of the following expressions are meaningful?

(1) $\vec{u}\cdot(\vec{v}\times\vec{w})$ **(2)** $(\vec{u}\times\vec{v})\cdot\vec{w}$

(3) $(\vec{u}\cdot\vec{v})\times\vec{w}$ **(4)** $\vec{u}\times(\vec{v}\cdot\vec{w})$

27. If E and F are events with $P(E) \le P(F)$ and $P(E \cap F) > 0$, then

(1) occurrence of E $\Rightarrow$ occurrence of F

(2) occurrence of F $\Rightarrow$ occurrence of E

(3) non-occurrence of E $\Rightarrow$ non-occurrence of F

(4) none of the above implications holds

28. A fair coin is tossed repeatedly. If tail appears on first four tosses, then the probability of head appearing on fifth toss equals

(1) $\frac{1}{2}$ **(2)** $\frac{1}{32}$ **(3)** $\frac{31}{32}$ **(4)** $\frac{1}{5}$

29. The number of values of c such that the straight line $y = 4x + c$ touches the curve $\frac{x^2}{4} + y^2 = 1$ is

(1) 0 **(2)** 1 **(3)** 2 **(4)** infinite

30. The order of the differential equation whose general solution is given by $y = (C_1 + C_2)\cos(x + C_3) + C_4 e^{(x + C_5)}$ where C_1, C_2, C_3, C_4, C_5 are arbitrary constants, is

(1) 5 **(2)** 4 **(3)** 3 **(4)** 2

31. The diagonals of a parallelogram PQRS are along the lines $x + 3y = 4$ and $6x - 2y = 7$. Then PQRS will be a

(1) rectangle

(2) square

(3) cyclic quadrilateral

(4) rhombus

32. In a college of 300 students, every students reads 5 news papers and every news paper is read by 60 students. Then the number of news papers is

SPACE FOR ROUGH WORK

(1) at least 30

(2) at most 20

(3) exactly 25

(4) none of the above

33. Let A_0 A_1 A_2 A_3 A_4 A_5 be a regular hexagon inscribed in a circle of unit radius. Then the product of the line segments $A_0 A_1$, $A_0 A_2$ and $A_0 A_4$ is

(1) $\frac{3}{4}$ **(2)** $3\sqrt{3}$ **(3)** 3 **(4)** $\frac{3\sqrt{3}}{2}$

34. If P = (x, y), F_1 = (3, 0), F_2 = (– 3, 0) and $16x^2 + 25y^2 = 400$, then $PF_1 + PF_2$ equals

(1) 8 **(2)** 6 **(3)** 10 **(4)** 12

35. The number of values of x where the function $f(x) = \cos x + \cos\left(\sqrt{2}x\right)$ attains its maximum is

(1) 0 **(2)** 1 **(3)** 2 **(4)** infinite

36. $\lim\limits_{x \to 1} \frac{\sqrt{1 - \cos 2(x - 1)}}{x - 1}$

(1) exists and it equals $\sqrt{2}$

(2) exists and it equals $-\sqrt{2}$

(3) does not exist because $x - 1 \to 0$

(4) does not exist because left hand limit is not equal to right hand limit.

37. If x > 1, y > 1, z > 1 are in G.P., then $\frac{1}{1 + \ln x}, \frac{1}{1 + \ln y}, \frac{1}{1 + \ln z}$ are in

(1) A.P.

(2) H.P.

(3) G.P.

(4) None of the above

38. The number of values of x in the interval $[0, 5\pi]$ satisfying the equation $3\sin^2 x - 7\sin x + 2 = 0$ is

(1) 0 **(2)** 5 **(3)** 6 **(4)** 10

39. If the vertices P, Q, R of a triangle PQR are rational points, which of the following point of the triangle PQR may not be a rational point?

(1) Centroid **(2)** Incentre

(3) Circumcentre **(4)** Orthocentre

(A rational point is a point both of whose co-ordinates are rational numbers.)

SPACE FOR ROUGH WORK

40. Which of the following number (s) is/are rational?

(1) sin 15° **(2)** cos 15°

(3) sin 15° cos 15° **(4)** sin 15° cos 75°

41. $\int_{0}^{\pi^2} \sin \sqrt{x}\, dx =$

(1) π **(2)** 2π **(3)** $2\pi^2$ **(4)** π^2

42. For the ellipse $3x^2 + 4y^2 = 5$, if $y + 3x = 0$ is one diameter, the conjugate diameter is (Note: Two diameters of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are said to be conjugate when each bisects all chords parallel to the other).

(1) $4y - x = 0$ **(2)** $4y + x = 0$

(3) $y - 4x = 0$ **(4)** $y + 4x = 0$

43. A solution of the differential equation $p^2y + p(x - y) - x = 0$ is

(1) $x^2 - y^2 = c$ **(2)** $y^2 = 2x + c$

(3) $y = x + c$ **(4)** $x^2 + y^2 = c^2$

44. In the binomial expansion $(a - b)^n$, $n \geq 5$, the sum of the 5th and 6th terms is zero. Then $\frac{nb - 5a}{b} =$

(1) 14 **(2)** 7 **(3)** 4 **(4)** 1

45. Equation of the plane containing the line $\frac{x-3}{2} = \frac{y-4}{3} = \frac{z-5}{4}$ is

(1) $4x + 4y - 5z = 3$

(2) $2x + 3y - 4z + 5 = 0$

(3) $4x + 6y + 8z + 13 = 0$

(4) $x + 2y + z = 0$

SPACE FOR ROUGH WORK

PART II: PHYSICS

46. For a short wave radio link between two stations via the ionosphere, the ratio of the maximum usable frequency to the critical frequency

(1) is always less than 1

(2) is always greater than 1

(3) may be $\lesseqgtr$ 1 depending on the distance between the two stations

(4) does not depend on the distance between the two stations

47. A plane electromagnetic wave travelling along the + z-direction, has its electric field given by

$E_x = 2\cos(\omega t)$ and

$E_y = 2\cos(\omega t + 90°)$

The wave is

(1) linearly polarised

(2) right circularly polarised

(3) left circularly polarised

(4) elliptically polarised

48. It is proposed to increase the Q of a coil. This can be done best by

(1) operating at low frequency.

(2) increasing the diameter of wire.

(3) increasing the diameter of coil.

(4) adding a core of magnetic material in compressed powder form.

49. In Compton effect, photons of wavelength λ and frequency υ scatter at angle ϕ with modified wavelength λ' and frequency υ' which of the following is true?

(1) $\lambda' - \lambda$ varies with ϕ and also with the scatter

(2) $\upsilon - \upsilon'$ is independent of the scattering material

(3) $\lambda' - \lambda$ varies with ϕ in proportion to $(1 + \cos\phi)$

(4) $\lambda' - \lambda$ is independent of the scatterer but varies with ϕ

SPACE FOR ROUGH WORK

50. In a laser source the emission from various atoms/molecules are coherent

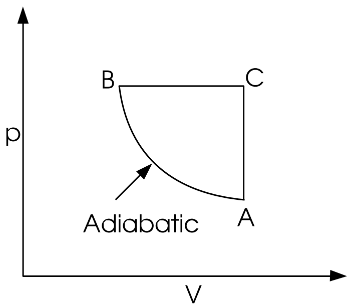
(1) in phase only

(2) in direction of emission only

(3) in phase, direction and polarization

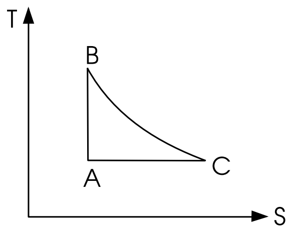
(4) in phase and polarization only

51. A cycle is shown in the p-V diagram.

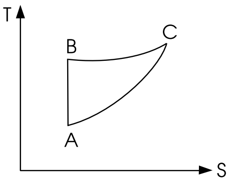


The corresponding representation in a T – S diagram will be

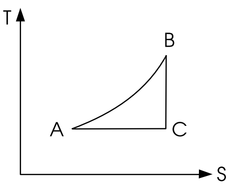
(1)



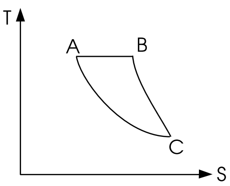
(2)



(3)



(4)



52. Given the truth table relating Y to A, B,

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

Then Y is given by

(1) $A + B$ **(2)** AB

(3) $\overline{AB}$ **(4)** $\overline{A + B}$

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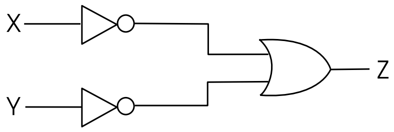
53. In the circuit shown, X, Y are inputs and Z is the output. The values of inputs for which the output Z = 0 are



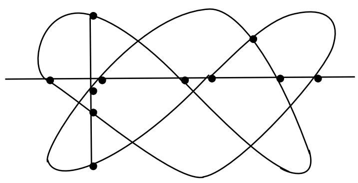
(1) X = 0, Y = 0

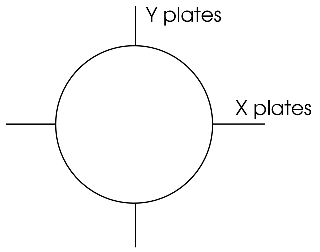
(2) X = 0, Y = 1

(3) X = 1, Y = 1

(4) X = 1, Y = 0

54. The frequency f_y of the Lissajous figure is





(1) $f_y = 1.5\, f_x$ **(2)** $f_y = 2f_x$

(3) $f_y = f_x$ **(4)** $f_t = 3f_x$

55. A satellite in a stable orbit contains two closed vessels; one of these is filled with hot steam and the other with water.

(i) The water exerts very little pressure on its container.

(ii) The steam exerts almost the same pressure as it would on Earth.

(iii) The water exerts the same pressure as it would on Earth.

(iv) The steam exerts very little pressure on its container.

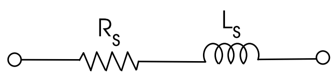
(1) (i) and (ii) are correct

(2) (iii) and (iv) are correct

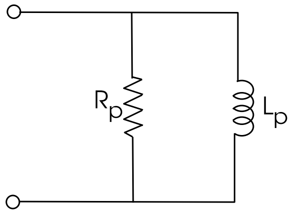
(3) only (ii) is correct

(4) All but (i) are correct

56. If the impedances of the series and parallel combination of the coil with its internal resistance are equal then



SPACE FOR ROUGH WORK



(1) $R_s = \frac{1}{R_p}$, $X_s = \frac{1}{X_p}$

(2) $R_s + X_{L_s} = R_p + X_{L_p}$

(3) $R_p = R_s\left(1 + Q_s^2\right), X_p = X_s\left(1 + Q_s^2\right)$

(4) $R_p = R_s\left(1 + Q_s^2\right), X_p = X_s\left(1 + \frac{1}{Q_s^2}\right)$

57. A solid right-circular cylinder is placed on a rough plane of inclination α to the horizontal. The least coefficient of friction between the cylinder and the plane so that the cylinder rolls down (without sliding) is

(1) $\tan \alpha$ **(2)** $\sin \alpha$

(3) $\frac{1}{3} \tan \alpha$ **(4)** $\frac{3}{2} \tan \alpha$

58. A capacitor remains connected to a battery and a dielectric slab is slipped between the plates. The energy will increase due to

(1) increase of potential difference

(2) increase of electric field strength

(3) increase of capacitance

(4) none of the above

59. When an electron in a hydrogen atom moves from an orbit to another orbit of longer radius, which of the following decreases?

(1) potential energy

(2) total energy

(3) angular momentum

(4) rotational speed

60. Newton's law of cooling can be deduced from

(1) Wien's displacement law

(2) Stefan-Boltzmann law

(3) The law of equipartition of energy

(4) Joule-Thomson effect

SPACE FOR ROUGH WORK

61. The probability of electrons being captured by the nucleus is maximum for

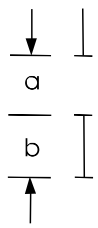
(1) K shell electrons

(2) L shell electrons

(3) M shell electrons

(4) same for all shells

62. In a plane transmission grating



a = b, then

(1) the second order spectrum will be absent

(2) first order spectrum will be absent

(3) spectra up to third order can be obtained

(4) no spectrum will be obtained

63. In the de Broglie hypothesis, waves are

(1) associated with particle at rest

(2) associated with a particle in motion

(3) associated with a medium

(4) not at all involved

64. In Rutherford's scattering formula, the scattering cross section for angle θ is proportional to

(1) $\sin^4\left(\frac{\theta}{2}\right)$

(2) $\sin^{-4}\left(\frac{\theta}{2}\right)$

(3) $\sin^2\left(\frac{\theta}{2}\right)\cos^2\left(\frac{\theta}{2}\right)$

(4) $\cot^4\left(\frac{\theta}{2}\right)$

65. A p-type silicon sample has conductivity compared to an n-type sample having the same dopant concentration

(1) higher **(2)** zero

(3) infinite **(4)** less

SPACE FOR ROUGH WORK

66. Silicon is not suitable for fabrication of light emitting diodes because it is

(1) an indirect band gap semiconductor

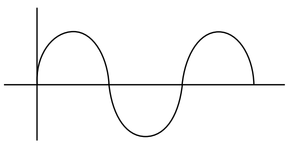
(2) a direct band gap semiconductor

(3) a wide band gap semicoductor

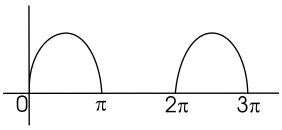
(4) a narrow band gap semiconductor

67. Match the waveforms and the form factors (FFs).

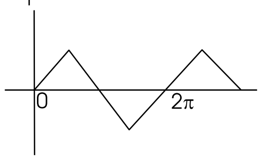
Waveforms | **Form factors**

A.


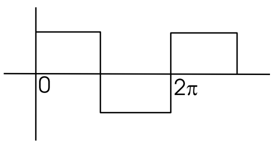
1. 1

B.


2. 1.15

C.


3. 1.11

D.


4. 1.57

Codes

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

68. Consider the following statements on negative feedback.

(i) It reduces the gain

(ii) It enhances noise and distortion

(iii) It decreases the input impedance

(iv) It increases the bandwidth

Choose the correct statements from above:

(1) (i), (iii) and (iv) **(2)** (i) and (iv)

(3) (ii) and (iii) **(4)** only (iv)

69. In a transofrmer if the transfer of energy occurs at the same voltage, then the transformer is

(1) current transformer

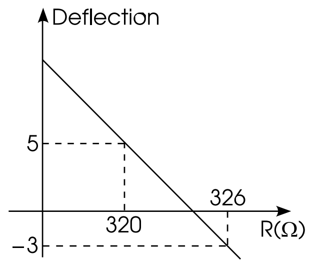
(2) potential transformer

(3) isolating transformer

(4) step-up transformer

SPACE FOR ROUGH WORK

70. In post office box, the graph of galvanometer deflection versus resistance R (pulled out of resistance box) for the ratio 100 : 1 is given as shown (due to unsuitable values of R, galvanometer shows deflection). The two consecutive values of R are shown in the **Figure:**



The value of unknown resistance would be

(1) 3.2 Ω **(2)** 3.24 Ω

(3) 3.206 Ω **(4)** 3.2375 Ω

71. Given two statements for resonance tube method:

S_1: Lower frequency tuning fork will require large tube to obtain two successive resonance positions.

S_2: Higher frequency fork gives resonance positions for relatively small length of air column.

(1) S_1 only true

(2) S_2 only true

(3) Both S_1, S_2 are true

(4) Neither S_1 nor S_2 is true

72. A 100 MHz carrier wave is frequency modulated by a 10 kHz signal. The peak frequency deviation is 60 kHz

	Column I		Column II
(a)	Maximum carrier frequency (MHz)	(i)	99.94
(b)	Minimum carrier frequency (MHz)	(ii)	6
(c)	Frequency swing (kHz)	(iii)	120
(d)	Modulation index (rad)	(iv)	100.06

Then match them

(1) (a-iv) (b-i) (c-iii) (d-ii)

(2) (a-i) (b-ii) (c-iii) (d-iv)

(3) (a-ii) (b-iii) (c-iv) (d-i)

(4) (a-iii) (b-iv) (c-ii) (d-i)

SPACE FOR ROUGH WORK

73. In the measurement of three quantities A, B, C it is stated as A = 2 ± 0.005, B = 1 ± 0.001, C = 4 ± 0.01. Then, the percentage error in $P = \frac{A}{B}$ is

(1) ± 0.35 **(2)** ± 0.6

(3) ± 1.05 **(4)** ± 0.7

74. Given two statements about a faulty physical balance:

S_1: If the masses of the left and right pans are m_1 and m_2 and if M_1 and M_2 are measured masses of a block placed successively in left and right pan then actual mass is $M = \sqrt{M_1M_2}$.

S_2: If ℓ_1 and ℓ_2 are lengths of left and right arm of the balance, then

$$M = \frac{M_1 + M_2}{2}$$

(1) only S_1 is correct

(2) only S_2 is correct

(3) both S_1 and S_2 are correct

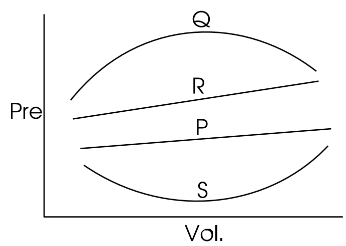
(4) neither S_1 nor S_2 is correct

75. Which of the following has 3 significant figures?

(1) 15.7 **(2)** 1040

(3) 1.57 **(4)** all of above

76. Which of the following relations correctly represent the work done under the indicator diagram shown?



(1) $W_P > W_Q > W_R > W_S$

(2) $W_Q > W_R > W_P > W_S$

(3) $W_P < W_Q > W_R > W_S$

(4) $W_Q > W_R > W_P < W_S$

SPACE FOR ROUGH WORK

77. Induction furnace is based on the heating effect of

(1) magnetic field

(2) eddy current

(3) electric field

(4) electrostatic field

78. Match the following.

	Column I		Column II
(a)	The current gain of a BJT will be increased if	(i)	The collector doping concentration is increased
(b)	The current gain of a BJT gain of a BJT will be reduced if	(ii)	The base width is reduced
(c)	The break-down voltage of a BJT will be reduced if	(iii)	The emitter doping con-centration to base doping concentration ratio is reduced
		(iv)	The base dop-ing concentra-tion is increa-sed keeping the ratio of the emitter doping concentration to base doping concentration constant

(1) (a-i) (b-iii) (c-i)

(2) (a-ii) (b-iii) (c-i)

(3) (a-iii) (b-i) (c-ii)

(4) (a-ii) (b-ii) (c-iii)

79. During a negative β-decay

(1) an electron which is already present within the nucleus is ejected

(2) a neutron in the nucleus decays emitting an electron

(3) a part of the binding energy of the nucleus is converted into an electron

(4) an atomic electron is ejected

SPACE FOR ROUGH WORK

80. An audio signal given by 15 sin 2π (2000 t) amplitude modulates a sinusoidal carrier wave 60 sin 2π (100,000) t. The modulation index is

(1) 1 **(2)** 0.25 **(3)** 0.5 **(4)** 0.33

81. A force of $\vec{F} = 3\hat{i} + c\hat{j} + 2\hat{k}$ acting on a particle causes a displacement of $\vec{s} = -4\hat{i} + 2\hat{j} + 3\hat{k}$ in its own direction. If the work done is $6\hat{j}$, then the value of c is

(1) 0 **(2)** 1 **(3)** 6 **(4)** 12

82. Two rods each of mass m and length ℓ are joined at centre to form a cross. The moment of inertia of this cross about an axis passing through the common centre of the rods and perpendicular to the plane formed by them, is

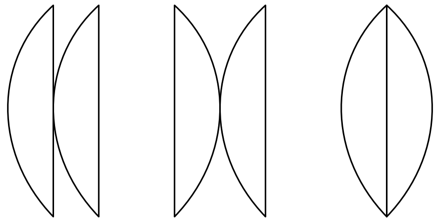
(1) $\frac{m\ell^2}{12}$ **(2)** $\frac{m\ell^2}{6}$

(3) $\frac{m\ell^2}{3}$ **(4)** $\frac{m\ell^2}{2}$

83. A uniform cube is subjected to volume compression. If each side is increased by 0.01%, then bulk strain is

(1) 0.01 **(2)** 0.06 **(3)** 0.02 **(4)** 0.03

84. Shown are 3 lens systems



a b c

All curved surfaces have same radii of curvature. The equivalent focal lengths are in ratio $f_a : f_b : f_c$ as

(1) 1 : 2 : 3 **(2)** 3 : 2 : 1

(3) 1 : 1 : 1 **(4)** 2 : 1 : 1

85. A silver voltmeter of resistance 2 Ω and a 3 Ω resistor are connected in series across a cell. If a resistance of 2 Ω is connected in parallel with the silver voltmeter, then the rate of deposition of silver will

(1) decrease by 37.5%

(2) decrease by 73%

(3) increase by 50%

(4) decrease by 50%

SPACE FOR ROUGH WORK

PART III: CHEMISTRY

86. Which of the following statement is wrong?

(1) Two p-orbitals always overlap laterally.

(2) A sigma bond has no free rotation around its axis.

(3) There can be more than one sigma bond between two atoms.

(4) All of these.

87. The compound having a tetrahedral geometry is

(1) $\left[Ni(CN)_4\right]^{-2}$ **(2)** $\left[Pd(CN)_4\right]^{-2}$

(3) $\left[PdCl_4\right]^{-2}$ **(4)** $\left[NiCl_4\right]^{-2}$

88. At its boiling point, a liquid is in equilibrium with its vapours. On an average, the molecules in the two phases have equal

(1) kinetic energies

(2) potential energies

(3) intermolecular forces

(4) total energies

89. The terminal velocity of a small sized spherical body of radius 'r' falling vertically in a viscous liquid varies with

(1) $\frac{1}{r^2}$ **(2)** $\frac{1}{r}$ **(3)** r **(4)** r^2

90. Zinc and aluminium metals produces hydrogen gas with dilute H_2SO_4. The ratio of moles of H_2 produced when 1 mole of each reacts with excess dilute H_2SO_4 will be

(1) 1 : 1.5 **(2)** 3 : 1 **(3)** 1 : 3 **(4)** 1 : 2

91. For the redox reaction

$xMnO_4^{-1} + yC_2O_4^{-2} + zH^+ \longrightarrow$

$Mn^{+2} + CO_2 + H_2O$, the correct stoichiometric coefficients x, y and z are respectively

(1) 2, 5, 16 **(2)** 16, 5, 2

(3) 5, 16, 2 **(4)** 2, 16, 5

SPACE FOR ROUGH WORK

92. For a reaction to be spontaneous at all temperatures

(1) ΔG and ΔH should be negative

(2) $\Delta G = \Delta H = 0$

(3) ΔG and ΔH should be positive

(4) $\Delta G = \Delta H$

93. Which of the following is correct for the equilibrium of the following reaction?

$C_{(graphite)} + H_2O_{(g)} \rightleftharpoons CO_{(g)} + H_{2(g)}$

(1) $pH_2 \propto pH_2O$

(2) $pH_2 \propto \sqrt{pH_2O}$

(3) $pH_2 \propto p^2H_2O$

(4) $pH_2 \propto p^2\ H_2O/pCO.$

94. The chemical reaction, $2O_{3(g)} \longrightarrow 3O_{2(g)}$ proceeds as given below

$O_{3(g)} \rightleftharpoons O_{2(g)} + (O)$ fast,

$2(O) + O_2 \longrightarrow 2O_{2(g)}$ slow.

The rate law expression is

(1) rate = $k[O_3]^2$

(2) rate = $k[O_3]^2\ [O_2]^+$

(3) rate = $k[O_3][O_2]$

(4) rate = $k[O_3]^{-2}$

95. Which one is zero order reaction among the following?

(1) $CH_3COOC_2H_5 \xrightarrow{H^+} CH_3COOH + CH_3CH_2OH$

(2) $C_{12}\,H_{22}\,O_{11(aq)} \xrightarrow{H^+}$ Glucose + Fructose

(3) $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + CH_3CH_2OH$

(4) $NH_{3(g)} \xrightarrow[\text{Powder}]{\text{Au}} N_{2(g)} + 3H_{2(g)}$

96. The oxidation numbers of oxygen in KO_2, OF_2, H_2O_2 are respectively

(1) – 2, – 2, – 2

(2) + 2, – 1, + 1

(3) – 1/2, + 2, – 1

(4) – 1, + 2, + 1

SPACE FOR ROUGH WORK

97. Among the following anions, the strongest Bronsted base is

(1) ClO^{-1} **(2)** ClO_2^{-2}

(3) ClO_3^{-1} **(4)** ClO_4^{-1}

98. Which is a false statement?

(1) Work is a state function.

(2) Work appears at the boundary of the system.

(3) Temperature is a state function.

(4) Enthalpy is an extensive property.

99. Which of the following statements is wrong for a zero order reaction?

(1) The rate is independent of the concentration of the reactants.

(2) The half-life of the reaction depends on the concentrations of the reactants.

(3) The rate is independent of the temperature of the reaction.

(4) The rate constant has the unit of $mol^{-1}\ s^{-1}$.

100. In the following galvanic cell,
(m = concentration (1 m))

(1) cations migrate to the cathode and are reduced on the cathode surface.

(2) anions migrate to the cathode and are reduced on the anode.

(3) Zn and Cu dissolved as a result of reaction.

(4) Zn^{+2} and Cu^{+2} ions react with each other to give complex ions.

101. The cause of Brownian movement is due to

(1) heat change in liquid state.

(2) convectional current.

(3) the collision of the molecules of the dispersion medium with dispersed particles.

(4) the attractive forces between the colloidal particles and molecules of the dispersion medium.

102. In a body-centred cubic packing of equal sized spheres, the maximum radius of a sphere that can fit into the void is

(1) 0.154 R **(2)** 0.225 R

(3) 0.414 R **(4)** 0.747 R

SPACE FOR ROUGH WORK

103. An inorganic substance liberates $O_{2(g)}$ on heating, turns acidified $KI_{(aq)}$ to brown colour solution and decolorise acidified $KMnO_4$ solution. The substance may be

(1) K_2CrO_4 **(2)** H_2O_2

(3) Cl_2 **(4)** $KClO_3$

104. When borax ($Na_2B_4O_7$) dissolved in water,

(1) only $B(OH)_3$ is formed.

(2) only $\left[B(OH)_4\right]^-$ is formed.

(3) both $B(OH)_3$ and $\left[B(OH)_4\right]^-$ are formed.

(4) both $B(OH)_3$ and B_2O_3 are formed.

105. The carbon atoms in diamond are bonded to each other in

(1) a linear configuration

(2) a planar configuration

(3) an octahedral configuration

(4) a tetrahedral configuration

106. Which of the following statements is wrong?

(1) The molecular formula of tetramethyl silane is $(CH_3)_4\ SiH_4$.

(2) $SiCl_4$ undergoes hydrolysis due to the presence of empty d-orbitals in Si.

(3) Fluorosilicic acid (H_2SiF_6) is a strong acid, exist only in solution.

(4) The octahedral SiF_6^{-2} ion is the only halogen complex of silicon which involves sp^3d^2 hybridisation.

107. Which of the following statements is correct?

(1) N_2O_5 solid exist as $NO_2^+\ NO_3^-$ (nitronium nitrate).

(2) The nitronium ion (NO_2^+) is isoelectronic with CO_2 and are isostructural (V shape).

(3) The nitrate ion $\left(NO_3^-\right)$ has a T-shaped structure.

(4) The NO_2^- ion has a pyramidal structure.

SPACE FOR ROUGH WORK

108. The metallic sulphide with highest solubility product value (K_{sp}) in water at 278 K is

(1) PbS **(2)** CuS **(3)** Ag_2S **(4)** ZnS

109. A greenish yellow poisonous gas reacts with alkali metal hydroxide to form a halate $\left[XO_3^-\right]$ which is used in firework and safety matches. The gas and the halate respectively are

(1) Br_2 and $KBrO_3$

(2) Cl_2 and $KClO_3$

(3) I_2 and KIO_3

(4) Cl_2 and $KClO_4$

110. The XeF_6 molecule is

(1) tetrahedral with one lone pair of electrons.

(2) octahedral with one lone pair of electrons.

(3) capped octahedral with one lone pair of electrons.

(4) capped octahedral with two lone pair of electrons.

111. Hypo solution is used in photography for fusing films. Its function is to undecomposed

(1) remove the the reduced silver metal by forming a soluble complex.

(2) remove the undecomposed AgBr by forming a soluble complex.

(3) remove bromine forming a soluble salt.

(4) decompose AgBr to metal Ag and bromine.

112. Calcium cyanamide is produced by heating

(1) calcium carbide in an electric furnace in nitrogen atmosphere at 1100°C.

(2) quick lime with nitrogen at 1000°C.

(3) gypsum with coke and nitrogen in electric furnace.

(4) limestone with NH_3 and coke at 2000°C.

SPACE FOR ROUGH WORK

113. $ZnSO_4$ on boiling with $NaHCO_3$ solution produces

(1) $ZnCO_3$

(2) $Zn(OH)_2$

(3) $ZnCO_3 \cdot Zn(OH)_2$

(4) Na_2ZnO_2

114. Which of the following statements is wrong?

(1) Lead salts are poisonous to living system.

(2) Metal lead is used in lead accumulation.

(3) Lead is corroded by water in presence of dissolved oxygen is known as plumbo solvency.

(4) Lead is a good conductor of electricity.

115. Stainless steel contains

(1) Fe, Cr, Ni, C **(2)** Fe, Al

(3) Fe, Mn, Cr **(4)** Fe, Co, Ni

116. The IUPAC name of $\left[CO(NH_3)_6\right]\left[Cr(CN)_6\right]$ is

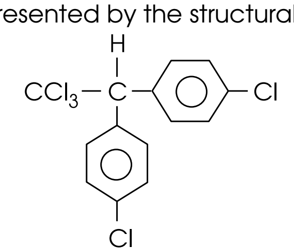
(1) hexaamminecobalt (III), hexacyanochromium (VI)

(2) hexaamminecobalt (III), hexacyanochromate (III)

(3) hexacyanochromium (III), hexaamminecobalt (III)

(4) hexacyanochromium cobalt hexaammine (VI)

117. The IUPAC name of the insecticide represented by the structural formula



is

(1) dichloro diphenyl trichloroethane

(2) trichloromethyl-bis-(4-chlorophenyl) methane

(3) 1, 1, 1-trichloro-2, 2-bis-(4-chlorophenyl) ethane

(4) 2, 2, 2-trichloro-1, 1-bis-(4-chlorophenyl) ethane

SPACE FOR ROUGH WORK

118. Ethylenedichloride and ethylidene dichloride are

(1) geometrical isomers

(2) nuclear isomers

(3) position isomers

(4) anomers

119. The products of the following reaction A, B and C are respectively

$$\begin{array}{ccccc} C & \xleftarrow{\text{AgCN}} & CH_3-CH_2I & \xrightarrow{\text{alc. KOH}} & A \\ & & \Big\downarrow{\scriptstyle (1)\ CH_3ONa \atop \scriptstyle (2)\ \Delta} & & \\ & & B & & \end{array}$$

(1) CH_3CH_2OH, $CH_3CH_2-O-CH_3$, CH_3CH_2CN

(2) CH_3CH_2OH, CH_3CH_2COONa, CH_3CH_2NC

(3) $CH_2=CH_2$, $CH_3CH_2-O-CH_3$, CH_3CH_2NC

(4) $CH\equiv CH$, $CH_3CH_2OCH_3$, CH_3CH_2CN

120. The products A, B and C of the following reactions are respectively

$$\begin{array}{ccccc} C & \xleftarrow{SOCl_2} & CH_3COOH & \xrightarrow{LiAlH_4} & A \\ & & \Big\downarrow{\scriptstyle Br_2/\text{Red P}} & & \\ & & B & & \end{array}$$

(1) CH_3OH, $CH_2BrCOOH$, $CH_2ClCOOH$

(2) CH_3CH_2OH, $CH_2BrCOOH$, CH_3COCl

(3) CH_3CH_2OH, CH_3COBr, CH_3COCl

(4) CH_3OH, $CH_2BrCOOH$, CH_3COCl

121. The products A, B and C of the following reactions are respectively

$$\begin{array}{ccccc} C & \xleftarrow{Br_2/KOH} & CH_3CONH_2 & \xrightarrow[\Delta]{P_2O_5} & A \\ & & \Big\downarrow{\scriptstyle HNO_2} & & \\ & & B & & \end{array}$$

(1) CH_3CN, CH_3COOH, CH_3NH_2

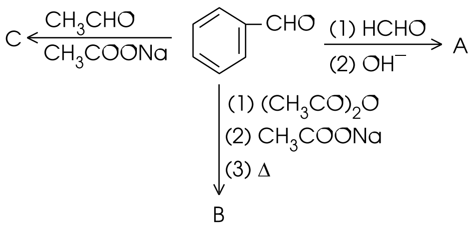
(2) CH_3COOH, CH_3COOH, CH_3NH_2

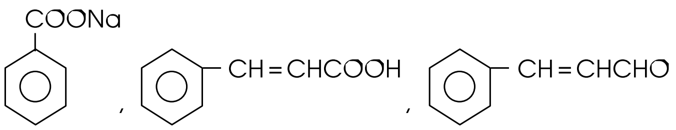
(3) CH_3CN, CH_3OH, CH_3NH_2

(4) CH_3CN, CH_3CH_2OH, CH_3NH_2

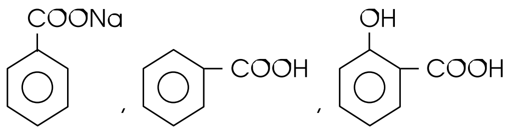
SPACE FOR ROUGH WORK

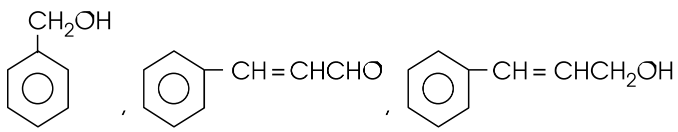
122. The products A, B and C of the following reactions are respectively



(1) 

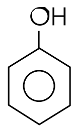
(2) 

(3) 

(4) 

SPACE FOR ROUGH WORK

123. Match the List I with List II and select the correct answers from the codes given below the list:

	List I		**List II**
A.	Insecticide	P.	
B.	Germicide	Q.	$C_{17}H_{35}$ COONa
C.	Miscelle	R.	$AgNO_3$
D.	Lyophobic sol	S.	$C_6H_6Cl_6$
		T.	Colloidal gold

Codes

	A	B	C	D
(1)	S	T	Q	P
(2)	S	P	Q	T
(3)	S	R	Q	P
(4)	P	S	Q	R

124. Match the List I with List II and select the correct answers using the codes given below the list:

	List I		**List II**
A.	Pyrene	P.	CCl_3NO_2
B.	Calgon	Q.	$Na_2(Na_4(PO_3)_6)$
C.	Chloropicrin	R.	CCl_4
D.	Hypnotic	S.	$C_6H_6Cl_6$
		T.	Barbituric acid derivatives

Codes

	A	B	C	D
(1)	R	Q	T	P
(2)	S	R	Q	P
(3)	R	Q	P	T
(4)	S	Q	T	P

SPACE FOR ROUGH WORK

125. Match the List I with List II and select the correct answer from the codes given below the list:

	List I (Test for)		**List II (Observation)**
A.	Phenol	P.	evolution of NH_3 with hot alkali
B.	Mono-carboxylic acid	Q.	evolution of H_2 with Grignard reagent
C.	Amide	R.	evolution of H_2 with zinc
D.	Acidic hydrogen	S.	purple colour with neutral $FeCl_3$
		T.	effervescence with hot aqueous $NaHCO_3$

Codes

	A	B	C	D
(1)	P	S	T	Q
(2)	S	R	P	Q
(3)	S	T	P	Q
(4)	S	P	T	Q

SPACE FOR ROUGH WORK

PART IV: ENGLISH PROFICIENCY AND LOGICAL REASONING

(a) ENGLISH PROFICIENCY

Directions for questions 126 to 128: Read the following passage carefully and answer the questions that follow.

The young are those to whom we look for future strength and for future good; and the longer we live, the more anxious we become that they who are to be the fresh recruits should be morally of right stature. Around them are peculiar temptations and trials, witching, cunning, insidious and forceful and we are obliged to see thousands falling by the way, whose fall seems and needless. They like ourselves, are to have but one chance in life. We who are somewhat advanced in years, seeing how many perils there are round about that one chance, feel an earnest desire that every advantage should be given to those who are coming onto fill our places. We can live but once, and life is usually moulded and takes its shape very early.

126. Which one of the following is correct? The author looks upon the young as

(1) handsome and healthy.

(2) an embodiment of possibilities.

(3) strong and hard working.

(4) a group of boys and girls who are obedient and dutiful.

127. What does the phrase "morally of right stature" mean?

(1) Being highly educated

(2) Having a good personality

(3) Having rectitude

(4) Feeling superior to others

128. Which one of the following is correct? The failure of many a young men and women is

(1) well deserved

(2) unwarranted

(3) fortuitous

(4) sad

Directions for questions 129 to 133: Each question below has a word capitalised followed by four words or phrases numbered 1 to 4. Choose the word that has nearly the same meaning as the capitalised word.

SPACE FOR ROUGH WORK

129. USURP

(1) to be lazy

(2) to climb

(3) to seize power or position illegally

(4) to yield

130. MERCURIAL

(1) mechanical **(2)** heavy

(3) clownish **(4)** quick-changing

131. ALLEVIATE

(1) to release **(2)** to lessen

(3) to deprive **(4)** to deceive

132. EXTENUATE

(1) to lessen in degree

(2) to express

(3) suggest

(4) object

133. RECTITUDE

(1) refuse **(2)** integrity

(3) reaching out **(4)** revenge

Direction for questions 134 to 136: Each of the following sentence has a mistake in grammar usage or idiom. Each sentence is broken up into four parts sequentially 1, 2, 3 and 4. Choose that part which has an error and mark accordingly.

134. **(1)** The carpet was badly stained

(2) to such an extent

(3) that you could n't tell

(4) its original colour

135. **(1)** It is greatly to tom's credit

(2) that he gave back

(3) the money he found

(4) his honesty does for him credit

136. **(1)** A terrific hue and cry

(2) was raised

(3) at the new tax proposals

(4) no error

SPACE FOR ROUGH WORK

Directions for questions 137 and 138: Each sentence below has a blank space indicating that something has been left out. Following each sentence four words are given. Choose the word that makes the sentence meaningful.

137. In the 20^{th} century, physicists have made their greatest discoveries about the characteristics of ___________ objects like the atom and its parts.

(1) infinitesimal **(2)** infinite

(3) microscopic **(4)** kaleidoscope

138. His moral decadence was marked by his __________ from the ways of integrity and honesty.

(1) declivity **(2)** obsession

(3) opprobrium **(4)** departure

Directions for questions 139 and 140: In each of the following questions, out of the four alternatives given, choose the one which can be substituted for the given words or sentence.

139. A person, such as a teacher, army officer etc., who believes in and enforces strict discipline.

(1) maudlin **(2)** martinet

(3) maverick **(4)** malthusian

140. A person who believes that ideas have value only in terms of their practical consequence and that practical results are the sole test of the truth or validity of beliefs.

(1) realist **(2)** optimist

(3) pragmatist **(4)** utopian

(b) LOGICAL REASONING

Directions for questions 141 to 144: In each of the following questions a pair of words with certain relationship between them is given followed by four pairs numbered 1 to 4. Select the pair wherein the words have closest relationship to the original pair.

141. EDUCATION : DEVELOPMENT ::

(1) Man : Speech **(2)** Nutrition : Health

(3) Game : Play **(4)** Child : Growth

142. HOUSE : ROOM ::

(1) Struggle : Fight **(2)** Transport : Car

(3) School : College **(4)** Boy : Girl

SPACE FOR ROUGH WORK

143. GILL : FIN ::

(1) Salad : Rice

(2) Sea : Fish

(3) Kill : Bomb

(4) Question : Team

144. BREAK : PIECE ::

(1) Writer : Pen

(2) Bread : Bake

(3) Kick : Football

(4) Muddy : Unclear

Directions for questions 145 to 147: In each question you find a set of sentences arranged in a haphazard way. Choose the correct arrangement of sentences as indicated by the number to make a coherent paragraph.

145. A. Indian films, cuisine and yoga have always been popular in China.

B. 33 year old Jin Shan Shan, a Jawaharlal University alumnus is actively promoting Bharatnatyam among her compatriots.

C. She has established a school for Bharatnatyam in China.

D. It has always been a passion for her to become an exponent of Bharatnatyam.

E. Around 50 Chinese children attend classes every week to learn the intricacies of the classical dance.

F. Now classical Indian dance has caught the imagination of the Chinese.

(1) AFBDCE **(2)** ECDFBA

(3) ABFDCE **(4)** EDCBFA

146. A. Our leaders decided to move towards progress through five year plans.

B. In the years that followed Independence, India had to tackle many problems.

C. We have decided to be a democracy and we have continued to remain so.

D. This path was laid down in the constitution we gave ourselves.

E. Sixty years have gone by and we have grown as a nation in many ways.

F. Leaders like Nehru and Ambedkar set the course our country was to take.

(1) EFDCBA **(2)** BEACDF

(3) BEDAFC **(4)** BDEACF

SPACE FOR ROUGH WORK

147. A. However, there may be times when enforcement of norms and limits leads to conflicts.

B. Norms and limits help children learn mutual respect, responsibility and cooperation.

C. Conflict resolution tools which can be used include decision-making, communication skills, managing aggressive behaviour and forgiveness.

D. Therefore, we need to understand conflicts and learn how to resolve them effectively.

E. Understanding conflicts is important when trying to comprehend concepts of positive discipline and physical and psychological punishment.

F. Conflict is a part of everybody's life.

(1) EFDCAB **(2)** CBDFEA

(3) DACFBE **(4)** BADCFE

Direction for question 148: In the following question, four out of the five alternatives are similar and form a group. Find the odd one that does not belong to the group.

148. **(1)** Rectangle

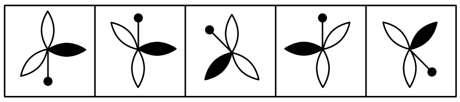
(2) Rhombus

(3) Square

(4) Circle

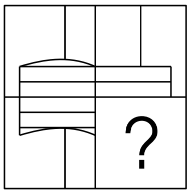
(5) Trapezium

Direction for question 149: Select the figure which does not belong to the group.

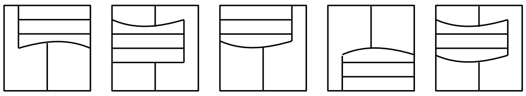


1 2 3 4 5

150. Choose the figure from the five alternatives 1, 2, 3, 4 and 5 that can be formed by joining the figures given in box marked (X).



(X)



(1) (2) (3) (4) (5)

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

BITSAT 2008
MTP 4/SOLNS

BRILLIANT'S
MOCK TEST 4

FOR STUDENTS OF

OUR ONE/TWO-YEAR POSTAL COURSE

TOWARDS

BITSAT, 2008

SOLUTIONS

PART I: MATHEMATICS

1. (4) $|\bar{c}| = \sqrt{3} \Rightarrow 1 + \alpha^2 + \beta^2 = 3$

$$\Rightarrow \alpha^2 + \beta^2 = 2$$

$\bar{a}$, $\bar{b}$, $\bar{c}$ are linearly dependent

$\Rightarrow \bar{c} = x\bar{a} + y\bar{b}$

$\Rightarrow \hat{i} + \alpha\hat{j} + \beta\vec{k}$

$= x(\vec{i} + \vec{j} + \vec{k}) + y(4\vec{i} + 3\vec{j} + 4\vec{k})$

$$\left.\begin{aligned} x + 4y &= 1 \\ x + 3y &= \alpha \\ x + 4y &= \beta \end{aligned}\right\}$$

$\Rightarrow \beta = 1$ and $\alpha^2 = 2 - \beta^2 = 2 - 1 = 1$

$$\alpha = \pm 1$$

2. (1) $h(x) = y - y^2 + y^3$ where $y = f(x)$

$$\frac{dh}{dy} = 3y^2 - 2y + 1$$

$$= 3\left(y - \frac{1}{3}\right)^2 + \frac{2}{3} > 0$$

$\therefore$ h increases with y or h is increasing whenever f(x) is increasing or equivalently h is decreasing whenever f(x) is decreasing.

3. (2) $\sin\theta$ = Imaginary part of $(\cos\theta + i\sin\theta)^n$

$$= {}^nC_1 \cos^{n-1}\theta \sin\theta - {}^nC_3 \cos^{n-3}\theta \sin^3\theta + \ldots$$

$$= n(1 - \sin^2\theta)^{\frac{n-1}{2}} \sin\theta$$

$${}^nC_3(1 - \sin^2\theta)^{\frac{n-3}{2}} \sin^3\theta + \ldots$$

$$= n\sin\theta + a\sin^3\theta + b\sin^5\theta + \ldots$$

$$= b_0 + b_1\sin\theta + b_2\sin^2\theta + \ldots$$

Comparison gives $b_0 = 0$ and $b_1 = n$

4. (1) $240 = 2^4 \times 3 \times 5$

Factors of 240 are the terms of $(1 + 2 + 2^2 + 2^3 + 2^4)(1 + 3)(1 + 5)$
$4n + 2 = 2(2n + 1) = 2 \times$ odd number.

Such factors are 2×1, 2×3, 2×5, 2×15

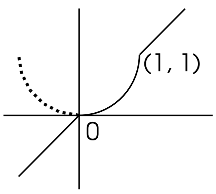
These are four in number.

5. (4) $h(x) = \min\{x, x^2\}$ for all x implies

$$h(x) = \begin{cases} x & \text{for } -\infty < x \le 0 \\ x^2 & \text{for } 0 \le x \le 1 \\ x & \text{for } 1 \le x < \infty \end{cases}$$

h(x) is continuous at 0 and 1 and hence for all x.

h(x) is not differentiable at x = 0 and at x = 1



graph gives the answer easily

$h'(0-) = 1$ and $h'(0+) = 0$

$h'(1-) = 2$ and $h'(1+) = 1$

Also $h'(x) = 1$ for all $x > 1$

6. (2) If the sides of the Δ are p, q, r then sin P, sin Q, sin R are in A.P $\Rightarrow$ p, q, r are in A.P. (since $p \propto \sin P$ etc.)

$\Rightarrow \dfrac{\Delta}{PD}, \dfrac{\Delta}{QE}, \dfrac{\Delta}{RF}$ are in A.P.

since $\dfrac{1}{2} p \cdot PD = \dfrac{1}{2} q \cdot QE$

$$= \frac{1}{2} r \cdot RF = \Delta$$

$\Rightarrow \dfrac{1}{PD}, \dfrac{1}{QE}, \dfrac{1}{RF}$ are in A.P.

$\Rightarrow$ altitudes are in H.P.

7. (4) $f(x) = \dfrac{x^2 - 1}{x^2 + 1} = 1 - \dfrac{2}{x^2 + 1}$.

min f(x) $\longleftrightarrow$ max $\dfrac{2}{x^2 + 1} \longrightarrow$

min $(x^2 + 1)$ which corresponds to x = 0

$\therefore$ minimum f(x) = – 1

8. (2) First arrange the seven white (all different) balls in a row in $\underline{|7}$ ways and then arrange the three black balls in 8 (6 interspaces plus two outside spaces) in ${}^8P_3$ ways

$$p = \frac{\underline{|7} \times {}^8P_3}{\underline{|10}} = \frac{7}{15}$$

9. (3) It is given that

$$a_n = \frac{1}{{}^nC_0} + \frac{1}{{}^nC_1} + \cdots + \frac{1}{{}^nC_n}$$

$$\text{Let } S = \sum_{r=0}^{n} \frac{r}{{}^nC_r}$$

$$= \frac{0}{{}^nC_0} + \frac{1}{{}^nC_1} + \frac{2}{{}^nC_2} + \cdots + \frac{n}{{}^nC_n}$$

$$= \frac{n}{{}^nC_0} + \frac{n-1}{{}^nC_1} + \frac{n-2}{{}^nC_2} + \cdots + \frac{0}{{}^nC_n}$$

$$2S = \frac{n}{{}^nC_0} + \frac{n}{{}^nC_1} + \cdots + \frac{n}{{}^nC_r}$$

$$\Rightarrow S = \frac{n}{2} \cdot a_n$$

10. (2) $x^2 + y^2 = 2^2$ and $(x - 3)^2 + (y - 4)^2 = 7^2$ touch internally, $d = r_1 - r_2 = 5$

Number of common tangents = 1

11. (4) $(1 + \omega - \omega^2)^7 = (-2\omega^2)^7 = -128\,\omega^{14}$

$= -128\,\omega^2$

12. (1) $\int_0^x f(t)\,dt = x + \int_x^1 t\,f(t)\,dt$

Differentiating w.r.t.x by Leibnitz rule

$1\,\{f(x)\} = 1 - \{xf(x)\}\,1$

$\therefore f(x) = \frac{1}{1 + x}$ and $f(1) = \frac{1}{2}$

13. (3) Equating slopes of PQ and RS, $\frac{b - 7}{a - 5} = \frac{4}{3}$ or $4a - 3b = -1$.

Equating slopes of PS and RQ, $\frac{b - 2}{a - 1} = \frac{1}{1}$ or $a - b = -1$

$\therefore a = 2$ and $b = 3$

14. (3) A, B, D are all equal as they represent box product $[\bar{u}\,\bar{v}\,\bar{w}]$ whereas c $\rightarrow \bar{v}\cdot(\bar{u}\times\bar{w}) = -[\bar{u}\,\bar{v}\,\bar{w}]$

15. (2) Let $y = 3x - 5$; Then $x = \frac{y + 5}{3}$;

Interchanging x and y, we get $y = \frac{x + 5}{3}\ \therefore\ f^{-1}(x) = \frac{x + 5}{3}$

16. (1) Case I ; W W B

$p_1 = \frac{3}{4}\times\frac{2}{4}\times\frac{3}{4}$

Case II ; W B W

$p_2 = \frac{3}{4}\times\frac{2}{4}\times\frac{1}{4}$

Case III ; B W W

$p_3 = \frac{1}{4}\times\frac{2}{4}\times\frac{1}{4}$

$\therefore p = p_1 + p_2 + p_3 = \frac{26}{64} = \frac{13}{32}$

17. (3) $T_n = \frac{1}{m} \Rightarrow \frac{1}{m} = a + (n - 1)\,d$

$T_m = \frac{1}{n} \Rightarrow \frac{1}{n} = a + (m - 1)\,d$

Solving $a = \frac{1}{mn}$ and $d = \frac{1}{mn}$

$\therefore T_{mn} = a + (mn - 1)\,d$

$= \frac{1}{mn} + (mn - 1)\frac{1}{mn} = 1$

18. (1) If $f(x) = \sin^2 x$ and $g(x) = \sqrt{x}$

$f(g(x)) = f(\sqrt{x}) = (\sin\sqrt{x})^2$

$g(f(x)) = g(\sin^2 x) = \sqrt{\sin^2 x} = |\sin x$

3 and 2 do not fit, on verification.

19. (4) $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = \begin{vmatrix} 6i + 4 & 0 & 0 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix}$

$= (6i + 4)(3i^2 + 3) = 0$

$\therefore x + iy = 0 \Rightarrow x = 0, y = 0$

20. (2) Each digit can be any one of 2, 5, 7, thus each digit can have 3 values. Hence there are 3^n, distinct n digit numbers. $3^n > 900 \Rightarrow n \geq 7$ since, $3^6 = 729$.

21. (1) $(F\cap E) \cup (F\cap \bar{E}) = F\cap(E\cup \bar{E}) = F\cap X = F$

Also $F\cap E$ and $F\cap \bar{E}$ are disjoint.

$\therefore\ P(F\cap E) + P(F\cap \bar{E}) = P(F)$

$\therefore\ \dfrac{P(F\cap E)}{P(F)} + \dfrac{P(F\cap \bar{E})}{P(F)} = 1$

(i.e.) $P\left(\dfrac{E}{F}\right) + P\left(\dfrac{\bar{E}}{F}\right) = 1$

Similar result is true if F is replaced by $\bar{F}$.

22. (1) If f(x) = x – (x)
then f(x) = x – (– 1) = x + 1 in (– 1, 0)

= x – 0 = x in (0, 1)

$\therefore \int_{-1}^{1} f(x)\,dx = \int_{-1}^{0} (x + 1)\,dx + \int_{0}^{1} x\,dx$

$= \left[\dfrac{x^2}{2} + x\right]_{-1}^{0} + \left[\dfrac{x^2}{2}\right]_{0}^{1} = 1$

23. (2) Any point on $xy = c^2$ is $\left(ct, \dfrac{c}{t}\right)$

Point of intersection are given by

$c^2t^2 + \dfrac{c^2}{t^2} = a^2$

$c^2 t^4 - a^2 t^2 + c^2 = 0$ with roots t_1, t_2, t_3, t_4

$\therefore\ \Sigma t_1 = 0,\ \Sigma t_1t_2 = -a^2;\ \Sigma t_1t_2t_3 = 0;\ t_1t_2t_3t_4 = 1$

$\therefore\ \Sigma x_1 = c\Sigma t_1 = 0$

$\sum y_1 = c\sum \dfrac{1}{t_1} = \dfrac{c}{t_1t_2t_3t_4}\Sigma t_1t_2t_3 = 0$

$x_1x_2x_3x_4 = c^4 \cdot t_1t_2t_3t_4 = c^4$

$y_1y_2y_3y_4 = \dfrac{c^4}{t_1t_2t_3t_4} = c^4$

24. (2) Since only two tests are needed, one faulty machine should be caught in the first test and the other one in the second test

$\therefore\ p = \dfrac{2}{4} \times \dfrac{1}{3} = \dfrac{1}{6}$

25. (2) $\sum_{n=1}^{13} i^n + \sum_{n=1}^{13} i^{n+1}$

$= \dfrac{i(1 - i^{13})}{1 - i} + \dfrac{i^2(1 - i^{13})}{1 - i}$

$= \dfrac{(i + i^2)(1 - i)}{(1 - i)} = -1 +$

26. (1) $\bar{u}\cdot(\bar{v}\times\bar{w})$ is meaningful.

27. (4) The first three choices demand either $E \subset F$ or $F \subset E$ which are not implied by $P(E) \le P(F)$ and $P(E\cap F) > 0$

28. (1) Each toss is independent of the earlier tosses and hence the probability of “head” appearance in the fifth toss = $\dfrac{1}{2}$

29. (3) y = mx + c touches the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ if $c = \pm\sqrt{a^2m^2 + b^2}$.
This is only a numerical example.

30. (3) $y = A\cos(x + B) + Ce^{x}$ where $C_1 + C_2 = A$ and $C_4\, e^{C_5} = C$. Thus there are only three arbitrary constants and hence the differential equation will be of 3rd order.

$y' = -A\sin(x + B) + Ce^{x}$

$y'' = -A\cos(x + B) + Ce^{x}$

$y''' = A\sin(x + B) + Ce^{x}$

$$\therefore\ \frac{y + y''}{y' + y'''} = \frac{2Ce^{x}}{2Ce^{x}} = 1$$

or $y''' - y'' + y' - y = 0$ is the differential equation.

31. (4) Slope of PR × slope of QS

$$= -\frac{1}{3} \times \frac{6}{2} = -1$$

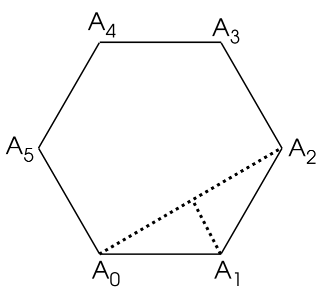
Diagonals are at right angles
⇒ parallelogram is a rhombus.

32. (3) Number of newspapers

$$= \frac{300 \times 5}{60} = 25$$

33. (3) $\angle A_1A_0A_2 = 30°$

$\therefore\ A_0A_2 = 2 \cdot 1 \cdot \cos 30° = \sqrt{3}$



$A_0A_4 = A_0A_2 = \sqrt{3}$

$\therefore\ (A_0A_1)\,(A_0A_2)(A_0A_4)$

$$= 1 \cdot (\sqrt{3})\,(\sqrt{3}) = 3$$

34. (3) $\dfrac{x^2}{25} + \dfrac{y^2}{16} = 1$ is the ellipse with a = 5, b = 4, $e = \dfrac{3}{5}$

$\therefore$ ae = 3

$\therefore$ (3, 0) and (– 3, 0) are the foci.

$\therefore\ PF_1 + PF_2 = 2a = 10$

35. (2) $f(x) = \cos x + \cos\left(\sqrt{2}\,x\right)$ attains its maximum value 2 when x = 0; If x = 2π or any even multiple of π, $\sqrt{2}\,x = 2\sqrt{2}\,n\pi$ and $\cos\left(2\sqrt{2}\,n\pi\right) \neq 1$. Similarly, if $\sqrt{2}x = 2m\pi$, $x = \sqrt{2}m\pi$ and $\cos x \neq 1$. The only value of x for which f(x) is maximum is x = 0.

36. (4) $$\lim_{x \to 1} \frac{\sqrt{1 - \cos 2(x - 1)}}{x - 1}$$

$$= \lim_{y \to 0} \frac{\sqrt{2\sin^2 y}}{y}$$

$$= \lim_{y \to 0} \frac{\sqrt{2}\,|\sin y|}{Y}$$

$$= \begin{cases} \sqrt{2} \text{ if } y \to 0+ \\ -\sqrt{2} \text{ if } y \to 0- \end{cases}$$

Hence the left hand and right hand limits are unequal and therefore limit does not exist.

37. (2) x, y, z in G.P.

$\Rightarrow y^2 = xz$

$\Rightarrow 2 \log y = \log x + \log z.$

$\Rightarrow$ ln x, ln y, ln z are in A.P.

$\Rightarrow$ 1 + ln x, 1 + ln y, 1 + lnz are in A.P.

$\Rightarrow$ their reciprocals are in H.P.

38. (3) $3 \sin^2 x - 7 \sin x + 2 = 0$

$\Rightarrow (3 \sin x - 1)(\sin x - 2) = 0$

$\Rightarrow \sin x = \frac{1}{3}$ only. Hence $x = \alpha$

$= \sin^{-1}\frac{1}{3}$; $\pi - \alpha$, $2\pi + \alpha$, $3\pi - \alpha$,

$4\pi + \alpha$, $5\pi - \alpha$, satisfy $\sin x = \frac{1}{3}$; six values.

39. (2) (i) Centroid $= \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$ is a rational point.

(ii) Equations of altitudes will contain only rational coefficient and hence the orthocentre will also be a rational point.

(iii) Similar argument gives the circumcentre to be a rational point.

(iv) The length of the sides a, b, c may not be rational and hence the incentre may not be a rational point.

40. (3) $\sin 15° \cos 15° = \frac{1}{2} \sin 30° = \frac{1}{4}$.

The other three are

$\sin 15° = \frac{\sqrt{3} - 1}{2\sqrt{2}}$, $\cos 15° = \frac{\sqrt{3} + 1}{2\sqrt{2}}$

and $\sin 15° \cdot \cos 75° = \sin^2 15°$

$= \left(\frac{\sqrt{3} - 1}{2\sqrt{2}}\right)^2 = \frac{2 - \sqrt{2}}{4}$

are irrational.

41. (2) $\int_0^{\pi^2} \sin\sqrt{x}\, dx = \int_{t=0}^{\pi} 2t \sin t\, dt$,

by putting $x = t^2$

$= 2\left\{t(-\cos t)\right\}_0^{\pi} - \int_0^{\pi} (-\cos t)(+1)\, dt$

$= 2\left[\pi + (\sin t)_0^{\pi}\right] = 2\pi$

42. (1) $\frac{x^2}{\frac{5}{3}} + \frac{y^2}{\frac{5}{4}} = 1$

$m_0 = -3$, $m_1 m_0 = -\frac{b^2}{a^2}$

$\Rightarrow m_1 = -\frac{b^2}{a^2 m_0} = -\frac{\frac{5}{4}}{\left(\frac{5}{3}\right)(-3)}$

$= \frac{1}{4}$.

Hence the equations of the conjugate diameter is $y = \frac{1}{4}x$.

i.e., $4y - x = 0$

43. (4) $p^2 y + p(x - y) - x = 0$

$\Rightarrow p = \frac{y - x \pm \sqrt{(x - y)^2 + 4xy}}{2y}$

$$= \frac{y - x \pm (x + y)}{2y} = 1 \text{ or } -\frac{x}{y}$$

If $\frac{dy}{dx} = -\frac{x}{y}$, then $x\,dx + y\,dy = 0$

$\Rightarrow x^2 + y^2 = c^2$

44. (3) $T_5 + T_6 = 0$

$\Rightarrow {}^nC_4\, a^{n-4}\, b^4 - {}^nC_5\, a^{n-5}\, b^5 = 0$

$$\Rightarrow a^{n-5}\, b^4 \left\{\frac{n(n-1)(n-2)(n-3)}{24}\right\}$$

$$\left\{a - \frac{(n-4)\,b}{5}\right\} = 0$$

$\Rightarrow 5a - nb + 4b = 0$

$$\Rightarrow \frac{nb - 5a}{b} = 4$$

45. (1) (3, 4, 5) satisfies $4x + 4y - 5z = 3$ and $(2, 3, 4) \cdot (4, 4, -5) = 0$.

PART II: PHYSICS

46. (2)

47. (3)

48. (4)

49. (3)

50. (3)

51. (2)

52. (4)

53. (3)

54. (1)

55. (1)

56. (4)

57. (3)

58. (3)

59. (4)

60. (2)

61. (1)

62. (1)

63. (2)

64. (2)

65. (4)

66. (1)

67. (2)

68. (2)

69. (3)

70. (2) For post office box (Wheatstone bridge), under balanced conditions

$\frac{P}{Q} = \frac{R}{S}$, where S is unknown resistance

$S = \frac{Q}{P} \times R$ [Here, $\frac{P}{Q}$ = 100 given]

From the given graph the galvanometer shows zero deflection at – R = 323.75 = 324 Ω [upto 3 significant digits].

So, S = 3.24 Ω

71. (3)

72. (1) (a) f_{max} = 100 MHz + 60 kHz

= 100.06 MHz

f_{min} = 100 MHz – 60 kHz

= 99.94 MHz

(b) Frequency swing = 2 × 60

= 120 kHz

(c) m_f = 60/10 = 6 rad

73. (1) $$\frac{\Delta P}{P} \times 100 = \pm\left[\frac{\Delta A}{A} \times 100 + \frac{\Delta B}{B} \times 100\right]$$

$= \pm\,[0.25 + 0.1]$

$= \pm\, 0.35$

74. (4) **For S_1: Unequal Weight of Pan**

Let m_1 and m_2 be the masses of the left and right pans of the balance. If M_1 and M_2 are the measured mass of a block, which is successively placed in the left and right pan of the balance, then from the condition of equilibrium, we get,

$$m_1 + M = m_2 + M_1 \qquad \text{... (i)}$$

and $m_1 + M_2 = m_2 + M$ ... (ii)

where M is the actual mass of the block.

Subtracting equation (ii) from (i), we get, $M - M_2 = M_1 - M$

or $M = \dfrac{M_1 + M_2}{2}$

For S_2: Unequal Lengths of Arm

Let ℓ_1 and ℓ_2 be the lengths of the left and right arm of the physical balance. If M_1 and M_2 are the measured mass of the block, which is successively placed in the left and right pans of the balance, then from the condition of equilibrium, we get

$\ell_1 M = \ell_2 M_1$ ... (iii)

and $\ell_1 M_2 = \ell_2 M$ ... (iv)

where M is the actual mass of the block.

Dividing equation (iii) and (iv), we get

$$\frac{M}{M_2} = \frac{M_1}{M}$$

$$M = \sqrt{M_1 M_2}$$

75. (4)

76. (2)

77. (2)

78. (2)

79. (2)

80. (2) $m = \dfrac{E_m}{E_S} = \dfrac{15}{60} = 0.25$

81. (3) $W = \vec{F} \cdot \vec{S}$

$\Rightarrow 6 = \left(3\hat{i} + c\hat{j} + 2\hat{k}\right) \cdot \left(-4\hat{i} + 2\hat{j} + 3\hat{k}\right)$

$\Rightarrow 6 = -12 + 2c + 6$

$\Rightarrow c = 6$

82. (2)

83. (4) $V = L^3$

$\dfrac{\Delta V}{V} \times 100 = \dfrac{3\Delta L}{L} \times 100$

$\Rightarrow \dfrac{\Delta V}{V} = 0.03\%$

84. (3) f_p = focal length of each plano-convex lens

$\dfrac{1}{F_a} = \dfrac{1}{f_p} + \dfrac{1}{f_p}$

$\Rightarrow F_a = \dfrac{f_p}{2}$

Similarly, $F_b = \dfrac{f_p}{2}$, $F_c = \dfrac{f_p}{2}$

85. (1) $I = \dfrac{E}{2+3} = \dfrac{E}{5}$ amp

$m = ZIt = \dfrac{EZ}{5}$ gm/s, where Z Ω is included so,

effective resistance $= \dfrac{2 \times 2}{2+2} + 3 = 4\ \Omega$

$\Rightarrow I' = \dfrac{E}{4} \Rightarrow m' = \dfrac{ZE}{8}$ gm/s

$\Delta m = \dfrac{m - m'}{m} = \dfrac{300 \times 5}{40}$

$= 37.5\%$ (decrease)

PART III: CHEMISTRY

86. (4)

87. (4)

$_{28}Ni^{2+}$ 3d^8 [↑↓][↑↓][↑↓][↑][↑] 4s^0 [ ] 4p^0 [ ][ ][ ]

$[Ni(CN)_4]^{-2}$ 3d^8 [↑↓][↑↓][↑↓][↑↓][ ] 4s^0 [ ] 4p^0 [ ][ ][ ]

dsp^2 hybridisation

CN^- makes Ni^{+2} electrons to pair up.

$[NiCl_4]^{-2}$ 3d^8 [↑↓][↑↓][↑↓][↑][↑] 4s^0 [ ] 4p^0 [ ][ ][ ]

sp^3 hybridisation

No pairing of electrons.

88. (2)

89. (4)

90. (1) $Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$ – 1 mole H_2

$$Al + \frac{3}{2} H_2SO_4 \longrightarrow \frac{1}{2} Al_2(SO_4)_3 + \frac{3}{2} H_{2(g)}$$

Ratio of moles H_2 formed by

1 mole of Zn : 1 mole of Al

$= 1 : \frac{3}{2}$ i.e., 1 : 1.5

91. (1) $2KMnO_4 + 3H_2SO_4 \longrightarrow 2MnSO_4 + K_2SO_4 + 3H_2O + 5[O]$

$$5\left[H_2^+C_2O_4^{-2} + [O] \longrightarrow 2CO_2 + H_2O\right]$$

$$2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 \longrightarrow 2MnSO_4 + K_2SO_4 + 10CO_2 + 8H_2O$$

$$2MnO_4^{-1} + 5C_2O_4^{-2} + 16H^+ \longrightarrow 2Mn^{+2} + 10CO_2 + 8H_2O$$

x z y

92. (1)

93. (2) $C_{(graphite)} + H_2O_{(g)} \rightleftharpoons CO_{(g)} + H_{2(g)}$

$$K_p = \frac{[pCO][pH_2]}{[pH_2O]}$$

$[pH_2]\,[pCO] = K_p\,[pH_2O]$

$[pH_2] = [pCO]$

$\therefore [pH_2]^2 = K_p\,[pH_2O]$

$[pH_2] \propto \sqrt{pH_2O}$

94. (2)

95. (4)

96. (3)

97. (1) $HOCl \rightleftharpoons H^+ + OCl^-$

Weakest acid — Strongest Bronsted base

98. (2)

99. (3)

100. (1)

101. (3)

102. (1)

103. (2)

104. (3)

105. (4)

106. (3)

107. (1)

108. (4)

109. (2)

110. (3)

111. (2) $AgBr_{(s)} + 2Na_2S_2O_{3(aq)} \longrightarrow Na_3\left[Ag\,(S_2O_3)_2\right]_{(aq)} + NaBr_{(aq)}$

112. (1) $CaC_{2(s)} + N_{2(g)} \xrightarrow[\text{electric furnace}]{\Delta} CaNCN + C_{(graphite)}$

113. (1) $ZnSO_{4(aq)} + 2NaHCO_{3(aq)} \longrightarrow ZnCO_{3(s)} + Na_2SO_{4(aq)} + H_2O_{(\ell)} + CO_{2(g)}$

114. (4)

115. (1)

116. (2)

117. (3)

118. (3)

119. (3)

120. (2)

121. (1)

122. (1)

123. (2)

124. (3)

125. (3)

PART IV: ENGLISH PROFICIENCY AND LOGICAL REASONING

(a) ENGLISH PROFICIENCY

126. (3)

127. (3)

128. (3)

129. (3)

130. (4)

131. (2)

132. (1)

133. (2)

134. (1) 'The carpet was stained' in place of 'The carpet was badly stained.

135. (4) 'his honesty did him credit' in place of 'his honesty does for him credit'.

136. (1) 'A big hue and cry' in place of 'A terrific hue and cry'.

137. (3)

138. (4)

139. (2)

140. (3)

(b) LOGICAL REASONING

141. (2) Nutrition is a cause for health.

142. (2) Car is a part of transport system.

143 (1) Salad and rice are part of food.

144. (3) 'kick' is an action that makes the football move.

145. (1)

146. (1)

147. (4)

148. (4)

149. (2) All other figures can be rotated into each other.

150. (3)