ADMISSION CUM SCHOLARSHIP TEST

SAMPLE TEST PAPER

(For Students Appearing in Class 12TH BOARD IN 2024)

STREAM : ENGINEERING | COURSE OFFERED : REBOOST

Time : 2 hours **Maximum Marks: 240**

DO NOT BREAK THE SEALS ON THIS BOOKLET, AWAIT INSTRUCTIONS FROM THE INVIGILATOR.

SEAL

INSTRUCTIONS

(A) General :

1. This Question paper contains **THREE** parts (Physics, Chemistry and Mathematics).
2. This Question Paper contains 13 pages, other than the OMR.
3. This Question Paper contains total **60 questions, 20 questions each** in **Physics, Chemistry and Mathematics**.
4. The Question Paper has blank spaces at the bottom of each page for rough work.No additional sheets will be provided for rough work.
5. Blank papers, clip boards, log tables, slide rule, calculators, cellular phones, pagers and electronic gadgets, in any form, are **NOT** allowed.
6. This booklet also contains the **OMR** answer sheet (i.e., A machine gradable Response Sheet).

(B) Answering on the OMR:

7. Each question will have **4 choices** in both the Sections, out of which **only one choice is correct**.
8. Fill the bubble with **Ball Pen (Blue or Black) ONLY.**

(C) Filling – Name and Registration No.

9. On the **OMR sheet**, write your Name and Registration No. using ball pen. Also, put your signature in the appropriate box using ball pen.

(D) Marking Scheme:

9. (a) For each question, you will be awarded **4 marks** if you have darkened only one bubble corresponding to the right answer.
   (b) In case you have not darkened any bubble, you will be awarded 0 mark for that question.
   (c) In all other cases, you will be awarded **–1 mark**.

Name :.....

Registration No.: ☐☐☐☐☐☐☐☐ ☐☐☐☐☐☐☐☐

PART-A : PHYSICS

1. A particle starts moving on a straight line with zero initial velocity and acceleration:

$a = +2\ m/s^2$ for $0 < t < 2s$

$a = -2\ m/s^2$ for $t > 2s$.

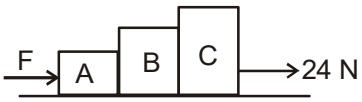
The time at which the particle will pass through its original position, is:

(A) $4+2\sqrt{2}\,s$ (B) $2+2\sqrt{2}\,s$ (C) $2\sqrt{2}\,s$ (D) $4\ s$

2. A particle starts moving on a circle with initial angular velocity zero, and some constant angular acceleration. The particle passes through its original position for the first time with angular velocity ω. The angular velocity of the particle, at the moment it passes through its original position the second time, is:

(A) $\sqrt{2}\,\omega$ (B) 2ω (C) $2\sqrt{2}\,\omega$ (D) 4ω

3. Three blocks A, B and C of mass 1kg, 2kg and 6kg respectively are placed in contact with each other, on a horizontal smooth surface, as shown in the figure. A force 24 N is applied horizontally on the block C, toward right. A force F is applied horizontally on the block A, toward right. If the normal contact force between the block B and C is zero, the value of F will be:



(A) 4 N (B) 6 N (C) 10 N (D) 12 N

4. A perfectly flexible chain of mass M and length L is placed on a horizontal table. A boy holds one end of the chain and very slowly lifts this end vertically upward. The total work done by the boy in lifting the chain, by the time the other end of the chain just leaves contact with the table, is:

(A) $Mg\frac{\ell}{2}$ (B) $Mg\ell$ (C) $\frac{2Mg\ell}{3}$ (D) $2Mg\ell$

Space for rough work

5. A ball is released on a horizontal floor, from a height of 320 m. Coefficient of restitution for the collision of the ball with the floor is 1/2. The time interval between the second and the third collision of the ball with the floor is:

(A) 2 s (B) 4 s (C) 6 s (D) 8 s

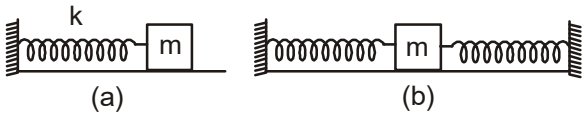
6. A circular disc of mass M and radius R is rolling (not pure rolling) on a horizontal surface. Velocity of the centre of the disc is v. Total kinetic energy of the disc is $11Mv^2/4$. Angular velocity of the disc is:

(A) $\frac{v}{R}$ (B) $\frac{2v}{R}$ (C) $\frac{3v}{R}$ (D) $\frac{4v}{R}$

7. A spherical solid ball of bulk modulus B is taken from the surface of ocean to a depth of h. The density of the liquid is σ (constant). Acceleration due to gravity is g. The fractional change in the radius of the ball is:

(A) $\frac{\sigma gh}{B}$ (B) $\frac{\sigma gh}{2B}$ (C) $\frac{\sigma gh}{3B}$ (D) $\frac{\sigma gh}{4B}$

8. A block is connected with a spring and placed on a smooth horizontal floor as shown in the figure (a). If displaced and released, the block oscillates with a time period T. Now the spring is cut into two equal parts and the two parts are connected with the same block as shown in the figure (b). Now the block will oscillate with time period:



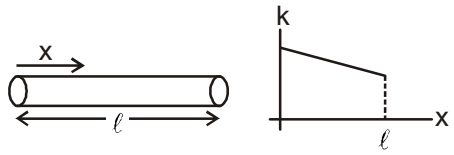
(A) $\frac{T}{\sqrt{2}}$ (B) $\frac{T}{2}$ (C) T (D) 2T

9. The velocity of the wave $y = A\sin^2(ax + bt)$ is :

(A) $\frac{a}{b}$ (B) $\frac{b}{a}$ (C) $\frac{2a}{b}$ (D) $\frac{2b}{a}$

Space for rough work

10. The coefficient of thermal conductivity of a rod changes with x (distance from left end) as shown in the graph. The left end of the rod is maintained at 100°C. In the steady state, the temperature of the midpoint of the rod is 50°C. The temperature (t°C) of the right end of the rod will be:



(A) $t > 0^oC$ (B) $t < 0^oC$ (C) $t = 0^oC$ (D) data insufficient.

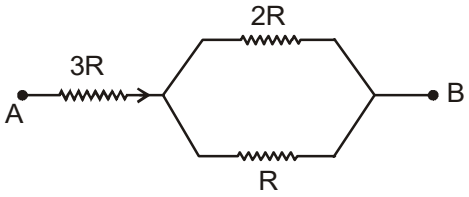
11. Three particles A, B and C are placed on the vertices of an equilateral triangle. Mass of all particles is same. Charges on the particles A, B and C are +q, - q and +q. The three particles are released simultaneously. Just after the releasing, ratio of the accelerations of the particle A and B (a_A / a_B) will be:

(A) 1 (B) 2 (C) $\sqrt{3}$ (D) $\frac{1}{\sqrt{3}}$

12. Two particle having same charge +Q are fixed at (0, b) and (2a, b). A third particle of mass m and charge – q is released at (a , b + c). Assuming, c << a, time period of the oscillations of the third particle will be:

(A) $2\pi\sqrt{\frac{2\pi\varepsilon_0 ma^3}{Qq}}$ (B) $\pi\sqrt{\frac{\pi\varepsilon_0 ma^3}{Qq}}$ (C) $\pi\sqrt{\frac{2\pi\varepsilon_0 ma^3}{Qq}}$ (D) $2\pi\sqrt{\frac{\pi\varepsilon_0 ma^3}{Qq}}$

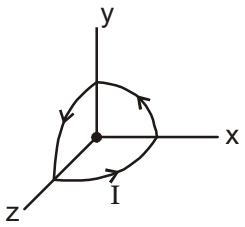
13. Three resistances R, 2R and 3R are connected between A and B as shown in the figure. A current flows in the combination from A to B. The heat generated per second in resistance R is H. The total heat generated in the entire combination, per second, is:



(A) $\frac{22}{3}H$ (B) 6H (C) $\frac{33}{4}H$ (D) $\frac{11}{6}H$

Space for rough work

14. A loop consists of three circular parts lying in the xy, yz and zx planes, such that their centres are common at origin. Radius of these three circular parts is R. A current I flows in the loop. Magnetic field at the origin will be:



(A) $\frac{\sqrt{3}\mu_0 I}{2R}$ (B) $\frac{\sqrt{3}\mu_0 I}{4R}$ (C) $\frac{\sqrt{3}\mu_0 I}{8R}$ (D) $\frac{\sqrt{3}\mu_0 I}{16R}$

15. A charged particle having charge +q and mass m is projected from origin with velocity $v = v_0\hat{i}$ in the uniform magnetic field $\vec{B} = B_0\hat{i} + B_0\hat{j}$. The particle will touch the xy plane for the first time, at:

(A) $\left(\frac{\pi mv_0}{\sqrt{2}qB_0}, \frac{\pi mv_0}{\sqrt{2}qB_0}\right)$ (B) $\left(\frac{\pi mv_0}{\sqrt{2}qB_0}, \frac{\pi mv_0}{2qB_0}\right)$

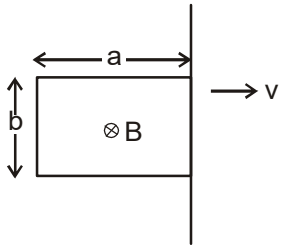
(C) $\left(\frac{\pi mv_0}{2qB_0}, \frac{\pi mv_0}{2qB_0}\right)$ (D) $\left(\frac{\pi mv_0}{qB_0}, \frac{\pi mv_0}{qB_0}\right)$

Space for rough work

16. A rectangular loop of side lengths a and b, and total resistance R is placed in a uniform magnetic field B. The magnetic field exists only on the left side of the vertical line shown in the figure. The magnetic field is perpendicular to the plane of paper, and the loop is in the plane of paper. Initially the loop is completely inside the magnetic field, and it pulled out of the magnetic field at a constant speed v, as shown in the figure. Total heat generated in the loop will be:

(A) $\frac{B^2b^2\,va}{4R}$ (B) $\frac{B^2b^2\,va}{2R}$

(C) $\frac{B^2b^2\,va}{R}$ (D) $\frac{2B^2b^2\,va}{R}$



17. The rms value of the current $I = \left(20\sqrt{2}\,A\right)\sin\left(10\pi t\right)$ is

(A) 10 A (B) $10\sqrt{2}$ A (C) 20 A (D) $20\sqrt{2}$ A

18. A point object moves on the principal axis of a convex lens of focal length 10cm. The speed of the object is 1 cm/s. The speed of the image at the moment the distance of the object from the lens becomes 15 cm, is:

(A) 1 cm/s (B) 2 cm/s (C) 3 cm/s (D) 4 cm/s.

19. The radius of the orbit of electron in He^+ in the fourth shell is r_1. The radius of the orbit of electron in H in the second shell is r_2. The ratio r_1/r_2 is:

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

20. What is the component of $3\hat{i}+4\hat{j}$ along $\hat{i}+\hat{j}$?

(A) $\frac{7}{2}(\hat{i}+\hat{j})$ (B) $\frac{3}{2}(\hat{i}+\hat{j})$ (C) $\frac{5}{2}(\hat{i}+\hat{j})$ (D) $\frac{1}{2}(\hat{i}+\hat{j})$

Space for rough work

PART-B : CHEMISTRY

21. Freezing point of an aqueous solution is (–0.186)ºC. Elevation of boiling point of the same solution is $K_b = 0.512$ºC, $K_f = 1.86$ºC, find the increase in boiling point.

(A) 0.186 ºC (B) 0.0512 ºC (C) 0.092 ºC (D) 0.2372 ºC

22. The value of $(n_2 + n_1)$ and $\left(n_2^2 - n_1^2\right)$ for He^+ ion in atomic spectrum are 4 and 8 respectively. The wavelength of emitted photon when electron jump from n_2 to n_1 is

(A) $\frac{32}{9} R_H$ (B) $\frac{9}{32} R_H$ (C) $\frac{9}{32 R_H}$ (D) $\frac{32}{9 R_H}$

23. For a certain gas which deviates a little from ideal behaviour. A plot between $P/\rho vs\, P$ was found to be non - linear, the intercept on y -axis will be :

(A) $\frac{RT}{M}$ (B) $\frac{M}{RT}$ (C) $\frac{MZ}{RT}$ (D) $\frac{R}{TM}$

24. The dissociation constant for $[Ag(NH_3)_2]^+$ into Ag^+ and NH_3 is 10^{-13} at 298 K. If $E^o_{Ag^+/Ag} = 0.8V$, then Eº for the half cell $[Ag(NH_3)_2]^+ + e^- \longrightarrow Ag + 2NH_3$ will be

(A) 0.33 V (B) –0.33 V (C) –0.033 V (D) 0.033 V

25. A solution contains 0.09 M HCl, 0.09 M CCl_2HCOOH, and 0.1 M CH_3COOH. If total $[H^+] = 0.1$ M and K_a for $CH_3COOH = 10^{-5}$, K_a for CCl_2HCOOH is -

(A) 1.35×10^{-4} (B) 0.18×10^{-2}

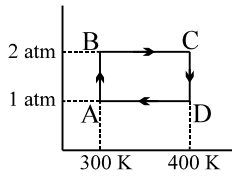
(C) 0.18×10^{-5} (D) 1.25×10^{-2}

26. In a first order reaction, the concentration of the reactant, decreases from 0.8 M to 0.4 M is 15 minutes. The time taken for the concentration to change 0.1 M to 0.025 M is

(A) 7.5 minutes (B) 15 minutes (C) 30 minutes (D) 60 minutes

Space for rough work

27. Two moles of Helium gas undergo a reversible cyclic process as shown in figure. Assuming gas to be ideal, what is the net work involved in the cyclic process?



(A) –100 R/n4 (B) +100R/n4 (C) +200R/n4 (D) –200R/n4

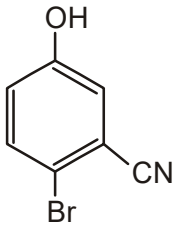
28. Solid $Ca(HCO_3)_2$ decomposes as

$$Ca(HCO_3)_2(s) \rightleftharpoons CaCO_3(s) + CO_2(g) + H_2O(g)$$

If the total pressure is 0.2 bar at 420 K, what is the standard free energy change for the given reaction $(\Delta_r G^o)$?

(A) 840 kJ/mol (B) 3.86 kJ/mol (C) 6.98 kJ/mol (D) 16.083 kJ/mol

29. The IUPAC name of the following compound is:-



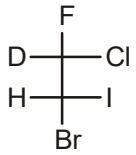
(A) 4-Bromo-3-cyanophenol

(B) 2-Bromo-5-hydroxybenzonitrile

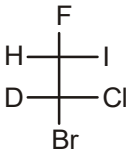
(C) 2-Cyano-4-hydroxybromobenzene

(D) 6-Bromo-3-hydroxybenzonitrile

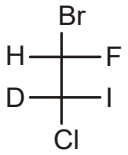
30. Number of fractions on fractional distillation of mixture of :



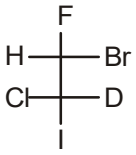
(I)



(II)



(III)



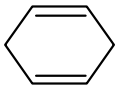
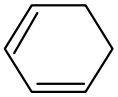
(IV)

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

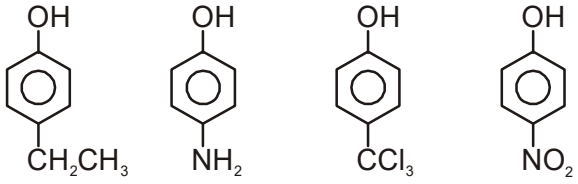
Space for rough work

31. Which of the following compound on ozonolysis followed by oxidative hydrolysis yields propane–1, 3–dioic acid (malonic acid) as the only product?

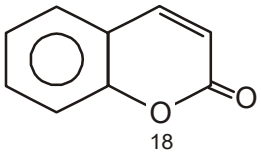
(A) CH_2=CH–CH_2–CH=CH_2 (B) CH_2=CH–CH=CH_2

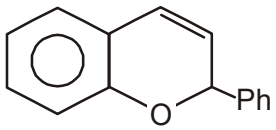
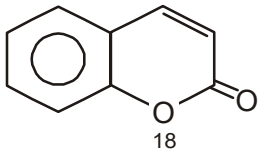
(C)  (D) 

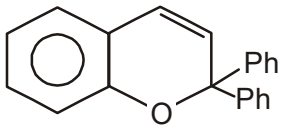
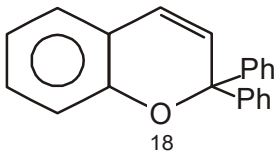
32. The correct order of acidic strength of given compound is



(A) I > II > III > IV (B) IV > III > II > I (C) IV > III > I > II (D) III > IV > II > I

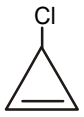
33.  $\xrightarrow[(2)\,H_2O]{(1)\,2PhMgBr} \xrightarrow[\Delta]{H_2SO_4}$ (B), Product (B) in this reaction is :

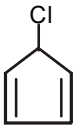
(A)  (B) 

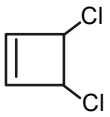
(C)  (D) 

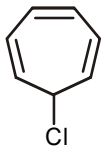
Space for rough work

34. Which of the following does not give white ppt. of AgCl when treated with $AgNO_3$

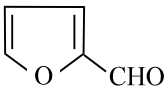
(A) 

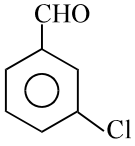
(B) 

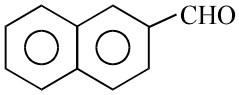
(C) 

(D) 

35. Which of following will not undergo Cannizaro reaction

(A) 

(B) 

(C) 

(D) $Cl_3C–CHO$

36. In which of the following Molecules $\sigma 2PZ$ Molecular orbital is filled after $\pi 2px$ and $\pi 2py$ molecular orbitals?

(A) O_2 (B) Ne_2 (C) N_2 (D) F_2

37. The electronegativity of H,X,O are 2.1, 0.8 and 3.5 respectively comment on the nature of compound H–O–X that is :

(A) Basic (B) Acidic (C) Amphoteric (D) Cant be predicted

38. The complex which is dsp^2 hybridized and diamagnetic in nature?

(P) $Na_4[Cr(CO)_4]$ (Q) $[Ni(DMG)_2]$ (R) $[PtHBr(PEt_3)_2]$

(S) $[Ag(SCN)_4]^{3-}$ (T) $[AuBr_4]^-$

(A) P,Q,S only (B) P,R,S,T only (C) Q,R,T only (D) R,T only

39. The complex which exhibits geometrical as well optical isomersim is :

(A) $[Co(gly)_3]$ (B) $[Pt(gly)_2]$ (C) $[Co(en)_3]Cl_3$ (D) $K_3[Co(OX)_3]$

40. Incerasing order of average oxidation state of iron in Haemtite(P), Magnatite (Q) and Siderite (R).

(A) P < Q < R (B) R < Q < P (C) R < P < Q (D) Q < P < R

Space for rough work

PART-C : MATHEMATICS

41. The equation of a straight line having equal intercepts and passing through (3, 5) is

(A) $x + y - 8 = 0$ (B) $2x - y - 1 = 0$ (C) $x + y + 8 = 0$ (D) $x - y - 8 = 0$

42. The radius of the circle passing through the points (1, 2), (5, 2) and (5, -2) is

(A) $5\sqrt{2}$ (B) $2\sqrt{5}$ (C) $3\sqrt{2}$ (D) $2\sqrt{2}$

43. If $\cos\theta \sin\theta = \sqrt{2}\sin\theta$ then one of the values of $\cos\theta + \sin\theta$ =

(A) 1 (B) $-\sqrt{2}\cos\theta$ (C) $\sqrt{2}\sin\theta$ (D) none of these

44. The value of $\sqrt{20+\sqrt{20+\sqrt{20+.....\infty}}}$ is equal to

(A) 7 (B) 5 (C) -4 (D) 3

45. If $a > 2$, roots of the equation $(2 - a)x^2 + 3ax - 1 = 0$ are

(A) one positive and one negative (B) both negative

(C) both positive (D) both imaginary

46. The solution set of the inequality $x(2^x - 1)(x+2)(x-3)^2 \le 0$

(A) $(-\infty, -2]$; (B) $[2, \infty)$ (C) $(-\infty, -2] \cup \{0, 3\}$ (D) None of these

47. A box contains 100 bulbs out of which 10 are defective. 5 bulbs are drawn from the box. The probability that none is defective, is

(A) $\frac{^{90}C_5}{^{100}C_5}$ (B) $1-\frac{^{10}C_5}{^{100}C_5}$ (C) $\left(\frac{9}{10}\right)^5$ (D) $1-\left(\frac{1}{10}\right)^5$

48. If A = [a b], B = [–b –a] and $C = \begin{bmatrix} a \\ -a \end{bmatrix}$, then the correct statement is

(A) A = –B (B) A + B = A – B (C) AC = BC (D) CA = CB

Space for rough work

49. If $f(7) = 5$ and $f'(7) = 5$, then $\underset{x \to 7}{Lt} \dfrac{x f(7) - 7 f(x)}{x - 7}$

(A) 35 (B) -35 (C) 28 (D) -30

50. Vectors $\vec{a}$ & $\vec{b}$ make an angle $\theta = \dfrac{2\pi}{3}$. If $|\vec{a}| = 1, |\vec{b}| = 2$ then $\left\{\left(\vec{a} + 3\vec{b}\right) x \left(3\vec{a} - \vec{b}\right)\right\}^2 =$

(A) 225 (B) 250 (C) 275 (D) 300

51. If the points $(-1, 3, 3)$, $(-4, 2, 2)$ and $(5, 5, \lambda)$ are collinear then $\lambda =$

(A) -10 (B) 5 (C) -5 (D) 10

52. The lines $lx + my + n = 0$, $mx + ny + l = 0$ and $nx + ly + m = 0$, (l, m, n are not all equal) are concurrent if

(A) $l^2 + m^2 + n^2 = 1$ (B) $lm + mn + nl = 1$

(C) $lm + mn + nl = 0$ (D) $l + m + n = 0$

53. $\underset{x \to 0}{Lt} \dfrac{\sqrt{1+x^3} - \sqrt{1-x^3}}{x^3} =$

(A) 1 (B) -1 (C) 2 (D) $\dfrac{1}{2}$

54. The domain of $\dfrac{1}{\sqrt{|x| - x}}$ is

(A) $(-\infty, 0)$ (B) $(-\infty, 0]$ (C) $(0, \infty)$ (D) $R - \{0\}$

55. Let $f(x) = 2^{2x-1}$ and $g(x) = -2^x + 2x\log 2$, then set of all values of x such that $f'(x) > g'(x)$ is

(A) (0, 1) (B) $(-1, 0)$ (C) $(0, \infty)$ (D) $(-\infty, 0)$

Space for rough work

56. If R be a relation from A = {1, 2, 3, 4} to B = {1, 3, 5} i.e., $(a,b) \in R \Leftrightarrow a < b$, then R^{-1}

(A) {((3, 1), (5, 1), (3, 2), (5, 2), (5, 3), (5, 4))}

(B) {(3, 3), (3, 4), (4, 5)}

(C) {(1, 3), (1, 5), (2, 3), (2, 5), (3, 5), (4, 5)}

(D) {(3,3), (3, 5), (5, 3), (5, 5)}

57. $I = \int \frac{2x-3}{(x-1)(x-2)} dx$ is equal to

(A) $\log\left|\frac{x-1}{x-2}\right| + c$

(B) $\log |(x-1)(x-2)| + c$

(C) $\log\left|\frac{x-2}{x-1}\right| + c$

(D) none of these

58. $\int_0^{\pi/4} \frac{dx}{1+\cos 2x}$ equals

(A) – 1 (B) 1 (C) 1/2 (D) – 1/2

59. The area bounded by the curves $y^2 = 8x$ and $x^2 = 8y$ is

(A) 64 sq. units

(B) 64/3 sq. units

(C) 9/2 sq. units

(D) none of these

60. The differential equation of the curve given by $y = ae^x + be^{-x}$ is

(A) $\frac{d^2y}{dx^2} = \frac{dy}{dx}$ (B) $\frac{d^2y}{dx^2} = y + c$ (C) $\frac{d^2y}{dx^2} = y$ (D) none of these

Space for rough work

ANSWER KEYS

SAMPLE TEST PAPER

(For Students Appearing in Class 12TH BOARD IN 2024)

STREAM : ENGINEERING | COURSE OFFERED : REBOOST

PHYSICS

1. (A)	**2. (A)**	**3. (D)**	**4. (A)**
5. (B)	**6. (C)**	**7. (C)**	**8. (B)**
9. (B)	**10. (B)**	**11. (D)**	**12. (A)**
13. (C)	**14. (C)**	**15. (A)**	**16. (C)**
17. (C)	**18. (D)**	**19. (C)**	**20. (A)**

CHEMISTRY

21. (B)	**22. (C)**	**23. (A)**	**24. (D)**
25. (D)	**26. (C)**	**27. (A)**	**28. (D)**
29. (B)	**30. (C)**	**31. (C)**	**32. (C)**
33. (D)	**34. (B)**	**35. (D)**	**36. (C)**
37. (A)	**38. (C)**	**39. (A)**	**40. (B)**

MATHEMATICS

41. (A)	42. (D)	43. (A)	44. (B)
45. (C)	46. (C)	47. (A)	48. (C)
49. (D)	50. (D)	51. (B)	52. (D)
53. (A)	54. (A)	55. (C)	56. (A)
57. (B)	58. (C)	59. (B)	60. (C)