PANDEY SIR'S
IITIAN CLASSES
•IIT-JEE • MEDICAL • FOUNDATION • BOARD

IITIAN CLASSES
SAT
SCHOLARSHIP CUM ADMISSION TEST

SAMPLE PAPER

INSTRUCTIONS:

1. This Questions paper contains 12 printed pages. The question paper contains 20 questions in each of 3 parts, in total, 60 questions. All of them are compulsory. ***Please ensure that the question Paper you have received contains all Questions and pages. If you find some mistake like missing questions or pages then contact the invigilator immediately.***

SECTION – I

Each question in this section has **ONLY ONE** correct alternative and carry **3 marks** each.
There is **NEGATIVE** marking and 1 mark will be deducted for each wrong answer.

SECTION – II

Each question in this section has **ONE OR MORE THAN ONE** correct alternative and carry **5 marks** each.
There is **NEGATIVE** marking and **1 mark** will be deducted for each wrong answer. There is no partial marking.

SECTION – III

This section contains **Two Comprehensions** based on each there are three questions which have only one correct alternative and carry **3 marks** each.
There is **NEGATIVE** marking and **1 mark** will be deducted for each wrong answer.

2. Indicate the correct answer(s) for each question by filling appropriate bubble(s) in your OMR sheet.
3. Use only HB pencil or Black/Blue Ball Pen for darkening the bubble(s).
4. Use of calculator, Log Table, Slide Rule & Mobile is not allowed.
5. No extra sheet will be provided for rough work.

+1 Moving +2

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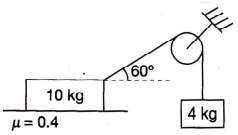
PHYSICS

SINGLE OPTIONS CORRECT ONLY

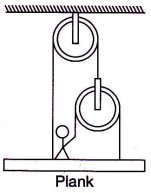
Q1. The value of frictional force and acceleration of block of mass 10 kg, as shown in the figure, are



(a) 10 N, $1\,m/s^2$ (b) 20N, $2\,m/s^2$

(c) 20 N, $0\,m/s^2$ (d) 10N, $0\,m/s^2$

Q2. In the figure, the force with which the man should pull the rope to hold the plank in position is F. If weight of the man is 60 kgf, the plank and pulleys have negligible masses, then $(g = 10\,m/s^2)$

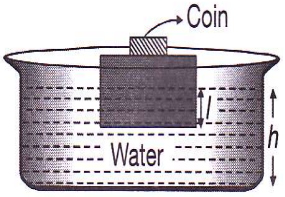


(a) F = 150 N (b) F = 240 N (c) F = 300 N (d) F = 1200 N

Q3. Starting from rest, a particle rotates in a circle of radius $R = \sqrt{2}\,m$ with an angular acceleration $\alpha = (\pi/4)\ rad/s^2$. The magnitude of average velocity of the particle over the time it rotates a quarter circle is

(a) 1.5 m/s (b) 2 m/s (c) 1 m/s (d) 1.25 m/s

Q4. A wooden block with a coin placed on its top, floats in water as shown in the figure. The distance ℓ and h are shown in figure. After some time the coin falls into the water. Then



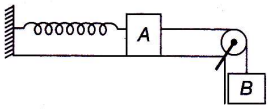
(a) ℓ decreases and h increases

(b) ℓ increases and h decreases

(c) Both ℓ and h increase

(d) Both ℓ and h decrease

Q5. In the figure below, block A is of mass m and block B is of mass 2m. The spring has a force constant k. All the surfaces are smooth and the system is released from rest with spring unstretched, then



(a) The maximum extension of the spring is $\frac{4mg}{k}$.

(b) The speed of block A when extension in spring is $\frac{2mg}{k}$, is $2g\sqrt{\frac{m}{k}}$.

(c) The net acceleration of block B when the extension in the spring is maximum, is $\frac{g}{2}$.

(d) Tension in the thread for extension of $\frac{2mg}{k}$ in spring is mg.

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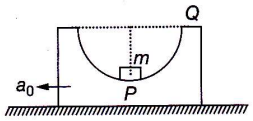
Q6. A small block of mass m lying at rest at point P of a wedge having a smooth semi-circular track of radius R. What should be the minimum value of horizontal acceleration a_0 of wedge so that mass can just reach the point Q?



(a) g/2 (b) $\sqrt{g}$ (c) g (d) Not possible

Q7. A projectile of mass m is thrown with velocity ν making an angle of 30^o with vertical. Neglecting air resistance the magnitude of change in momentum between the starting point and at the maximum height is

(a) $\frac{m\nu}{2}$ (b) $\frac{\sqrt{3}\,m\nu}{2}$ (c) $m\nu$ (d) $\frac{\sqrt{7}\,m\nu}{2}$

Q8. From the top of a tower, a stone is thrown up and it reaches the ground in time t_1. A second stone is thrown down with the same speed and it reaches the ground in time t_2. A third stone is released from rest and it reaches the ground in time t_3.

(a) $t_3 = \frac{1}{2}(t_1 + t_2)$ (b) $t_3 = \sqrt{t_1 t_2}$ (c) $\frac{1}{t_3} = \frac{1}{t_2} - \frac{1}{t_1}$ (d) $t_3^2 = t_1^2 - t_2^2$

Q9. A particle is thrown with a speed u at an angle θ to the horizontal. When the particle makes an angle ϕ with the horizontal, its speed changes to υ, then

(a) $\upsilon = u\cos\theta$ (b) $\upsilon = u\cos\theta\,.\cos\phi$ (c) $\upsilon = u\cos\theta\,.\sec\phi$ (d) $\upsilon = u\sec\theta\,.\cos\phi$

Q10. A ball of mass m is tied up with string and rotated along a horizontal circle of radius r. At an instant, its velocity is ν, and tension in string is T, the force required for circular motion is

(a) $T - \frac{m\nu^2}{r}$ (b) $T + \frac{m\nu^2}{r}$ (c) $\frac{m\nu^2}{r}$ (d) Zero

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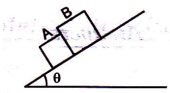
ONE OR MORE OPTIONS ARE CORRECT

Q11. The two blocks A and B of equal mass are initially in contact when released from rest on the inclined plane. The coefficients of friction between the inclined plane and A and B are μ_1 and μ_2 respectively.



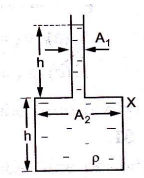
(a) If $\mu_1 > \mu_2$, the blocks will always remain in contact.

(b) If $\mu_1 < \mu_2$, the blocks will slide down with different accelerations.

(c) If $\mu_1 > \mu_2$, the blocks will have a common acceleration $\frac{1}{2}(\mu_1 + \mu_2)g\sin\theta$.

(d) If $\mu_1 < \mu_2$, the blocks will have a common acceleration $\frac{\mu_1\mu_2 g}{\mu_1 + \mu_2}\sin\theta$.

Q12. The vessel shown in the figure has two sections of areas of cross-section A_1 and A_2. A liquid of density ρ fills both the sections, up to a height h in each. Neglect atmospheric pressure.



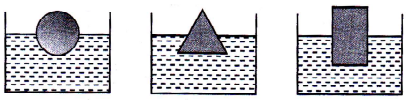
(a) The pressure at the base of the vessel is $2h\rho g$.

(b) The force exerted by the liquid on the base of the vessel is $2h\rho gA_2$.

(c) The weight of the liquid is $< 2h\rho gA_2$.

(d) The walls of the vessel at the level X exert a downward force $h\rho g\,(A_2 - A_1)$ on the liquid.

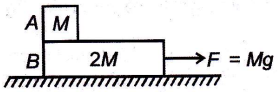
Q13. A solid sphere, a cone and a cylinder are floating in water. All have same mass, density and radius. Let f_1, f_2 and f_3 are fraction of their volumes inside the water respectively, and h_1, h_2 and h_3 are their depths inside water, respectively. Then



(a) $f_1 = f_2 = f_3$ (b) $f_3 > f_2 > f_1$

(c) $h_3 < h_1$ (d) $h_3 < h_2$

Q14. In the figure shown, there is no friction between B and ground and $\mu = \frac{2}{3}$ between A and B.



(a) The net work done on block A with respect to B is zero

(b) The net work done on block A with respect to ground for a displacement 'S' is $\frac{MgS}{3}$

(c) The net work done on block B with respect to ground for a displacement 'S' is $\frac{2MgS}{3}$

(d) The work done by friction with respect to ground on A and B is equal and opposite in sign.

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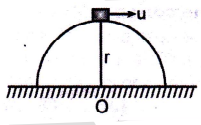
PASSAGE TYPE QUESTIONS

Passage - 1 (Q. 15-17)

A small block of mass m is projected horizontally from the top of the smooth and fixed hemisphere of radius r with speed u as shown. For values of $u \geq u_0, (u_0 = \sqrt{gr})$ It does not slide on the hemisphere. [i.e. leave the surface at the top itself]



Q15. For $u = 2u_0$, it lands at point P on ground. Find OP.

(a) $\sqrt{2}$ r (b) 2 r (c) 4 r (d) $2\sqrt{2}$ r

Q16. For $u = u_0/3$, find the height from the ground at which at leaves the hemisphere.

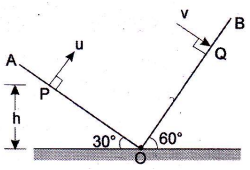
(a) $\frac{19r}{9}$ (b) $\frac{19r}{27}$ (c) $\frac{10r}{9}$ (d) $\frac{10r}{27}$

Q17. Find its net acceleration at the instant it leaves the hemisphere.

(a) g/4 (b) g/2 (c) g (d) g/3

Passage - 2 (Q.18-20)

Two inclined planes OA and OB having inclinations 30^o and 60^o with the horizontal respectively intersect each other at O, as shown in figure. A particle is projected from point P with velocity $u = 10\sqrt{3}\frac{m}{s}$ along a direction perpendicular to plane OA. If the particle strikes plane OB perpendicular at Q (Take $g = 10\,m/s^2$). Then



Q18. The time of flight from P to Q is

(a) 5 Sec. (b) 2 Sec. (c) 1 Sec. (d) None of these

Q19. The speed with which the particle strikes the plane OB is

(a) 10 m/s (b) 20 m/s (c) 30 m/s (d) 40 m/s

Q20. The height h of point P from the ground is

(a) $10\sqrt{3}$ m (b) 10 m (c) 5 m (d) 20 m

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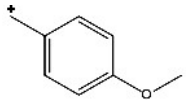
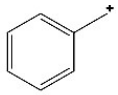
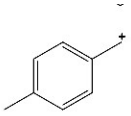
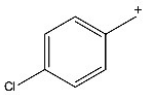
SINGLE OPTIONS CORRECT ONLY

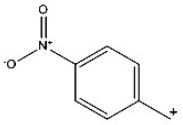
Q21. Which of the following are not named correctly according to IUPAC convention?
(a) 3-iodo-4-isobutylheptane (b) 2-chlorobut-3-ene
(c) 2,3-dimethylbut-2-ene (d) 2,2-dimethylpropanenitrile

Q22. What is the pH of 10^{-7}M HCl?
(a) 6.00 (b) 6.70 (c) 6.89 (d) 6.99

Q23. Consider the following equilibrium $PCl_5(g)$ $PCl_{3(g)} + Cl_2(g)$ at 300K, Starting with initial pressure of 1 atm ,the temperature is now raised to 600K and the equilibrium pressure is now 2.4 atm. What is the degree of dissociation of PCl_5?
(a) 10% (b) 25% (c) 20% (d) 16%

Q24. The order of stability of the following carbocations is

(I)  (II)  (III)  (IV) 

(V) 

(a) I > II > III > IV > V (b) I > III > II > IV > V (c) II > V > I > IV > I (d) III > I > II > V > IV

Q25. A certain alkene undergoes reductive ozonolysis to give butanone and propanal, the alkene is
(a) 2-ethylpent-2-ene (b) 3-ethylpent-2-ene
(c) 3-methylhex-3-ene (d) 4-methylhex-3-ene

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Q26. A certain solution of concentration 0.2M having a density of 1.2g/cc. If the molality of the solution is 0.25m, the Relative Molecular Mass of the solute is
(a) 2000 (b) 2500 (c) 4000 (d) 1500

Q27. 22 g of propane is completely burned in air and the final products are cooled to room temperature, the amount of water collected is
(a) 18ml (b) 36ml (c) 54ml (d) 9ml

Q28. Propanoic acid is first treated with soda lime and then heated with oxygen over Cu catalyst at 300^{o}C, the product is then collected and further treated with concentrated strong acid at 443K to give a gas. The gas is
(a) Ethane (b) Ethene (c) Ethyne (d) Benzene

Q29. Which of the following is not a linear molecule
(a) HCN (b) NO_2 (c) CS_2 (d) C_2H_2

Q30. Ice and water are in equilibrium at 0^{o}C and 1 atm pressure, Suddenly the pressure is increased, one observes that
(a) No change (b) More ice will form
(c) More ice will melt (d) The equilibrium constant will change

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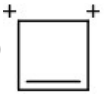
ONE OR MORE OPTIONS ARE CORRECT

Q31. The compounds among the following that cannot exist at room temperature are

(a)  (b)  (c)  (d) 

Q32. The products obtained when tertbutyl chloride undergoes Wurtz reaction
(a) Isobutene (b) Isobutane
(c) 2,2,3,3-tetramethylbutane (d) 2,4-dimethyl hexane

Q33. An aqueous solution of NaOH is marked 10%w/w having a density of 1.25g/ml means
(a) 0.3125M (b) 0.3125m
(c) Mole fraction of solvent 20/21 (d) 0.3125N

Q34. Addition of inert gas at constant volume does not alter which of the following equilibriums
(a) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ (b) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(c) $C(s) + O_2(g) \rightleftharpoons CO_2(g)$ (d) $H_2S(g) \rightleftharpoons H_2(g) + S(s)$

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PASSAGE TYPE QUESTIONS

Passage-1(Q. 35-37)

At 298K the ionic product of water or any aqueous solution is 10^{-14} , it may change depending on temperature and So will the pH scale and its neutral point. The definition of pH is potentio de Hydrogen ion meaning the negative logarithm of the hydrogen ion concentration in the aqueous solution. pH is the measure of acidic or alkaline nature of the solution.

Q35. At 320K the pH of pure water is 6.5, the ionic product of water is
(a) 10^{-14} (b)10^{-13} (c) 3.17×10^{-14} (d) 10^{-15}

Q36. When rain is accompanied by thunderstorm the acidic nature of rainwater will
(a) Remain same (b) Increase (c) Decrease (d) will become neutral

Q37. At 298K, 50ml of 0.1M NaOH ,50ml of 0.1M KOH and 50ml of 0.1M H_2SO_4 , the resulting pH will be
(a) 12.3 (b) 7 (c) 11 (d) 1.7

Passage-2 (Q. 38-40)
Markonikov once said
During hydrohalogenation of alkenes the negative part of the addendum goes to that carbon atom of the double bond which forms a Stable carbocation after protonation of the double bond. However there are instances when peroxide had inhibited the reactions and caused contradicting results

Q38. Consider the reaction $CH_3\text{-}CH{=}CH_2 + HBr \rightarrow$, the hybridization state of the intermediate formed is
(a) sp^2 (b) sp^3 (c) Between sp^2 and sp^3 (d) Unhybridised

Q39. Consider all major and minor products total number of possible products when but-1-ene reacts with HBr are
(a) 2 (b) 3 (c) 1 (d) 4

Q40. The major product when propene reacts with HCl in peroxide is
(a) 1-chloropropane (b) 2-chloropropane (c) propane (d) no reaction

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SINGLE OPTIONS CORRECT ONLY

Q41. If the straight lines $ax+by+p=0$ and $x\cos\alpha+y\sin\alpha=p$ enclose an angle of $\frac{\pi}{4}$ and the line $x\sin\alpha-y\cos\alpha=0$ meets them at the same point, then a^2+b^2 is

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

Q42. If $P\left(1+\frac{t}{\sqrt{2}}, 2+\frac{t}{\sqrt{2}}\right)$ be any point on a line, then the range of values of t for which the point P lies between the parallel lines $x+2y=1$ and $2x+4y=15$ is

(a) $-\frac{4\sqrt{2}}{3}<t<\frac{5\sqrt{2}}{6}$ (b) $0<t<\frac{5\sqrt{2}}{6}$ (c) $-\frac{4\sqrt{2}}{5}<t<0$ (d) $-\frac{4\sqrt{2}}{3}<t<\frac{\sqrt{2}}{6}$

Q43. The vertices of a variable triangle are (3, 4), $(5\cos\theta, 5\sin\theta)$, and $(5\sin\theta, -5\cos\theta)$, where $\theta\in R$. The locus of its orthocenter is

(a) $(x+y-1)^2+(x-y-7)^2=100$ (b) $(x+y-7)^2+(x-y-1)^2=100$

(c) $(x+y-7)^2+(x+y-1)^2=100$ (d) $(x+y-7)^2+(x-y+1)^2=100$

Q44. Sum to n terms of the series $1^3+3.2^3+3^3+3.4^3+5^3+.....$is (n is even)

(a) $\frac{n(n^2+1)(2n+1)}{3}$ (b) $\frac{n(n^3+4n^2+10n+8)}{8}$ (c) $\frac{n(n^3+1)}{8}$ (d) $\frac{n^2(2n^2+6n+5)}{4}$

Q45. The sum of all integers from 1 to 100 which are divisible by 2 or 5, is

(a) 3050 (b) 3000 (c) 2550 (d) 1050

Q46. The solution set of the inequation $\left|x+\frac{1}{x}\right|<4$, is

(a) $(2-\sqrt{3}, 2+\sqrt{3})\cup(-2-\sqrt{3}, -2+\sqrt{3})$ (b) $R-(2-\sqrt{3}, 2+\sqrt{3})$

(c) $R-(-2-\sqrt{3}, -2+\sqrt{3})$ (d) None of these

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Q47. If $m=\sum_{r=0}^{\infty} a^r$, $n=\sum_{r=0}^{\infty} b^r$, where $0<a, b<1$, then the quadratic equation whose roots are a and b is

(a) $mnx^2+(m+n+2mn)x+mn-m-n+1=0$ (b) $mnx^2-(2mn-m-n)x+mn-m-n+1=0$

(c) $mnx^2+(2mn+m+n)x+mn+m+n+1=0$ (d) $mnx^2-(2mn+m+n)x+mn+m+n+1=0$

Q48. If $\frac{1}{1.2.3.4}+\frac{1}{2.3.4.5}+\frac{1}{3.4.5.6}+....\text{to n terms}=\frac{1}{18}-f(n)$. Then f(n) is equal to

(a) $\frac{n}{(n+1)(n+2)(n+3)}$ (b) $\frac{1}{3(n+1)(n+2)(n+3)}$

(c) $\frac{1}{n(n+1)(n+2)(n+3)}$ (d) $\frac{n}{3(n+1)(n+2)(n+3)}$

Q49. The solution set of $\left|\frac{x+1}{x}\right|+|x+1|=\frac{(x+1)^2}{|x|}$ is

(a) $\{x\,|\,x\geq 0\}$ (b) $\{x\,|\,x>0\}\cup\{-1\}$ (c) $\{-1, 1\}$ (d) $\{x\,|\,x\geq 1 \text{ or } x\leq -1\}$

Q50. Let A, B and C be finite sets such that $A\cap B\cap C=\phi$ and each one of the sets $A\,\Delta\,B$, $B\Delta C$ and $C\Delta A$ has 100 elements. The number of elements in $A\cup B\cup C$ is

(a) 250 (b) 200 (c)150 (d) 300

SPACE FOR ROUGH WORK

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ONE OR MORE OPTIONS ARE CORRECT

Q51. Find the equation of the line passing through the point (2, 3) & making intercept of length 2 units between the lines $y + 2x = 3$ & $y + 2x = 5$.

(a) $3x - 4y = 18$ (b) $x = 2$ (c) $3x + 4y = 18$ (d) $x + 2 = 0$

Q52. If $(m+1)$th, $(n+1)$th and $(r+1)$th terms of an A.P. are in G.P. and m, n, r are in H.P. where $m \neq n \neq r$, then the ratio of the first term of the A.P. to its common difference is

(a) $-\frac{n}{2}$ (b) $-\frac{m}{2}$ (c) r (d) $-\frac{mr}{m+r}$

Q53. If α, β $(\alpha \neq \beta)$ are the roots of $x^2 - p(x+1) - q = 0$, then

(a) $(\alpha+1)(\beta+1) = 1-q$ (b) $(\alpha+1)(\beta+1) = 1+q$

(c) $\frac{(\alpha+1)^2}{(\alpha+1)^2+q-1} + \frac{(\beta+1)^2}{(\beta+1)^2+q-1} = q$ (d) $\frac{\alpha^2+2\alpha+1}{\alpha^2+2\alpha+q} + \frac{\beta^2+2\beta+1}{\beta^2+2\beta+q} = 1$

Q54. If $||x^2 - 5x + 4| - |2x - 3|| = |x^2 - 3x + 1|$, then x belongs to the interval

(a) $(-\infty, 1]$ (b) $\left(1, \frac{3}{2}\right)$ (c) $\left[\frac{3}{2}, 4\right]$ (d) $(4, +\infty)$

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PASSAGE TYPE QUESTIONS

Passage - 1 (Q. 55-57)

Let L be the line belonging to the family of straight lines $(a+2b)\,x+(a-3b)\,y+a-8b=0$, $a, b \in R$, which is the farthest from the point (2, 2).

Q55. The equation of line L is
(a) $x+4y+7=0$ (b) $2x+3y+4=0$ (c) $4x-y-6=0$ (d) None of these

Q56. Area enclosed by the line L and the coordinate axes is
(a) 4/3 sq. units (b) 9/2 sq. units (c) 49/8 sq. units (d) None of these

Q57. If L is concurrent with the line $x-2y+1=0$ and $3x-4y+\lambda=0$, then the value of λ is
(a) 2 (b) 1 (c) -4 (d) 5

Passage - 2 (Q. 58-60)

Let V_r denote the sum of first r terms of an arithmetic progression (A.P.) whose first term is r and the common difference is $(2r-1)$. Let $T_r = V_{r+1} - V_r - 2$; $Q_r = T_{r+1} - T_r$, $W_r = \frac{1}{T_r} + \frac{1}{4(r+1)}$ and $X_r = 3^{Qr}$ for r = 1, 2, ...

Q58. The sum $V_1 + V_2 + ... + V_n$ is
(a) $\frac{1}{12}n(n+1)(3n^2-n+1)$ (b) $\frac{1}{12}n(n+1)(3n^2+n+2)$ (c) $\frac{1}{2}n(2n^2-n+1)$ (d) $\frac{1}{3}(2n^3-2n+3)$

Q59. T_r is always
(a) An odd number (b) An even number (c) A prime number (d) A composite number

Q60. $W_1, W_2, W_3, ...$ are in
(a) A.P. (b) G.P. (c) H.P. (d) A.G.P.

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ANSWERS KEY

Class: 11th Moving 12th (Non-Medical)

1 C	2 A	3 C	4 D	5 A	6 C	7 B	8 B	9 C	10 C
11 AB	12 ABCD	13 ACD	14 ABCD	15 D	16 B	17 C	18 B	19 A	20 C
21 B	22 B	23 C	24 B	25 C	26 A	27 B	28 B	29 B	30 C
31 AC	32 ABC	33 ACD	34 ABCD	35 B	36 A	37 B	38 A	39 B	40 B
41 C	42 A	43 D	44 D	45 A	46 A	47 B	48 B	49 B	50 C
51 BC	52 AD	53 AD	54 AC	55 A	56 C	57 D	58 B	59 D	60 C

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