CENTRE FOR SOCIAL RESPONSIBILITY AND LEADERSHIP

SAMPLE SELECTION TEST PAPER

INSTRUCTION FOR STUDENTS

A. GENERAL INSTRUCTIONS

1. There are total 60 questions and four sections - **Section I (Aptitude), Section II (Physics), Section III (Mathematics) & Section IV (Chemistry).**
2. Each section contains 15 Questions.
3. +4 marks will be given for each correct answer and –1 mark for each wrong answer. In all other cases, no marks will be given.
4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 3 above.
5. **Duration of test will be 2 hours.**
6. **Maximum marks is 240.**

APTITUDE (SECTION - I)

1. Pointing to Manju, Raju said, "The son of her only brother is the brother of my wife". How is Manju related to Raju?

   (A) Mother's sister
   (B) Grandmother
   (C) Mother-in-law
   (D) Sister of father-in-law

2. When 75% of a number is added to 75, the result is the number again. Find the number.

   (A) 350
   (B) 300
   (C) 250
   (D) 200

3. 20 men can dig 40 holes in 60 days. So, 10 men can dig 20 holes in how many days?

   (A) 30 days
   (B) 60 days
   (C) 75 days
   (D) 90 days

4. A father said to his son, "I was as old as you are at the present at the time of your birth". If the father's age is 38 years now, the son's age five years back was:

   (A) 14 years
   (B) 19 years
   (C) 33 years
   (D) 38 years

5. Arun and Amit started walking from two different points 'A' and 'B' respectively. Arun walks 2 kms North and turns to the East and walks 3 kms and again turns to North walks 4 kms and finally turns to East and Walks 5kms to reach point 'C'. Similarly, Amit walks 2 kms North and turns to west and walks 3 kms and finally turns to North, walks 4 kms and meets Arun at point 'C'.

   What is the distance between Arun and Amit's starting points?

   (A) 5 km
   (B) 8 km
   (C) 11 km
   (D) 13 km

6. If '–' stands for '×', '×' stands for '+', '+'stands for '÷' and '÷' stands for '–', then what is the value of $9 \div 18 \times 15 + 3 - 6 \times 12$?

   (A) 24
   (B) 30
   (C) 33
   (D) 42

Space for rough work

7. In a certain code language if the word 'MUSEUM' is coded as 'LSPAPG', then how will the word 'PALACE' be coded in that language?

(A) OYIWXY (B) OYIXYW
(C) IYXYWO (D) YXWYOI

8. Find the missing term : 157.5, 45, 15, _, 3, 2, 2

(A) 4 (B) 5
(C) 6 (D) 7

9. At what time between 3 PM and 4 PM would the two hands of the clock be together ?

(A) 3:15:12 PM (B) 3:15:44 PM
(C) 3:16:22 PM (D) 3:17:26 PM

10. **Study the following information to answer the given questions:**
P $ Q means P is not smaller than Q
P @ Q means P is neither smaller than nor equal to Q
P # Q means P is neither greater than nor equal to Q
P & Q means P is neither greater than nor smaller than Q
P * Q means P is not greater than Q

Statements: S @ L, L # M, M & B, B * Q
Conclusions: I. Q $ M
II. B @ L
III. S @ Q
IV. L @ Q

(A) I, II and III are true (B) I, II are true
(C) I, III are true (D) I, III and IV are true

11. In a certain code language, if the value of 28 + 14 = 50 and 36 + 43 = 63, then what is the value of 44 + 52 = ?

(A) 54 (B) 56
(C) 58 (D) 62

Space for rough work

12. There are 25 horses among which you need to find out the fastest 3 horses. You can conduct race among at most 5 to find out their relative speed. At no point you can find out the actual speed of the horse in a race. Find out how many races are required to get the top 3 horses.

(A) 5 (B) 6

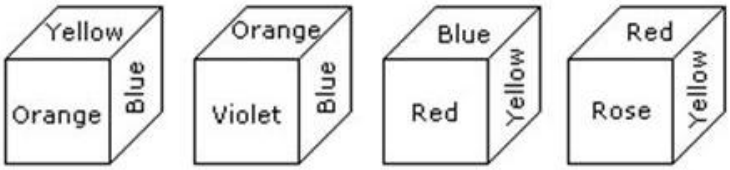
(C) 7 (D) 8

13. A software engineer has the capability of thinking 100 lines of code in five minutes and can type 100 lines of code in 10 minutes. He cannot type and think simultaneously. He takes a break for five minutes after every ten minutes. How many lines of codes will he complete typing after an hour?

(A) 250 lines (B) 300 lines

(C) 350 lines (D) None of these

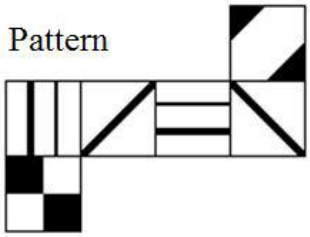
14. From the four positions of a dice given below, find the color which is opposite to orange?



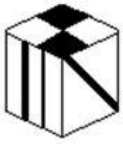
(A) Violet (B) Red

(C) Rose (D) Blue

15. Which of the cubes shown could be made from the pattern?



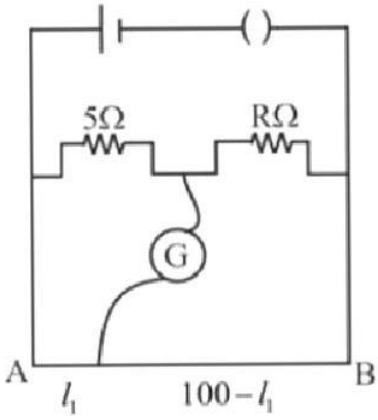
(A)  (B) 

(C)  (D) 

Space for rough work

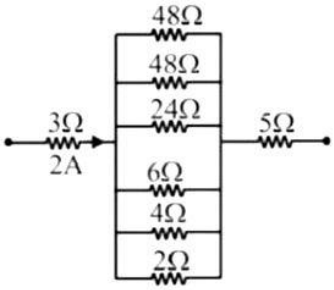
PHYSICS (SECTION - II)

16. The resistance in the two arms of the meter bridge are 5Ω and RΩ, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6\,l_1$. The resistance 'R' is :-



(A) 15Ω
(B) 10Ω
(C) 25Ω
(D) 20Ω

17. Find potential difference across 24Ω :-

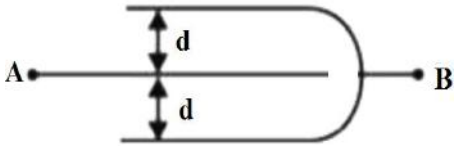


(A) 2 volt
(B) 48 volt
(C) 1 volt
(D) 4 volt

18. When a spring is stretched by 10 cm, the potential energy stored is *E*. When the spring is stretched by 10 cm more, the potential energy stored in the spring becomes

(A) 2 E
(B) 4 E
(C) 6 E
(D) 10 E

19. Three plates of common surface area A are connected as shown in figure. The effective capacitance will be



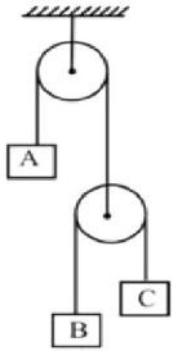
(A) $\varepsilon_0 A/d$
(B) $3\varepsilon_0 A/d$
(C) $\frac{3}{2}\varepsilon_0 A/d$
(D) $2\varepsilon_0 A/d$

20. A carnot engine having an efficiency of $\frac{1}{10}$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

(A) 90 J
(B) 99 J
(C) 100 J
(D) 1 J

Space for rough work

21. Three blocks A, B and C having masses m kg, 2 kg and 3 kg respectively are attached by massless strings and ideal pulleys as shown in the figure. When the system is released from rest, if the block 'A' remains stationary, the mass of block 'A' is



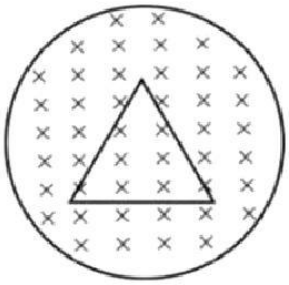
(A) 2.2 kg

(B) 2.6 kg

(C) 2.4 kg

(D) 4.8 kg

22. An equilateral triangular loop having a resistance R and length of each side 'ℓ' is placed in a magnetic field which is varying at $\frac{dB}{dt} = 1T/s.$ The induced current in the loop will be



(A) $\frac{\sqrt{3}}{4}\frac{\ell^2}{R}$

(B) $\frac{4}{\sqrt{3}}\frac{\ell^2}{R}$

(C) $\frac{\sqrt{3}}{4}\frac{R}{\ell^2}$

(D) $\frac{4}{\sqrt{3}}\frac{R}{\ell^2}$

23. The equivalent impedance of a circuit with $R = 4\Omega$, $L = \frac{40}{\pi}mH$ and $C = \frac{10}{\pi}mF$ connected in series to a source of 220 V, 50 Hz is

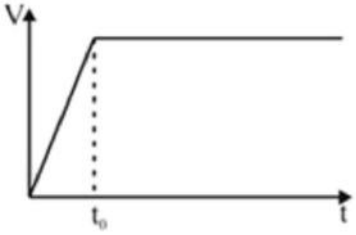
(A) 4Ω

(B) 5Ω

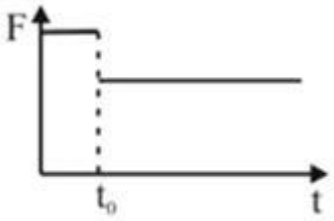
(C) $\sqrt{41}\Omega$

(D) 8Ω

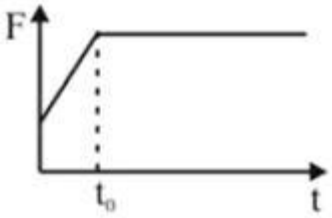
24. The following graph represents speed of a car as a function of time. We know that as the car speed up there is a friction force with air that can be approximately considered to be proportional to the speed of the car. Which of the following graphs can be the force of the engine as a function of time?



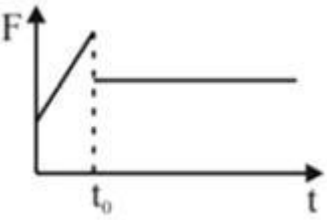
(A)



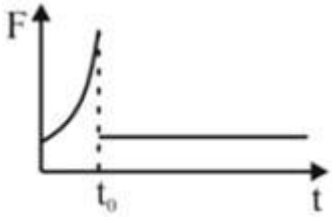
(B)



(C)

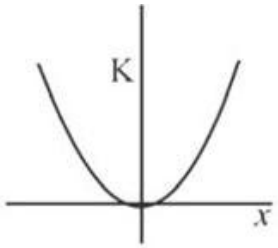


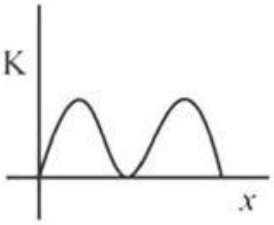
(D)

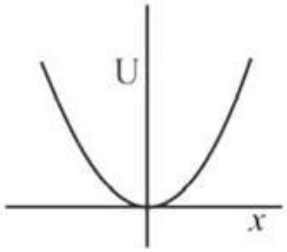


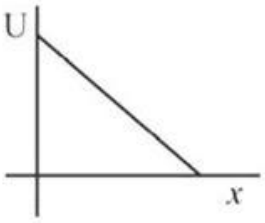
Space for rough work

25. During Simple Harmonic Motion (SHM) a particle has displacement x from mean position. If kinetic energy and potential energy are represented by K and U respectively, then choose the appropriate graph

(A) 

(B) 

(C) 

(D) 

26. Magnetic field exist in the space and given as $\vec{B} = -\frac{B_0}{l^2} x^2 \hat{k}$, where B_0 and l are positive constants. A particle having positive charge 'q' and mass 'm' is project with speed 'v_0' along positive x-axis from the origin. What is the maximum distance of the charged particle from the y-axis before it turns back due to the magnetic field. (Ignore any interaction other than magnetic field)

(A) $\left(\frac{ml^2 v_0}{3qB_0}\right)^{1/3}$

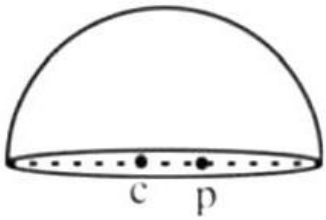
(B) $\left(\frac{3ml^2 v_0}{2qB_0}\right)^{1/3}$

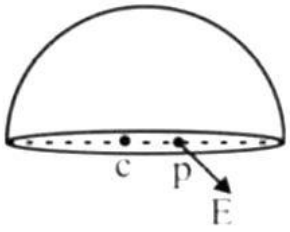
(C) $\left(\frac{3ml^2 v_0}{qB_0}\right)^{1/3}$

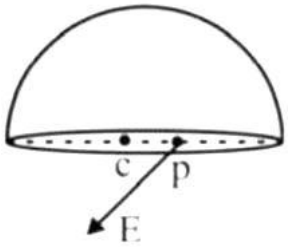
(D) $\left(\frac{ml^2 v_0}{qB_0}\right)^{1/3}$

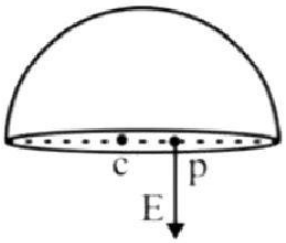
Space for rough work

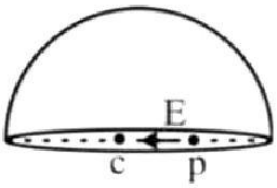
27. A thin non-conducting hemispherical shell contains a positive charge q on it, which is uniformly distributed on the shell. A point p lies on the diameter of shell as shown in figure. Then the direction of electric field at the point 'p' is



(A) 

(B) 

(C) 

(D) 

28. A coil of inductance L = 5H and resistance R = 55Ω is connected in series to the mains alternating voltage of frequency = 50 Hz in series. What can be the non-zero capacitance of the capacitor (in μF) connected in series with the coil if the power dissipated has to remain unchanged. (take $\pi^2 = 10$)

(A) 2 (B) 1

(C) 4 (D) 3

29. A swimmer jumps from a bridge over a canal and swims 1 km up stream. After that first km, he passes a floating cork. He continues swimming for half an hour and then turns around and swims back to the bridge. The swimmer and the cork reach the bridge at the same time. The swimmer has been swimming at a constant speed. The water in the canal flow at a speed of

(A) 1/2 km/hr (B) 1/3 km/hr

(C) 2 km/hr (D) 1 km/hr

30. The dimensional formula for a physical quantity ϕ is expressed as $[\phi] = [M^{-\alpha}L^{\beta}T^{2\gamma}]$. The errors measured in the quantities M, L and T are respectively, 3%, 4% and 6%. The maximum percentage of error that occurs in measuring the quantity is

(A) $-3\alpha + 4\beta + 12\gamma$ (B) $3\alpha + 4\beta + 12\gamma$

(C) $3\alpha - 4\beta - 12\gamma$ (D) $\alpha + \beta + 2\gamma$

Space for rough work

MATHEMATICS (SECTION-III)

31. The limit $\lim_{x \to a} \left(2 - \frac{a}{x}\right)^{\tan\left(\frac{\pi x}{2a}\right)}$ is equal to

(A) $e^{-a/\pi}$ (B) $e^{-2a/\pi}$

(C) $e^{-2/\pi}$ (D) 1

32. The determinant D = $\begin{vmatrix} b & c & ba+c \\ c & d & ca+d \\ ba+c & ca+d & aa^3-ca \end{vmatrix}$ is equal to zero if

(A) b, c, d are in A.P. (B) c, b, d are in G.P.

(C) b, c, d are in H.P. (D) α is a root of $ax^3 - bx^2 - 3cx - d = 0$

33. Value of $\int \sin^5 x \cos^4 x \, dx$

(a) $-\frac{\cos^9 x}{9} + 2\frac{\cos^7 x}{7} - \frac{\cos^5 x}{5} + C$ (b) $\frac{\cos^9 x}{9} + 2\frac{\cos^7 x}{7} - \frac{\cos^5 x}{5} + C$

(c) $\frac{\cos^9 x}{9} + 2\frac{\cos^7 x}{7} + \frac{\cos^5 x}{5} + C$ (d) $-\frac{\cos^9 x}{9} + 2\frac{\cos^7 x}{7} + \frac{\cos^5 x}{5} + C$

34. For what values of a does the curve $f(x) = x(a^2 - 2a - 2) + \cos x$ is always strictly monotonic $\forall\, x \in R$

(A) $a \in R$ (B) $|a| < \sqrt{2}$

(C) $1 - \sqrt{2} < a < 1 + \sqrt{2}$ (D) $|a| < \sqrt{2} - 1$

35. The mean and S.D. of the marks of 200 candidates were found to be 40 and 15 respectively. Later, it was discovered that a score of 40 was wrongly read as 50. The correct mean and S.D. respectively are

(A) 14.98, 39.95 (B) 39.95, 14.98

(C) 39.95, 224.5 (D) None of these

Space for rough work

36. $f(x) = \begin{cases} |1-4x^2| & 0 \le x < 1 \\ [x^2 - 2x] & 1 \le x \le 2 \end{cases}$ then number of points where $f(x)$ is discontinuous and not differential respectively.

(A) 2, 4 (B) 4, 2

(C) 2, 3 (D) 3, 2

37. In a geometric progression consisting of positive terms, each term equals the sum of the next two terms. Then the common ratio of this progression equals

(A) $\frac{1}{2}(1-\sqrt{5})$ (B) $\frac{1}{2}\sqrt{5}$

(C) $\sqrt{5}$ (D) $\frac{1}{2}(\sqrt{5}-1)$

38. If $|z-2+i| = 2$, then Sum of the greatest and least value of $|z|$ is

(A) 4 (B) $2\sqrt{5}$

(C) $\sqrt{5}+2$ (D) $\sqrt{5}-2$

39. The area bounded by the curves $y = |x| - 1$ and $y = -|x| + 1$ is

(A) 1 (B) 2

(C) $2\sqrt{2}$ (D) 4

40. If the quadratic equations $ax^2 + bx + c = 0$ & $2x^2 + 3x + 2 = 0$ have one common root, and $a + b + c = 14$ then the value of the $a - c + b$

(A) 4 (B) 10

(C) 6 (D) 8

41. In a purse there are 10 coins, all 5 paise except one which is a rupee. In another purse there are 10 coins all 5 paise. 9 coins are taken out from the former purse & put into the latter & then 9 coins are taken out from the latter & put into the former. Then the chance that the rupee is still in the first purse is:

(A) 9/19 (B) 10/19

(C) 4/9 (D) None of these

Space for rough work

42. If $f(x) = \cos\left[\frac{\pi^2}{2}\right]x + \sin\left[-\frac{\pi^2}{2}\right]x$, where $[x]$ denotes the greatest integer function, then which of the following is not correct –

(A) $f(0) = 1$

(B) $f\left(\frac{\pi}{3}\right) = \frac{1}{\sqrt{3}+1}$

(C) $f\left(\frac{\pi}{2}\right) = 0$

(D) $f(\pi) = 0$

43. Sum of the integral values of $\boldsymbol{a}$, for which the function $f(x) = \left|x^2 - 4|x| + 3\right|$ when equated as $f(x) = \boldsymbol{a}$ has exactly four distinct real roots.

(A) 2

(B) 3

(C) 4

(D) 5

44. For a ΔABC in which $a = \sqrt{3} + 1$, $b = \sqrt{3} - 1$, $C = 60°$. Then value of side c and angle A respectively

(A) $\sqrt{6}, 105^0$

(B) $\sqrt{6}, 15^0$

(C) $\sqrt{3}, 15^0$

(D) $\sqrt{3}, 105^0$

45. The true set of real values of x for which the function, $f(x) = x\ell nx - x + 1$ is positive is

(A) $(1, \infty)$

(B) $(1/e, \infty)$

(C) $[e, \infty)$

(D) $(0, 1)$ and $(1, \infty)$

Space for rough work

CHEMISTRY (SECTION - IV)

46. In P_4O_{10} number of oxygen atoms attached to each phosphorus are

(A) 2 (B) 3

(C) 5 (D) 4

47. The atomic mass of Cu is 63.546. There are only two naturally occurring isotopes of copper Cu^{63} and Cu^{65}. The percentage of natural abundance of Cu^{63} is nearly

(A) 30 (B) 10

(C) 50 (D) 73

48. A sample of copper sulphate pentahydrate contains 3.782 g of Cu. How many grams of oxygen are in the sample?

(A) 0.952 g (B) 3.809 g

(C) 4.761 g (D) 8.576 g

49. Which one among the following compounds will produce a secondary alcohol on reaction with Grignard reagent?

(A) CH_3COCH_3 (B) $CH_3 - COOCH_3$

(C) $HCOOCH_3$ (D) All of these

50. In which of the following species the bonds are non-directional?

(A) $NC1_3$ (B) RbCl

(C) $BeC1_2$ (D) BCl_3

51. If the atomic number of an element is 33, it will be placed in the periodic table in the

(A) 1st group (B) 3rd group

(C) 15th group (D) 17th group

52. Two vessels, A and B, contain the same gas. If the pressure, volume and absolute temperature of the gas in A are two times as compared with those of gas in B, and if mass of the gas in B is x g, the mass of the gas in A will be :

(A) 4x g (B) x/2 g

(C) 2x g (D) x g

53. S–S bond is present in

(A) $H_2S_2O_7$ (B) $H_2S_2O_8$

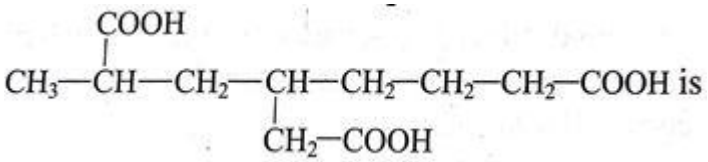
(C) $H_2S_2O_6$ (D) $H_2S_2O_5$

Space for rough work

54. Which is incorrectly given according to order indicated?

(A) $F_2 > Cl_2 > Br_2 > I_2$; Oxidising power
(B) HI > HBr > HCl > HF ; Acidic strength
(C) $F_2 > Cl_2 > Br_2 > I_2$; Bond dissociation enthalpy
(D) HF > HI > HBr > HCl ; Boiling point

55. IUPAC name of the compound



(A) 2-methyl-4-ethanoic octane-1, 8-octanedioic acid
(B) 2-methyl-4-(carboxy methyl) octane-1, 8-dioic acid
(C) 2-methyl-1, 6-heptane tricarboxylic acid
(D) None of these

56. How many unit cells are present in a cube shaped ideal crystal of NaCl of mass 1.00 g?

(A) 2.57×10^{21} unit cells
(B) 5.14×10^{21} unit cells
(C) 1.28×10^{21} unit cells
(D) 1.71×10^{21} unit cells

57. The work function of metal is 6 eV. If light of frequency 1×10^{15} Hz is incident on the metal, intensity of light is increased 4 times, then

(A) No photoelectron will be ejected
(B) 8 photoelectrons of zero kinetic energy shall be ejected
(C) 2 photoelectrons of 2 eV kinetic energy are ejected
(D) Only one photoelectron is ejected

58. $Zn(S) + Cl_2$ (1 atm) $\rightarrow Zn^{2+} 2Cl^-$. The E° of the cell is 2.12 V. To increase E.

(A) Zn^{2+} concentration should be increased
(B) Zn^{2+} concentration should be decreased
(C) Cl^- concentration should be increased
(D) Partial pressure Cl_2 should be decreased

59. A 50 ml of a 20% (w/w) solution of density 1.2 g/ml is diluted until its strength becomes 6% (w/w). Determine the mass of water added

(A) 88 g
(B) 120 g
(C) 140 g
(D) 180 g

60. Reaction A → B follows second order kinetics. Doubling the concentration of A will increase the rate of formation of B by a factor of :

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

Space for rough work

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Sample Paper Answer Key (CODE -1S)

S.No	APTITUDE	S.No	PHYSICS	S.No	MATHS	S.NO	CHEMISTRY
1	D	16	A	31	C	46	D
2	B	17	A	32	D	47	D
3	B	18	B	33	A	48	D
4	A	19	D	34	C	49	C
5	C	20	A	35	B	50	B
6	C	21	D	36	C	51	C
7	A	22	A	37	D	52	C
8	C	23	B	38	B	53	C
9	C	24	C	39	B	54	C
10	B	25	C	40	C	55	B
11	B	26	C	41	B	56	A
12	C	27	A	42	D	57	A
13	A	28	B	43	A	58	B
14	B	29	D	44	A	59	C
15	A	30	B	45	D	60	D