

FIITJEE RET – 4

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P2)_SET-A

DATE: 02.07.2018

Time: 3 hours

Maximum Marks: 240

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 questions.
2. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. Fill in the boxes provided for Name and Enrolment No.
4. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
5. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format:

7. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
8. **Section I** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).
9. **Section II** contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
10. **Section III** contains **2 paragraphs** type questions. Each paragraph describes an experiment, a situation or a problem. Two multiple choice questions will be asked based on this paragraph. One or more than one option can be correct.

D. Marking Scheme

11. For each question in **Section I**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answers in this section.
12. For each question in **Section II**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **-2 marks** will be awarded for incorrect answers in this section.
13. For each question in **Section III**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **-2 marks** will be awarded for incorrect answers in this section.

Don't write / mark your answers in this question booklet.

If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME:

ENROLLMENT NO.:

PAPER – II
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive
- ◆ For each question, darken the bubble corresponding to the correct integer in the ORS
- ◆ **Marking scheme:**

+4	If the bubble corresponding to the answer is darkened
0	In all other cases

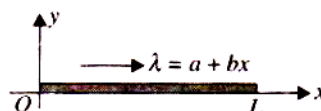
1. Each side of a cube is measured to be 7.2 m. What are the total surface area (in m^2) of the cube to appropriate significant figures is 31 k. Find k?
2. 5.74 g of a substance occupies 1.2 cm^3 . Express its density (in g cm^{-3}) by keeping the significant figures in view is $k(26)$, find the value of k?
3. The mass of a box measured by a grocer's balance is 2.300 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. The difference in the masses (in g) of the pieces to correct significant figures is 0.02k. Find the value of k?
4. The value of $\int_0^{\pi/2} (\sin x + \cos x) dx$ will be.
5. The volume of a cube is increasing at the rate of $1200 \text{ cm}^3/\text{min}$ at the instant its edges are 20 cm long. The rate at which the lengths of the edges are changing at that instant is equal to $k \text{ cm/s}$. Then find 300 k.
6. A sail boat sails 2 km due east, 5 km 37° south of east, and finally an unknown displacement. If the final displacement of the boat from the starting point is 6 km due east, determine the third displacement's magnitude.
7. In an experiment, we measure quantities a, b and c. Then x is calculated from the formula, $x = \frac{ab^2}{c^3}$. The percentage errors in a, b, c are $\pm 1\%$, $\pm 2\%$, and $\pm 1\%$ respectively. The percentage error in x can be
8. Current is defined as rate of flow of charge. If charge flowing through a conductor is given by $q = q_0 \sin \omega t$. Then initial current through conductor is $1/k$ times $q_0 \omega$. The value of 'k' is

Space for rough work

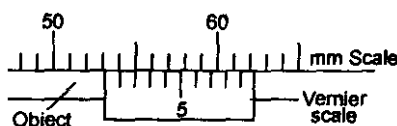
SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ Each question has FOUR options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
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 - 2** In all other cases

9. You are given a rod of length L . The linear mass density is λ such that $\lambda = a + bx$. Here a and b are constants. Find the mass of the rod.



- (A) $aL + \frac{bL^2}{2}$ (B) $aL - \frac{bL^2}{2}$ (C) abL (D) None of these
10. If $u = e^x + e^{-x}$ and $v = e^x - e^{-x}$
- (A) $\frac{du}{dx} = v$ (B) $\frac{dv}{dx} = u$ (C) $u \frac{du}{dx} = v \frac{dv}{dx}$ (D) $\frac{du}{dx} + \frac{dv}{dx} = 2e^{-x}$
11. A bee of mass 0.000087 kg sits on a flower of mass 0.0123 kg. What is the total mass supported by the stem of the flower upto appropriate significant figures ?
- (A) 0.012387 gk (B) 0.01239 kg (C) 0.0124 kg (D) 0.012 kg
12. A man runs 100.5 m in 10.3 s. his average speed upto appropriate significant figure is
- (A) 9.71 ms^{-1} (B) 9.708 ms^{-1} (C) 9.7087 ms^{-1} (D) 9.70874 ms^{-1}
13. What is the reading of vernier scale shown is figure:



- (A) 54.6 mm (B) 53.2 nun (C) 52.7 mm (D) 54.7 mm

Space for rough work

14. The focal length of a mirror is given by $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$; where u and v represent object and image distances respectively. The maximum relative error in f is

(A) $\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v}$

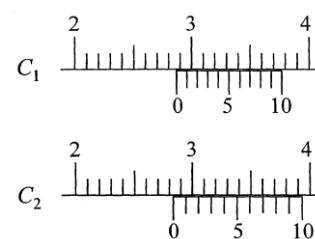
(B) $\frac{\Delta f}{f} = \frac{1}{\Delta u/u} + \frac{1}{\Delta u/v}$

(C) $\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v} - \frac{\Delta(u+v)}{u+v}$

(D) $\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v} + \frac{\Delta u}{u+v} + \frac{\Delta v}{u+v}$

15. The value of measurement of a physical quantity in 5 trials were found to be 1.51, 1.53, 1.53, 1.52, 1.54. Then
- (A) mean absolute error is 0.01
 (B) absolute error in measurement 1.51 is 0.02
 (C) percentage error is 0.1%
 (D) absolute error in the measurement 1.52 is 0.01

16. There are two Vernier callipers both of which have 1cm divided into 10 equal divisions on the main scale. The Vernier scale of one of the callipers (C_1) has 10 equal divisions that correspond to 9 main scale divisions. The vernier scale of the other calliper (C_2) has 10 equal divisions that correspond to 11 main scale divisions. The readings of the two callipers are shown in the figure. The measured values (in cm) by callipers C_1 and C_2 , respectively, are



- (A) 2.87 and 2.86
 (C) 2.87 and 2.83

- (B) 2.87 and 2.87
 (D) 2.85 and 2.82

SECTION 3 (Maximum Marks: 16)

- ◆ This section contains **TWO** paragraphs
- ◆ Based on each paragraph, there will be **TWO** questions
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
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Space for rough work

Paragraph-1

In electromagnetic theory, the electric and magnetic phenomena are related to each other. Therefore, the dimensions of electric and magnetic quantities must also be related to each other. In the questions below $[E]$ and $[B]$ stand for dimensions of electric and magnetic field respectively, while $[\epsilon_0]$ and $[\mu_0]$ stand for dimensions of the permittivity and permeability of free space respectively. $[L]$ and $[T]$ are dimensions of length and time respectively. All the quantities are given in SI units.

(There are two questions based on PARAGRAPH "1", the question below is one of them)

17. The relation between $[E]$ and $[B]$ is
- (A) $[E] = [B][L][T]$ (B) $[E] = [B][L]^{-1}[T]$
 (C) $[E] = [B][L][T]^{-1}$ (D) $[E] = [B][L]^{-1}[T]^{-1}$
18. The relation between $[\epsilon_0]$ and $[\mu_0]$ is
- (A) $[\mu_0] = [\epsilon_0][L]^2[T]^{-2}$ (B) $[\mu_0] = [\epsilon_0][L]^{-2}[T]^2$
 (C) $[\mu_0] = [\epsilon_0]^{-1}[L]^2[T]^{-2}$ (D) $[\mu_0] = [\epsilon_0]^{-1}[L]^{-2}[T]^2$

Paragraph-2

If a , b , c are physical quantities of same dimensions and $a = 10$ units, $b = 20$ units, $c = 30$ units

with percentage error in $a = 1\%$

with percentage error in $b = 2\%$

with percentage error in $c = 3\%$

19. Percentage error in $\frac{a^3\sqrt{b}}{c^2}$ is
- (A) 5% (B) 10% (C) 20% (D) 15%
20. Absolute error in $(a + b)$ is
- (A) 0.4 units (B) 0.2 units (C) 0.3 units (D) 0.5 units

Space for rough work

PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 32)

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0 In all other cases
-

21. The maximum number of electrons can have principal quantum number $n = 3$ and spin quantum number $m_s = -1/2$ is
 22. In an atom, the total number of electrons having quantum numbers $n = 4$, $|m_\ell| = 1$ and $m_s = -1/2$ is :
 23. A certain transition in H spectrum from an excited state to ground state in one or more steps gives rise to total 10 lines. How many of these belong to UV spectrum ?
 24. What is the total number of pairs of electrons at least same quantum numbers for Be ?
 25. The sum of all the quantum numbers of He^+ & Li^{2+} is.
 26. The maximum number of electrons that can be accommodated in an orbital is
 27. The number of nodes in 3p orbital.
 28. The number of species among the following having magnetic moment value of 2.84 BM is ..
 Fe^{2+} , Cr, Cr^{3+} , Ti^{2+} , Mn^{2+} , V^{3+}
-

Space for rough work

SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
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29. Which of the following statements is/are correct ?
 (A) The electronic configuration of Cr is $[\text{Ar}]3d^5 4s^1$ (atomic number of Cr is 24)
 (B) The magnetic quantum number may have a negative value.
 (C) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type (atomic number of Ag is 47)
 (D) Atomic number of Nitrogen is 7
30. The ground state electronic configuration of nitrogen atom can be represented by
 (A)

↑↓	↑↓	↑	↑	↑
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 (B)

↑↓	↑↓	↑	↓	↑
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 (C)

↑↓	↑↓	↑	↓	↓
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 (D)

↑↓	↑↓	↓	↓	↓
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31. Which of the following species has (have) five unpaired electrons ?
 (A) Cs (B) Mn (C) Mn^{2+} (D) Fe^{2+}
32. Which of the following sets of quantum number is/are not permitted ?
 (A) $n = 3, l = 3, m = +1, s = +\frac{1}{2}$ (B) $n = 3, l = 2, m = +2, s = -\frac{1}{2}$
 (C) $n = 3, l = 1, m = +2, s = -\frac{1}{2}$ (D) $n = 3, l = 0, m = 0, s = +\frac{1}{2}$
33. Which of the following is/are possible ?
 (A) 3f (B) 4d (C) 2d (D) 3p
34. An electron has spin quantum number (s) $+1/2$ and magnetic quantum number is -1 . It can be present in
 (A) s orbital (B) d orbital (C) p orbital (D) f orbital
35. The radial part of wave function depends on the quantum numbers
 (A) n (B) l (C) l, m_l (D) n only
36. Magnetic moment of V(Z = 23), Cr(Z = 24), and Mn (Z = 25) are x, y, z, respectively, hence
 (A) $x = y = z$ (B) $x < y < z$ (C) $x < z < y$ (D) $z < y < x$

Space for rough work

SECTION 3 (Maximum Marks: 16)

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Paragraph-1

Three quantum numbers are required to define an orbital while four quantum numbers are required to describe an electron.

37. Which of the following statement is correct ?
- (A) The quantum numbers of the electron in H atom are exactly identical with that of one electron of He atom.
- (B) The maximum of the radial distribution of s orbital decreases as the principal quantum number increase.
- (C) According to Pauli's exclusion principle, the lower energetic orbital will be filled first
- (D) The N atom has the electronic configuration of $1s^2 2s^2 2p^3$ which is represented as
- | | | | | |
|----|----|----|---|--|
| ↑↓ | ↑↓ | ↑↓ | ↑ | |
|----|----|----|---|--|
38. $(n + 1)$ maximum and minimum for which of the following orbitals : 6s, 5p, 6d, 4d, 2p, 3s, 2s ?
- (A) 6f and 1s (B) 6d and 2s (C) 5p and 3s (D) 6s and 2p

Paragraph-2

The electronic configuration of an element is written as follows : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$.

39. On removal of one electron, the electronic configuration will become
- (A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$ (B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^1$
- (C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^0$ (D) None of these
40. The Radial node value for an electron in 3s is identical with that of an electron present in
- (A) 3p orbital (B) 3d orbital
- (C) 4s orbital (D) 4p orbital

Space for rough work

PART III: MATHEMATICS
SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive
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0 In all other cases

41. $\cot 16^\circ \cot 44^\circ + \cot 44^\circ \cot 76^\circ - \cot 76^\circ \cot 16^\circ =$
42. $\sqrt{\sin^4 x + 4\cos^2 x} - \sqrt{\cos^4 x + 4\sin^2 x} - \cos 2x =$
43. Value of $\cos \frac{2\pi}{15} \cdot \cos \frac{4\pi}{15} \cdot \cos \frac{8\pi}{15} \cdot \cos \frac{14\pi}{15} = \frac{k}{32}$, then the value of k is
44. If $\tan^2 A \tan^2 B + \tan^2 B \tan^2 C + \tan^2 C \tan^2 A + 2 \tan^2 A \tan^2 B \tan^2 C = 1$, then the value of $\sin 2A \tan A + \sin 2B \tan B + \sin 2C \tan C$ is
45. $\cos^2 A + \cos^2(A + 120^\circ) + \cos^2(A - 120^\circ) = \frac{3k}{16}$, then value of k is
46. If $\alpha = \frac{2\pi}{7}$, then value of $\tan \alpha \tan 2\alpha + \tan 2\alpha \tan 4\alpha + \tan 4\alpha \tan \alpha = -k$, then the value of k is
47. If $\sin \theta = 3 \sin(\theta + 2\alpha)$ and if $\tan(\theta + \alpha) + 2 \tan \alpha = m$, then the value of $7m$ is
48. The value of $8184 (\sin 12^\circ \sin 48^\circ \sin 54^\circ) + 181 [\tan 203^\circ + \tan 22^\circ + \tan 203^\circ \tan 22^\circ]$ is equal to $\frac{2408}{k}$, then the value of 'k' is

Space for rough work

SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ Each question has FOUR options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
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49. Value of $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8}$ is
- (A) $\sqrt{2}$ (B) $\frac{3}{2}$
- (C) $\frac{1}{2} \left\{ \left(1 + \frac{1}{\sqrt{2}} \right)^2 + \left(1 - \frac{1}{\sqrt{2}} \right)^2 \right\}$ (D) $\frac{1}{2} \left\{ \left(1 + \frac{1}{\sqrt{2}} \right)^2 - \left(1 - \frac{1}{\sqrt{2}} \right)^2 \right\}$
50. $\tan A + 2 \tan 2A + 4 \tan 4A + 8 \cot 8A =$
- (A) $\cot A + 2 \tan 2A$ (B) $\cot A$ (C) $\tan A$ (D) $\tan A + 2 \cot 2A$
51. If $\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \alpha) = \frac{3}{2}$, then
- (A) $\cos \alpha + \cos \beta + \cos \gamma = 0$ (B) $\sin \alpha + \sin \beta + \sin \gamma = 0$
- (C) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = 0$ (D) $\sin 2\alpha + \sin 2\beta + \sin 2\gamma = 0$
52. If $\tan \alpha$ and $\tan \beta$ are the roots of the equation $x^2 + px + q = 0$ ($p \neq 0$), then
- (A) $\sin^2(\alpha + \beta) + p \sin(\alpha + \beta) \cos(\alpha + \beta) + q \cos^2(\alpha + \beta) = q$
- (B) $\tan(\alpha + \beta) = \frac{p}{q} - 1$
- (C) $\cos(\alpha + \beta) = 1 - q$
- (D) $\sin(\alpha + \beta) = -p$
53. The value of $\tan^2 \alpha - \tan^2 \beta - \frac{1}{2} \sin(\alpha - \beta) \sec^2 \alpha \sec^2 \beta$ is zero, if
- (A) $\sin(\alpha + \beta) = 0$ (B) $\sin(\alpha + \beta) = \frac{1}{2}$ (C) $\sin(\alpha - \beta) = 0$ (D) $\sin(\alpha - \beta) = \frac{1}{2}$

Space for rough work

54. If $x = a \cos^3 \theta \sin^2 \theta$, $y = a \sin^3 \theta \cos^2 \theta$ and $\frac{(x^2 + y^2)^p}{(xy)^q}$ ($p, q \in \mathbb{N}$) is independent of θ , then
 (A) $p = 4$ (B) $p = 5$ (C) $q = 4$ (D) $q = 5$
55. If $\tan \alpha = \frac{1}{\sqrt{x(x^2 + x + 1)}}$, $\tan \beta = \frac{\sqrt{x}}{\sqrt{x^2 + x + 1}}$ and $\tan \gamma = \sqrt{x^{-3} + x^{-2} + x^{-1}}$, then
 (A) $\alpha + \beta = \gamma$ (B) $\alpha + \beta + \gamma = 0$ (C) $\frac{\alpha}{\gamma} - \frac{\beta}{\gamma} = 1$ (D) $\frac{\alpha}{\gamma} + \frac{\beta}{\gamma} = 1$
56. If $\cot \theta + \tan \theta = x$ and $\sec \theta - \cos \theta = y$, then
 (A) $\sin \theta \cos \theta = \frac{1}{2}$ (B) $\sin \theta \tan \theta = y$ (C) $(x^2 y)^{2/3} - (xy^2)^{2/3} = 1$ (D) $(x^2 y)^{1/3} + (xy^2)^{1/3} = 1$

SECTION 3 (Maximum Marks: 16)

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Paragraph-1

$$P = \sqrt{1 + \sin 2A}, Q = \sqrt{1 - \sin 2A}$$

57. If $P + Q = 2 \sin A$, then A lies in
 (A) $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ (B) $\left[\frac{3\pi}{4}, \frac{5\pi}{4}\right]$ (C) $\left[0, \frac{\pi}{4}\right]$ (D) $\left[\frac{5\pi}{4}, \frac{7\pi}{4}\right]$
58. If $P + Q = -2 \cos A$, then A lies in
 (A) $\left[0, \frac{\pi}{4}\right]$ (B) $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ (C) $\left[\frac{3\pi}{4}, \frac{5\pi}{4}\right]$ (D) $\left[\frac{5\pi}{4}, \frac{7\pi}{4}\right]$

Space for rough work

Paragraph-2

x, y, z are respectively the sines and p, q, r are respectively cosines of the angles α, β, γ which are in A.P, with common difference $\frac{2\pi}{3}$.

59. $yz + zx + xy$ is equal to

- (A) $p + q + r$ (B) $x + y + z$ (C) $-\frac{3}{4}$ (D) $-\frac{3}{8}$

60. Value of $x^2(qy - rz) + y^2(rz - px) + z^2(px - qy)$ is equal to

- (A) 0 (B) $x + y + z$ (C) $p + q + r$ (D) $\frac{3\sqrt{3}}{8}$

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DATE: 02.07.2018

ANSWERS

PHYSICS

1.	0	2.	BONUS	3.	0	4.	2
5.	5	6.	3	7.	8	8.	1
9.	A	10.	A,B,C	11.	C	12.	A
13.	B	14.	D	15.	A, B, D	16.	C
17.	C	18.	D	19.	B	20.	D

CHEMISTRY

21.	9	22.	6	23.	4	24.	Bonus
25.	1 or 2 3	26.	2	27.	2	28.	2
29.	A, B, C, D	30.	A, D	31.	B, C	32.	A, C
33.	B, D	34.	B, C, D	35.	A, B	36.	C
37.	A	38.	B	39.	B	40.	D

MATHEMATICS

41.	3	42.	0	43.	2	44.	2
45.	8	46.	7	47.	0	48.	2
49.	BC	50.	BD	51.	AB (Bonus)	52.	B
53.	BC	54.	BC	55.	AD	56.	BC
57.	A	58.	C	59.	C	60.	D

FIITJEE RET – 4

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P2)_SET-B

DATE: 02.07.2018

Time: 3 hours

Maximum Marks: 240

INSTRUCTIONS:

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C. Question paper format:

14. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
15. **Section I** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).
16. **Section II** contains **8 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
17. **Section III** contains **2 paragraphs** type questions. Each paragraph describes an experiment, a situation or a problem. Two multiple choice questions will be asked based on this paragraph. One or more than one option can be correct.

D. Marking Scheme

18. For each question in **Section I**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answers in this section.
19. For each question in **Section II**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **-2 marks** will be awarded for incorrect answers in this section.
20. For each question in **Section III**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **-2 marks** will be awarded for incorrect answers in this section.

Don't write / mark your answers in this question booklet.

If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME:

ENROLLMENT NO.:

PAPER – II
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
 - ◆ The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive
 - ◆ For each question, darken the bubble corresponding to the correct integer in the ORS
 - ◆ **Marking scheme:**
 - +4** If the bubble corresponding to the answer is darkened
 - 0** In all other cases
-

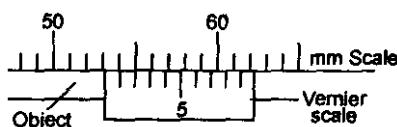
1. The volume of a cube is increasing at the rate of $1200 \text{ cm}^3 / \text{min}$ at the instant its edges are 20 cm long. The rate at which the lengths of the edges are changing at that instant is equal to $k \text{ cm} / \text{s}$. Then find $300k$.
2. A sail boat sails 2 km due east, 5 km 37° south of east, and finally an unknown displacement. If the final displacement of the boat from the starting point is 6 km due east, determine the third displacement's magnitude.
3. In an experiment, we measure quantities a , b and c . Then x is calculated from the formula, $x = \frac{ab^2}{c^3}$. The percentage errors in a , b , c are $\pm 1\%$, $\pm 2\%$, and $\pm 1\%$ respectively. The percentage error in x can be
4. Current is defined as rate of flow of charge. If charge flowing through a conductor is given by $q = q_0 \sin \omega t$. Then initial current through conductor is $1/k$ times $q_0 \omega$. The value of 'k' is
5. Each side of a cube is measured to be 7.2 m. What are the total surface area (in m^2) of the cube to appropriate significant figures is $31k$. Find k ?
6. 5.74 g of a substance occupies 1.2 cm^3 . Express its density (in g cm^{-3}) by keeping the significant figures in view is $k(26)$, find the value of k ?
7. The mass of a box measured by a grocer's balance is 2.300 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. The difference in the masses (in g) of the pieces to correct significant figures is $0.02k$. Find the value of k ?
8. The value of $\int_0^{\pi/2} (\sin x + \cos x) dx$ will be.

Space for rough work

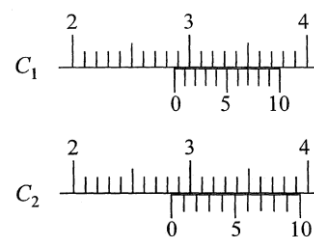
SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ Each question has FOUR options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- ◆ **Marking scheme:**
 - +4** If only the bubble(s) corresponding to all the correct option(s) is(are) darkened
 - 0** If none of the bubbles is darkened
 - 2** In all other cases

9. What is the reading of vernier scale shown is figure:

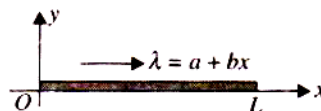


- (A) 54.6 mm (B) 53.2 nun (C) 52.7 mm (D) 54.7 mm
10. The focal length of a mirror is given by $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$; where u and v represent object and image distances respectively. The maximum relative error in f is
- (A) $\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v}$ (B) $\frac{\Delta f}{f} = \frac{1}{\Delta u/u} + \frac{1}{\Delta u/v}$
- (C) $\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v} - \frac{\Delta(u+v)}{u+v}$ (D) $\frac{\Delta f}{f} = \frac{\Delta u}{u} + \frac{\Delta v}{v} + \frac{\Delta u}{u+v} + \frac{\Delta v}{u+v}$
11. The value of measurement of a physical quantity in 5 trails were found to be 1.51, 1.53, 1.53, 1.52, 1.54. Then
- (A) mean absolute error is 0.01
 (B) absolute error in measurement 1.51 is 0.02
 (C) percentage error is 0.1%
 (D) absolute error in the measurement 1.52 is 0.01
12. There are two Vernier callipers both of which have 1cm divided into 10 equal divisions on the main scale. The Vernier scale of one of the callipers (C_1) has 10 equal divisions that correspond to 9 main scale divisions. The vernier scale of the other calliper (C_2) has 10 equal divisions that correspond to 11 main scale divisions. The readings of the two callipers are shown in the figure. The measured values (in cm) by callipers C_1 and C_2 , respectively, are
- (A) 2.87 and 2.86 (B) 2.87 and 2.87
 (C) 2.87 and 2.83 (D) 2.85 and 2.82



Space for rough work

13. You are given a rod of length L . The linear mass density is λ such that $\lambda = a + bx$. Here a and b are constants. Find the mass of the rod.



- (A) $aL + \frac{bL^2}{2}$ (B) $aL - \frac{bL^2}{2}$ (C) abL (D) None of these
14. If $u = e^x + e^{-x}$ and $v = e^x - e^{-x}$
- (A) $\frac{du}{dx} = v$ (B) $\frac{dv}{dx} = u$ (C) $u \frac{du}{dx} = v \frac{dv}{dx}$ (D) $\frac{du}{dx} + \frac{dv}{dx} = 2e^{-x}$
15. A bee of mass 0.000087 kg sits on a flower of mass 0.0123 kg. What is the total mass supported by the stem of the flower upto appropriate significant figures ?
- (A) 0.012387 gk (B) 0.01239 kg (C) 0.0124 kg (D) 0.012 kg
16. A man runs 100.5 m in 10.3 s. his average speed upto appropriate significant figure is
- (A) 9.71 ms^{-1} (B) 9.708 ms^{-1} (C) 9.7087 ms^{-1} (D) 9.70874 ms^{-1}

SECTION 3 (Maximum Marks: 16)

- ◆ This section contains **TWO** paragraphs
- ◆ Based on each paragraph, there will be **TWO** questions
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- ◆ **Marking scheme:**
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 - 0** If none of the bubbles is darkened
 - 2** In all other cases

Space for rough work

Paragraph-1

If a, b, c are physical quantities of same dimensions and a = 10 units, b = 20 units, c = 30 units

with percentage error in a = 1%

with percentage error in b = 2%

with percentage error in c = 3%

17. Percentage error in $\frac{a^3 \sqrt{b}}{c^2}$ is
 (A) 5% (B) 10% (C) 20% (D) 15%
18. Absolute error in (a + b) is
 (A) 0.4 units (B) 0.2 units (C) 0.3 units (D) 0.5 units

Paragraph-2

In electromagnetic theory, the electric and magnetic phenomena are related to each other. Therefore, the dimensions of electric and magnetic quantities must also be related to each other. In the questions below [E] and [B] stand for dimensions of electric and magnetic field respectively, while $[\epsilon_0]$ and $[\mu_0]$ stand for dimensions of the permittivity and permeability of free space respectively. [L] and [T] are dimensions of length and time respectively. All the quantities are given in SI units.

(There are two questions based on PARAGRAPH "1", the question below is one of them)

19. The relation between [E] and [B] is
 (A) $[E] = [B][L][T]$ (B) $[E] = [B][L]^{-1}[T]$
 (C) $[E] = [B][L][T]^{-1}$ (D) $[E] = [B][L]^{-1}[T]^{-1}$
20. The relation between $[\epsilon_0]$ and $[\mu_0]$ is
 (A) $[\mu_0] = [\epsilon_0][L]^2[T]^{-2}$ (B) $[\mu_0] = [\epsilon_0][L]^{-2}[T]^2$
 (C) $[\mu_0] = [\epsilon_0]^{-1}[L]^2[T]^{-2}$ (D) $[\mu_0] = [\epsilon_0]^{-1}[L]^{-2}[T]^2$

Space for rough work

PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive
- ◆ For each question, darken the bubble corresponding to the correct integer in the ORS

◆ **Marking scheme:**

- +4** If the bubble corresponding to the answer is darkened
0 In all other cases
-

21. The sum of all the quantum numbers of He^+ & Li^{2+} is.
 22. The maximum number of electrons that can be accommodated in an orbital is
 23. The number of nodes in 3p orbital.
 24. The number of species among the following having magnetic moment value of 2.84 BM is ..
 Fe^{2+} , Cr, Cr^{3+} , Ti^{2+} , Mn^{2+} , V^{3+}
 25. The maximum number of electrons can have principal quantum number $n = 3$ and spin quantum number $m_s = -1/2$ is
 26. In an atom, the total number of electrons having quantum numbers $n = 4$, $|m_\ell| = 1$ and $m_s = -1/2$ is :
 27. A certain transition in H spectrum from an excited state to ground state in one or more steps gives rise to total 10 lines. How many of these belong to UV spectrum ?
 28. What is the total number of pairs of electrons at least same quantum numbers for Be ?
-

Space for rough work

SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ Each question has FOUR options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- ◆ **Marking scheme:**
 - +4** If only the bubble(s) corresponding to all the correct option(s) is(are) darkened
 - 0** If none of the bubbles is darkened
 - 2** In all other cases

29. Which of the following is/are possible ?
 (A) 3f (B) 4d (C) 2d (D) 3p
30. An electron has spin quantum number (s) + 1/2 and magnetic quantum number is -1. It can be present in
 (A) s orbital (B) d orbital (C) p orbital (D) f orbital
31. The radial part of wave function depends on the quantum numbers
 (A) n (B) l (C) l, m_l (D) n only
32. Magnetic moment of V(Z = 23), Cr(Z = 24), and Mn (Z = 25) are x, y, z, respectively, hence
 (A) x = y = z (B) x < y < z (C) x < z < y (D) z < y < x
33. Which of the following statements is/are correct ?
 (A) The electronic configuration of Cr is [Ar]3d⁵ 4s¹ (atomic number of Cr is 24)
 (B) The magnetic quantum number may have a negative value.
 (C) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type (atomic number of Ag is 47)
 (D) Atomic number of Nitrogen is 7
34. The ground state electronic configuration of nitrogen atom can be represented by
 (A)

↑↓	↑↓	↑	↑	↑
----	----	---	---	---

 (B)

↑↓	↑↓	↑	↓	↑
----	----	---	---	---

 (C)

↑↓	↑↓	↑	↓	↓
----	----	---	---	---

 (D)

↑↓	↑↓	↓	↓	↓
----	----	---	---	---
35. Which of the following species has (have) five unpaired electrons ?
 (A) Cs (B) Mn (C) Mn²⁺ (D) Fe²⁺
36. Which of the following sets of quantum number is/are not permitted ?
 (A) n = 3, l = 3, m = + 1, s = + $\frac{1}{2}$ (B) n = 3, l = 2, m = + 2, s = - $\frac{1}{2}$
 (C) n = 3, l = 1, m = + 2, s = - $\frac{1}{2}$ (D) n = 3, l = 0, m = 0, s = + $\frac{1}{2}$

Space for rough work

SECTION 3 (Maximum Marks: 16)

- ◆ This section contains **TWO** paragraphs
- ◆ Based on each paragraph, there will be **TWO** questions
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
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 - 2** In all other cases

Paragraph-1

The electronic configuration of an element is written as follows : $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^2$.

37. On removal of one electron, the electronic configuration will become
 (A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$ (B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8 4s^1$
 (C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9 4s^0$ (D) None of these
38. The Radial node value for an electron in 3s is identical with that of an electron present in
 (A) 3p orbital (B) 3d orbital
 (C) 4s orbital (D) 4p orbital

Paragraph-2

Three quantum numbers are required to define an orbital while four quantum numbers are required to describe an electron.

39. Which of the following statement is correct ?
 (A) The quantum numbers of the electron in H atom are exactly identical with that of one electron of He atom.
 (B) The maximum of the radial distribution of s orbital decreases as the principal quantum number increase.
 (C) According to Pauli's exclusion principle, the lower energetic orbital will be filled first
 (D) The N atom has the electronic configuration of $1s^2 2s^2 2p^3$ which is represented as
- | | | | | |
|----|----|----|---|--|
| ↑↓ | ↑↓ | ↑↓ | ↑ | |
|----|----|----|---|--|
40. (n + l) maximum and minimum for which of the following orbitals : 6s, 5p, 6d, 4d, 2p, 3s, 2s ?
 (A) 6f and 1s (B) 6d and 2s (C) 5p and 3s (D) 6s and 2p

Space for rough work

PART III: MATHEMATICS
SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive
- ◆ For each question, darken the bubble corresponding to the correct integer in the ORS

◆ **Marking scheme:**

- +4** If the bubble corresponding to the answer is darkened
0 In all other cases

41. $\cos^2 A + \cos^2(A + 120^\circ) + \cos^2(A - 120^\circ) = \frac{3k}{16}$, then value of k is
42. If $\alpha = \frac{2\pi}{7}$, then value of $\tan \alpha \tan 2\alpha + \tan 2\alpha \tan 4\alpha + \tan 4\alpha \tan \alpha = -k$, then the value of k is
43. If $\sin \theta = 3 \sin(\theta + 2\alpha)$ and if $\tan(\theta + \alpha) + 2 \tan \alpha = m$, then the value of 7m is
44. The value of $8184 (\sin 12^\circ \sin 48^\circ \sin 54^\circ) + 181 [\tan 203^\circ + \tan 22^\circ + \tan 203^\circ \tan 22^\circ]$ is equal to $\frac{2408}{k}$, then the value of 'k' is
45. $\cot 16^\circ \cot 44^\circ + \cot 44^\circ \cot 76^\circ - \cot 76^\circ \cot 16^\circ =$
46. $\sqrt{\sin^4 x + 4 \cos^2 x} - \sqrt{\cos^4 x + 4 \sin^2 x} - \cos 2x =$
47. Value of $\cos \frac{2\pi}{15} \cdot \cos \frac{4\pi}{15} \cdot \cos \frac{8\pi}{15} \cdot \cos \frac{14\pi}{15} = \frac{k}{32}$, then the value of k is
48. If $\tan^2 A \tan^2 B + \tan^2 B \tan^2 C + \tan^2 C \tan^2 A + 2 \tan^2 A \tan^2 B \tan^2 C = 1$, then the value of $\sin 2A \tan A + \sin 2B \tan B + \sin 2C \tan C$ is

Space for rough work

SECTION 2 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions
- ◆ Each question has FOUR options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- ◆ **Marking scheme:**
 - +4** If only the bubble(s) corresponding to all the correct option(s) is(are) darkened
 - 0** If none of the bubbles is darkened
 - 2** In all other cases

49. The value of $\tan^2\alpha - \tan^2\beta - \frac{1}{2} \sin(\alpha - \beta) \sec^2\alpha \sec^2\beta$ is zero, if
 (A) $\sin(\alpha + \beta) = 0$ (B) $\sin(\alpha + \beta) = \frac{1}{2}$ (C) $\sin(\alpha - \beta) = 0$ (D) $\sin(\alpha - \beta) = \frac{1}{2}$
50. If $x = a \cos^3\theta \sin^2\theta$, $y = a \sin^3\theta \cos^2\theta$ and $\frac{(x^2 + y^2)^p}{(xy)^q}$ ($p, q \in \mathbb{N}$) is independent of θ , then
 (A) $p = 4$ (B) $p = 5$ (C) $q = 4$ (D) $q = 5$
51. If $\tan \alpha = \frac{1}{\sqrt{x(x^2 + x + 1)}}$, $\tan \beta = \frac{\sqrt{x}}{\sqrt{x^2 + x + 1}}$ and $\tan \gamma = \sqrt{x^{-3} + x^{-2} + x^{-1}}$, then
 (A) $\alpha + \beta = \gamma$ (B) $\alpha + \beta + \gamma = 0$ (C) $\frac{\alpha}{\gamma} - \frac{\beta}{\gamma} = 1$ (D) $\frac{\alpha}{\gamma} + \frac{\beta}{\gamma} = 1$
52. If $\cot \theta + \tan \theta = x$ and $\sec \theta - \cos \theta = y$, then
 (A) $\sin \theta \cos \theta = \frac{1}{2}$ (B) $\sin \theta \tan \theta = y$ (C) $(x^2y)^{2/3} - (xy^2)^{2/3} = 1$ (D) $(x^2y)^{1/3} + (xy^2)^{1/3} = 1$

Space for rough work

53. Value of $\cos^4 \frac{\pi}{8} + \cos^4 \frac{3\pi}{8} + \cos^4 \frac{5\pi}{8} + \cos^4 \frac{7\pi}{8}$ is
- (A) $\sqrt{2}$ (B) $\frac{3}{2}$
- (C) $\frac{1}{2} \left\{ \left(1 + \frac{1}{\sqrt{2}} \right)^2 + \left(1 - \frac{1}{\sqrt{2}} \right)^2 \right\}$ (D) $\frac{1}{2} \left\{ \left(1 + \frac{1}{\sqrt{2}} \right)^2 - \left(1 - \frac{1}{\sqrt{2}} \right)^2 \right\}$
54. $\tan A + 2 \tan 2A + 4 \tan 4A + 8 \cot 8A =$
- (A) $\cot A + 2 \tan 2A$ (B) $\cot A$ (C) $\tan A$ (D) $\tan A + 2 \cot 2A$
55. If $\cos(\alpha - \beta) + \cos(\beta - \gamma) + \cos(\gamma - \alpha) = \frac{3}{2}$, then
- (A) $\cos \alpha + \cos \beta + \cos \gamma = 0$ (B) $\sin \alpha + \sin \beta + \sin \gamma = 0$
- (C) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = 0$ (D) $\sin 2\alpha + \sin 2\beta + \sin 2\gamma = 0$
56. If $\tan \alpha$ and $\tan \beta$ are the roots of the equation $x^2 + px + q = 0$ ($p \neq 0$), then
- (A) $\sin^2(\alpha + \beta) + p \sin(\alpha + \beta) \cos(\alpha + \beta) + q \cos^2(\alpha + \beta) = q$
- (B) $\tan(\alpha + \beta) = \frac{p}{q} - 1$
- (C) $\cos(\alpha + \beta) = 1 - q$
- (D) $\sin(\alpha + \beta) = -p$

SECTION 3 (Maximum Marks: 16)

- ◆ This section contains **TWO** paragraphs
- ◆ Based on each paragraph, there will be **TWO** questions
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
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 - 2** In all other cases

Space for rough work

Paragraph-2

x, y, z are respectively the sines and p, q, r are respectively cosines of the angles α, β, γ which are in A.P, with common difference $\frac{2\pi}{3}$.

57. $yz + zx + xy$ is equal to
 (A) $p + q + r$ (B) $x + y + z$ (C) $-\frac{3}{4}$ (D) $-\frac{3}{8}$
58. Value of $x^2(qy - rz) + y^2(rz - px) + z^2(px - qy)$ is equal to
 (A) 0 (B) $x + y + z$ (C) $p + q + r$ (D) $\frac{3\sqrt{3}}{8}$

Paragraph-1

$$P = \sqrt{1 + \sin 2A}, Q = \sqrt{1 - \sin 2A}$$

59. If $P + Q = 2 \sin A$, then A lies in
 (A) $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ (B) $\left[\frac{3\pi}{4}, \frac{5\pi}{4}\right]$ (C) $\left[0, \frac{\pi}{4}\right]$ (D) $\left[\frac{5\pi}{4}, \frac{7\pi}{4}\right]$
60. If $P + Q = -2 \cos A$, then A lies in
 (A) $\left[0, \frac{\pi}{4}\right]$ (B) $\left[\frac{\pi}{4}, \frac{3\pi}{4}\right]$ (C) $\left[\frac{3\pi}{4}, \frac{5\pi}{4}\right]$ (D) $\left[\frac{5\pi}{4}, \frac{7\pi}{4}\right]$

Space for rough work

FITJEE RET – 4

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P2)_SET-B

DATE: 02.07.2018

ANSWERS

PHYSICS

1.	5	2.	3	3.	8	4.	1
5.	0	6.	BONUS	7.	0	8.	2
9.	B	10.	D	11.	A, B, D	12.	C
13.	A	14.	A,B,C	15.	C	16.	A
17.	B	18.	D	19.	C	20.	D

CHEMISTRY

21.	1 or 2 or 3	22.	2	23.	2	24.	2
25.	9	26.	6	27.	4	28.	Bonus
29.	B, D	30.	B, C, D	31.	A, B	32.	C
33.	A, B, C, D	34.	A, D	35.	B, C	36.	A, C
37.	B	38.	D	39.	A	40.	B

MATHEMATICS

41.	8	42.	7	43.	0	44.	2
45.	3	46.	0	47.	2	48.	2
49.	BC	50.	BC	51.	AD	52.	BC
53.	BC	54.	BD	55.	AB (Bonus)	56.	A
57.	C	58.	D	59.	A	60.	C