TEST SERIES CSIR-NET/JRF JUNE 2018

BOOKLET SERIES A

Paper Code 03 **Test Type: TEST SERIES**

LIFE SCIENCES

Duration: 2:00 Hours **Date: 23-05-2018**

Maximum Marks: 150

Read the following instructions carefully:

* Single Paper Test is divided into **THREE** Parts.

Part - A: This part shall carry **10** questions. Each question shall be of **2 marks.**

Part - B: This part shall carry **35** questions. Each question shall be of **2 marks.**

Part - C: This part shall contain **15** questions. Each question shall be of **4 marks**.

* Darken the appropriate bubbles with HB pencil/Ball Pen to write your answer.
* There will be negative marking @25% for each wrong answer.
* The candidates shall be allowed to carry the Question Paper Booklet after completion of the exam.
* For rough work, blank sheet is attached at the end of test booklet.

PART-A

1. A park is in shape of a circle. A man crossed the park across its diameter. What percentage of distance is saved by not walking along the circumference?
(a) 31.4% (b) 11.4% (c) 57% (d) none of these

2. If the average of three numbers a, b, c is A, then the average of a, b, c and A is
(a) Data insufficient (b) 2A
(c) A (d) 4A

3. Usain runs 100 m south from his house, turns left and runs 250 m, again turns left and runs 400 m, then turns right and runs 50 m to reach to the stadium. In which direction is the stadium from this house?
(a) South west (b) North east (c) East (d) North

4. A motorboat, whose speed is 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. The speed of the stream (in km/hr) is
(a) 4 (b) 5 (c) 6 (d) 10

5. Find the odd number
396, 462, 572, 427, 671, 264
(a) 396 (b) 427 (c) 671 (d) 264

6. Which number replaces the question mark?

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

7. Select the correct pattern
BBB | BBBB | BBBB | BB ?
(a) BB (b) BB (c) BB (d) BB

8. A takes twice as much time as B and thrice as much time as C to finish a piece of work. Working together, they can finish the work in 2 days. B can do the work alone in
(a) 4 days (b) 6 days (c) 8 days (d) 12 days

9. Let N be the greatest number that will divide 1305, 4665 and 6905, leaving the same remainder in each case. The sum of the digits in N is
(a) 4 (b) 5 (c) 6 (d) 8

10. The sum of first ten natural number is
(a) 55 (b) 65 (c) 75 (d) 85

PART-B

11. Consider the following four statements:
P. The solubility of a protein is lowest at its isoelectric point
Q. At low ionic strengths, solubility of a protein increases with increasing salt concentration
R. Tyrosine, tryptophan and phenylalanine have aromatic side chains capable of forming hydrogen bonds
S. Oxygen binding to hemoglobin decreases when pH is increased from 7.2 to 7.6

Of these statements,

(a) only P and Q are correct
(b) P, Q and S are correct
(c) all are correct
(d) only Q is correct

12. One of the carbon atoms of glucose is ^{14}C-labeled. If none of the TCA cycle intermediates are ^{14}C-labeled after glycolysis and one cycle of Krebs cycle, the carbon atom of glucose that was labeled is

(a) C1 (b) C6 (c) C2 (d) C3

13. How many bands would you expect if a pentameric sample of IgM containing β-mercaptoethanol is subjected to SDS-PAGE?

(a) 2 (b) 3 (c) 5 (d) 6

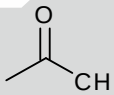
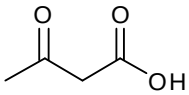
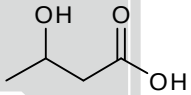
14. In a molecule of glycogen we find

(a) one reducing end and one non-reducing end
(b) many reducing ends and one non-reducing end
(c) one non-reducing end and many branch points
(d) one reducing end and many non-reducing ends

15. The synthesis of proteins requires 20 standard amino acids in the living systems. However, some organisms use selenocysteine as an additional amino acid for synthesizing proteins. Selenocysteine is biosynthesized from

(a) Cysteine (b) Serine (c) Threonine (d) Proline

16. The metabolite that is NOT used by brain as a source of energy under conditions of prolonged low blood-glucose levels is

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

17. Choose the correct set of match between Group I and Group II.

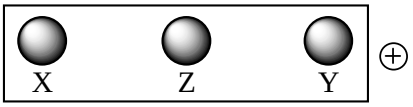
Group I	**Group II**
P. Pyridoxal 5'-phosphate	1. Carboxylation reaction
Q. Biotin	2. One-carbon transfer reaction
R. Thiamine pyrophosphate	3. Decarboxylation reaction
S. N^5, N^{10}-methylene tetrahydrofolate	4. Oxidation reduction reaction
	5. C-C bond cleavage

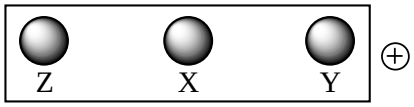
(a) P-1, Q-3, R-5, S-2
(b) P-3, Q-1, R-5, S-4
(c) P-3, Q-1, R-5, S-2
(d) P-1, Q-4, R-2, S-3

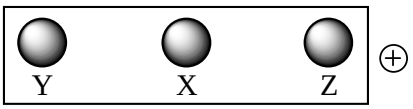
18. Biofilm observed in the lungs of cystic fibrosis patients is composed of

(a) polysaccharides
(b) polylactic acid
(c) polypeptides
(d) polyethylene glycol

19. The result of an electrophoretic separation of a mixture of amino acids X, Y and Z at pH = 5.0 is represented as (Given the isoelectric points of X, Y and Z are 9.87, 3.22 and 5.43, respectively)

(a) 

(b) 

(c) 

(d) 

20. What is the term for the specialized structure between closely apposed plasma membranes of adjacent cells that directly connects the cytoplasm?
(a) Synapse (b) Gap junction (c) Tight junction (d) Ion channel

21. Which of the following statements is false? One function of the plasma membrane is to
(a) synthesized proteins for the cell
(b) transport water and solutes into and out of the cell
(c) bind chemical signals from other cells
(d) structurally link cells together

22. A membrane that is permeable only to water separates two solutions of glucose dissolved in water. On one side of the membrane (side A), the glucose concentration is 0.1 g/ml. On the other side (side B), the glucose concentration is 0.5 g/ml. Initially, the rate of water flow is
(a) most rapid from side A to side B (b) most rapid from side B to side A
(c) the same in both directions (d) zero (no flow in either direction)

23. The rate of solute diffusion decreases in response to an increase in
(a) the concentration gradient (b) membrane permeability
(c) temperature (d) the molecular weight of the solute

24. The growth phase of the cell cycle is known as
(a) mitosis (b) metaphase
(c) interphase (d) M phase

25. Microfilaments and microtubules have the following in common
(a) Polarized (b) Involved in cell motility
(c) Use ATP for polymerization (d) Both (a) and (b)

26. A cell in G_1 of interphase has 12 chromosomes. How many chromatids will be found per cell during metaphase II of meiosis?
(a) 6 (b) 12 (c) 18 (d) 24

27. Among the following cell structure-function pairs, identify the correctly paired one
(a) Microvilli - engulfment of foreign bodies (b) Cytoskeleton - cell migration
(c) Peroxisomes - cellular respiration (d) Nucleolus - mRNA transcription

28. If only one bond is broken in the sugar-phosphate backbone, it is called as:
(a) Gap (b) Nick (c) Break (d) Leakage

29. The enzyme responsible for making cAMP is
(a) cAMP-dependent protein kinase (b) cAMP phosphodiesterase
(c) adenylate cyclase (d) DNA glycosylase

30. Steroid hormones and thyroid hormones diffuse across the plasma membrane of target cells and bind to
(a) DNA (b) RNA
(c) Intracellular receptors (d) Protein kinases

31. The various molecules that function in cells as second messengers
(a) have related structures
(b) are usually rapidly degraded or recycled after release
(c) bind to receptors on the cell surface
(d) always activate the enzyme C-kinase

32. Cholera toxin increases cAMP levels by
(a) modifying G_i protein
(b) modifying G_s protein
(c) binding to adenylate cyclase
(d) activating cAMP phosphodiesterase

33. Choose the correct signal transduction pathway.
(a) Hormone → 7 TM receptor → G protein → cAMP → PKA
(b) Hormone → G protein → 7 TM receptor → cAMP → PKA
(c) Hormone → 7 TM receptor → G protein → PKA → cAMP
(d) Hormone → 7 TM receptor → cAMP → G protein → PKA

34. A mutant G_α protein with increase GTPase activity would
(a) not bind to GTP
(b) not bind to GDP
(c) show increased signalling
(d) show decreased signalling

35. Upon stimulation of a eukaryotic cell, the intracellular calcium (Ca^{2+}) is released from
(a) endoplasmic reticulum
(b) nucleus
(c) peroxisome
(d) mitochondria

36. In mammals, the second messenger nitric oxide (NO) is produced from
(a) ammonium nitrate
(b) arginine
(c) urea
(d) nitrous acid

37. Protein binding regions of DNA are identified by one of the following techniques
(a) finger printing
(b) foot printing
(c) southern blotting
(d) western blotting

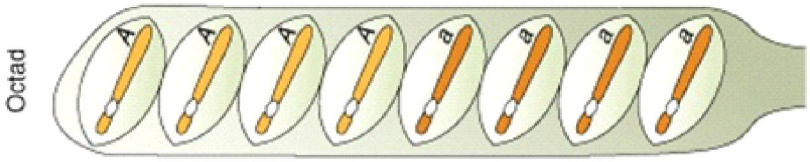
38. Shell coiling in *Limnaea* shows maternal effect in the progenies. Right-handed shell coiling is controlled by D and is dominant to left-handed coiling which is control by d. A cross between two *Limnaea* produces progenies of all left-handed. Which of the following is TRUE for the above cross?
(a) The phenotype of the mother is left-handed coiling.
(b) The phenotype of the grandmother is left-handed coiling.
(c) The genotype of the mother is dd.
(d) The genotype of the grandmother is dd.

39. Inbred lines of two mutant plants, both bearing white flowers, were crossed. The F1 plants were all red coloured flowers. Selfing the F1 plants, produced progeny with phenotypes of red and white coloured flowers in 9 : 7 ratio. Based on this information, which one of the following conclusions is correct?
(a) Flower colour is controlled by only one genes.
(b) Two gene loci controlled the flower colour.
(c) The mutations in the parents do not complement each other.
(d) Flower colour is polygenic and follows quantitative inheritance.

40. 200 individuals in a population carry the mutant alleles. However, only 160 individuals show the mutant phenotype and the remaining 40 individuals are normal despite the presence of mutant allele. What is the penetrance of the mutant allele in the population?
(a) 100 %
(b) 60%
(c) 20%
(d) 80%

41. A cross was made between *Hfr* $met^+arg^+leu^+str^S$ X *F-* $met^-arg^-leu^-str^r$ in which leu+ exconjugants are selected. If the linear organization of the genes are leu^+arg^+ met^+, which one of the following genotypes is expected to occur in the highest frequency?
(a) leu^+arg^- met^-
(b) leu^+arg^+ met^-
(c) leu^+arg^+ met^+
(d) leu^+arg^- met^+

42. In *Neurospora* a cross between the genotypes 'A' and 'a' results in an ascus with ascospores of genotypes as shown below:



Following are the statement for the above cross,

A) Crossing over between the centromeres and the gene
B) Segregation of alleles 'A' and 'a' in meiosis I
C) Segregation of alleles 'A' and 'a' in meiosis II
D) Assortment of alleles 'A' and 'a' is independent to the crossing over.

Which of the above statement are TRUE?

(a) A and B (b) B only (c) A and C (d) B and D

43. A cross was made between the F^+ donor and F^- recipient. Which of the following statements are true?

(a) Donor become F^- (b) The recipient will remain F^-
(c) Both will become F^+ (d) Both will become F^-

44. Two parents with genotype AaBbcc and aaBbCc are crossed. If the genes assort independent to one another, what would be the probability that progeny of the genotype aabbcc in the F1?

(a) 1/4 (b) 1/8 (c) 1/2 (d) 1/16

45. The number of haploid set of chromosomes is an organism is 10, what would be the number of linkage group in the organism

(a) 10 (b) 5 (c) 20 (d) 40

PART-C

46. Which of the following covalent bond types are found in the structure of ATP?

(a) N-glycoside, thioester, phosphomonoester
(b) phosphoanhydride, phosphomonoester, N-glycoside
(c) ester, ether, phosphoanhydride
(d) ether, thioester, phosphomonoester

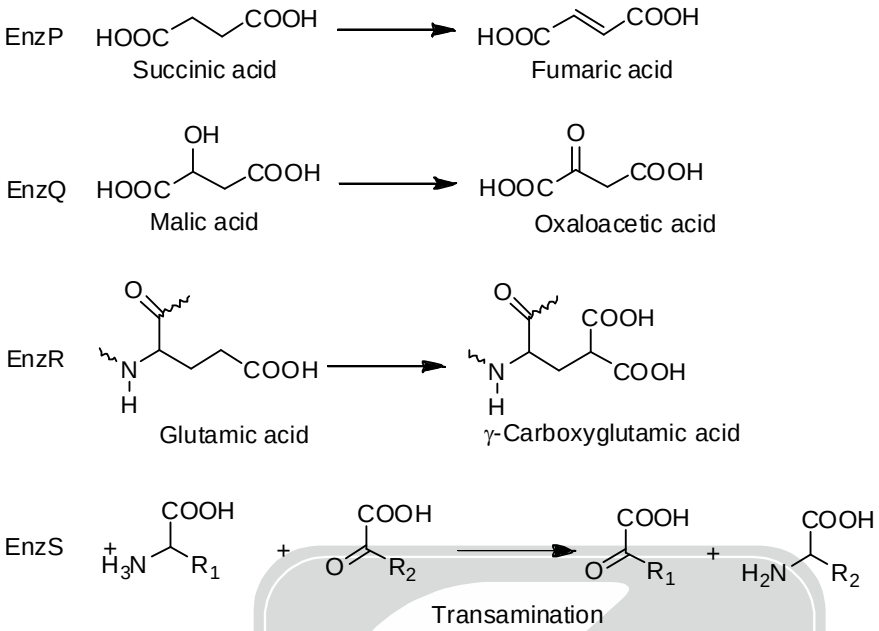
47. The composition of proteins P1 to P4 are shown below:

Protein	**Composition**
P1	Rich in polar residues; poor in apolar residues
P2	Rich in apolar residues; poor in polar residues
P3	Has comparable number of polar and apolar residues
P4	Rich in glycine and proline

Which one of the following options CORRECTLY relates the propensities of these proteins to be folded, aggregated or disordered in an aqueous buffered solution?

(a) P1, P2 and P4 are disordered and P3 is folded
(b) P1 and P3 are folded, P2 is aggregated and P4 is disordered
(c) P1 and P3 are folded, and P2 and P4 are disordered
(d) P1 and P4 are disordered, P2 aggregated and P3 is folded

48. EnzP, EnzQ, EnzR, and EnzS catalyze the metabolic reactions as shown below:



Each of the above enzymes is dependent on one of the following four vitamins (either the vitamin itself or its derivative):

Vit B2: Vitamin B2 (riboflavin)
Vit B3: Vitamin B3 (niacin)
Vit B6: Vitamin B6 (pyridoxal)
Vit K: Vitamin K

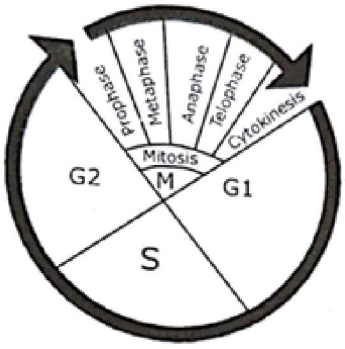
Which one of the following options gives the *correct* enzyme-vitamin matches?

(a) EnzP and Vit B3, EnzQ and Vit B2, EnzR and Vit B6, EnzS and Vit K
(b) EnzP and Vit B2, EnzQ and Vit B3, EnzR and Vit B6, EnzS and Vit K
(c) EnzP and Vit B2, EnzQ and Vit B3, EnzR and Vit K, EnzS and Vit B6
(d) EnzP and Vit B6, EnzQ and Vit B2, EnzR and Vit B3, EnzS and Vit K

49. At 25ºC values of $[\theta]_{222}$, the mean residue ellipticity at 222nm are –33000 and –3000 deg cm^2 d mol^{-1} for a polypeptide existing in α-helical (α) and β-structure (β), respectively. If this polypeptide undergoes a two state heat-induced $\alpha \rightarrow \beta$ transition and a value of $[\theta]_{222}$ = 18000 deg cm^2 d mol^{-1} is observed at 60ºC, then this observation leads to the conclusion that the α-helix conversion to β-structure is

(a) 40% (b) 50% (c) 55% (d) 60%

50. Study the following diagram depicting the plant cell cycle and match the following



Stages of cell cycle	Type of Cyclin
P. Late G1-phase	1. Cyclin B
Q. Beginning of S-phase	2. Cyclin E
R. Prior to mitotic phase	3. Cyclin A
S. Early M-phase	4. Cyclin D

(a) P-4, Q-2, R-3, S-1 (b) P-2, Q-3, R-1, S-4
(c) P-1, Q-4, R-3, S-2 (d) P-3, Q-1, R-2, S-4

51. ATP-driven pumps hydrolyze ATP to ADP and phosphate and use the energy released to pump ions or solutes across a membrane. There are many classes of these pumps and representative of each are found in all prokaryotic and eukaryotic cells. Which of the following statements about these pumps is NOT correct?

(a) P-type pumps are multipass transmembrane proteins which phosphorylate themselves during the pumping and involve in ion transport
(b) F-type pumps normally use the H^+ gradient across the membrane to drive the synthesis of ATP
(c) V-type pumps normally use voltage gradient for transport of small molecules
(d) ABC transporters primarily pump small molecules across cell membrane

52. Given below are organelles (Column-A) and properties associated with the organelles (Column-B)

Column-A	Column-B
A. Lysosomes	(i) Anterograde transport from ER to Golgi
B. *cis*-Golgi	(ii) Clathrin - coated vesicles
C. *trans*-Golgi	(iii) Cop I vesicle budding
D. Cop II vesicles	(iv) Mannose-6-phosphate receptor
E. Endocytic vesicles	(v) Protein aggregate for secretion

Choose the option that matches the organelles with the most appropriate property.

(a) A-(iv), B-(iii), C-(v), D-(i), E-(ii) (b) A-(v), B-(iv), C-(i), D-(v), E-(ii)
(c) A-(iii), B-(v), C-(i), D-(iv), E-(ii) (d) A-(iv), B-(v), C-(ii), D-(i), E-(iii)

53. Match the proteins in group I with cellular processes in group II

Group I	Group II
P. p53	1. DNA packaging
Q. Lysozyme	2. Apoptosis
R. Tubulins	3. Hydrolysis of polysaccharides
S. Histones	4. Chromosome segregation

(a) P-4, Q-2, R-3, S-1 (b) P-2, Q-3, R-1, S-4
(c) P-4, Q-3, R-1, S-2 (d) P-2, Q-3, R-4, S-1

54. Which one of the following best defines an oncogene?

(a) An oncogene never codes for a cell cycle protein, which promotes cell proliferation
(b) Oncogene are always involved in inherited forms of cancer
(c) An oncogene codes for a protein that prevents a cell from undergoing apoptosis
(d) An oncogene is a dominantly expressed mutated gene that renders a cell advantageous towards survival

55. Match the following reporter genes used in plant transformation experiments with the source of gene and detection/assay system

	Reporter gene	Source of gene	Detection/assay
P.	β-glucuronidase	1. *Aequorea victoria*	i. Radioactive assay
Q.	GFP	2. *Photinus pyralis*	ii. Fluorimetric
R.	Luciferase	3. *E. coli*	iii. Fluorescence
S.	Chloramphenicol acetyl transferase		iv. Luminescence

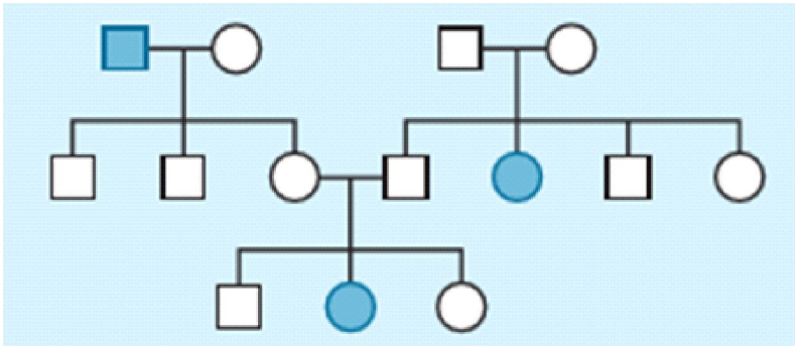
(a) P-3-i, Q-1-ii, R-2-iii, S-3-iv (b) P-3-ii, Q-1-iii, R-2-iv, S-3-i
(c) P-2-ii, Q-1-iii, R-3-iv, S-1-i (d) P-1-ii, Q-2-iii, R-3-i, S-3-iv

56. Cellular level of tumour suppressor protein p53 is maintained by the ubiquitin ligase protein. Mdm2. Over expression of Mdm2 thus stabilizing p53. Loss of function also converts normal cells into cancer cells. Based on the above information. Which one of the following statements is correct?
(a) Both MDM2 and p53 are oncogenes
(b) Both MDM2 and p53 are tumour suppressor genes
(c) MDM2 is an oncogene but p53 is a tumour suppressor gene
(d) p53 is an oncogene but MDM2 is a tumour suppressor gene

57. In the living organism cell are communicate with the help of signaling pathways.Read the statements carefully and find the WRONG statements
1) glucagon can act as primary messanger
2) Locations of the signaling receptors is intracellular
3) cAMP can act as secondary messanger
4) Hormones act through juxtacrine signaling
(a) 1, 4 (b) 2, 3 (c) 2, 4 (d) 1, 2, 4

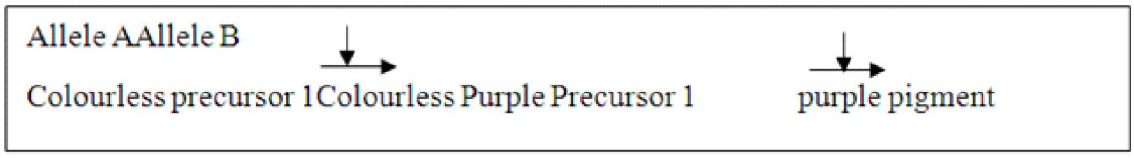
58. In a meiotic division if non-disjunction occurs at second division? What would be the expected gametes if 'n' represents the haploid number of chromosomes).
(a) only (n + 1) gametes
(b) only (n – 1) gametes
(c) All, (n), (n + 1) and (n – 1) types of gametes
(d) Both (n + 1) and (n – 1) types of gametes

59. The following is pedigree of a family of three generations suffering from a autosomal recessive disorder



What is the probability that the individual II-4 is a carrier?
(a) 100% (b) 50% (c) 25% (d) 0%

60. Given is the hypothetical pathway for purple pigment production in flowers of sweet pea:



Recessive mutation of either gene A or B leads to the formation of white flowers. A cross is made between two parents with the genotype: AaBb × aabb. Considering that the two genes assort independently, the phenotypes of the expected progenies are

(a) 9 purple : 7 white
(b) 3 white : 1 purple
(c) 3 purple : 1 white
(d) 9 purple : 4 light purple : 3 white

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TEST SERIES-1
(Part-A + Biochemistry + Cell Biology + Cell Signalling + Genetics + Relevant Technique)

Date : 23-05-2018

[ANSWER KEY]

PART-A

1. (c)	**2.** (a)	**3.** (b)	**4.** (b)	**5.** (b)
6. (a)	**7.** (c)	**8.** (b)	**9.** (a)	**10.** (a)

PART-B

11. (a)	**12.** (d)	**13.** (b)	**14.** (a)	**15.** (b)
16. (a)	**17.** (c)	**18.** (a)	**19.** (a)	**20.** (b)
21. (a)	**22.** (a)	**23.** (d)	**24.** (c)	**25.** (d)
26. (b)	**27.** (b)	**28.** (b)	**29.** (c)	**30.** (c)
31. (b)	**32.** (b)	**33.** (a)	**34.** (d)	**35.** (a)
36. (b)	**37.** (b)	**38.** (c)	**39.** (b)	**40.** (d)
41. (a)	**42.** (b)	**43.** (c)	**44.** (d)	**45.** (c)

PART-C

46. (d)	**47.** (b)	**48.** (c)	**49.** (b)	**50.** (b)
51. (c)	**52.** (a)	**53.** (d)	**54.** (d)	**55.** (b)
56. (c)	**57.** (c)	**58.** (c)	**59.** (b)	**60.** (b)