

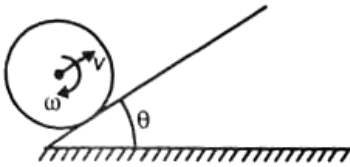
SAMPLE PAPER - 111

Time : 1 : 15 Hr.

Question : 60

PHYSICS

01. A spherical shell of mass m and radius R is rolling up without slipping on a rough inclined plane as shown in the figure. The direction of static friction acting on the shell is



- (1) Downwards along the inclined plane
 (2) Upward along the inclined plane
 (3) May be upwards or downward along the inclined plane
 (4) Static friction will not act
02. The two particles of mass M each move in a circle of radius R under the action of their mutual gravitational force of attraction. The speed of each particle is

- (1) $\sqrt{\frac{GM}{R}}$ (2) $\sqrt{\frac{GM}{2R}}$
 (3) $\sqrt{\frac{GM}{4R}}$ (4) $\sqrt{\frac{2GM}{R}}$

03. A steel wire, of uniform area 2 mm^2 , is heated up to 50°C and is stretched by tying its ends rigidly. The change in tension, when the temperature falls from 50°C to 30°C is (Take $Y=2 \times 10^{11} \text{ N m}^{-2}$, $\alpha=1.1 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$)
- (1) $1.5 \times 10^{10} \text{ N}$ (2) 5 N
 (3) 88 N (4) $2.5 \times 10^{10} \text{ N}$

04. A particle executes SHM of amplitude A and time period T . The distance travelled by the particle in the duration its phase changes from $\frac{\pi}{12}$ to $\frac{5\pi}{12}$.

- (1) $\frac{1}{\sqrt{2}}A$ (2) $\sqrt{\frac{3}{2}}A$

(3) $\frac{2}{\sqrt{3}}A$

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

05. For the harmonic travelling wave $y=2 \cos 2\pi(10t-0.0080x+3.5)$ where x and y are in cm and t is in second. What is the phase difference between the oscillatory motion at two points separated by a distance of 0.5 m :

- (1) 6.4π radian (2) 0.8π radian
 (3) π radian (4) $\frac{3\pi}{2}$ radian

06. A uniform string is clamped at its two ends. Its mass per length is given by 20 g/metre , the transverse displacement wave of the string is given by $y = 5 \sin\left(\frac{2\pi}{3}x\right) \cos(20\pi t) \text{ m}$, then tension in the string is

- (1) 9 N (2) 9.9 N (3) 1.8 N (4) 18 N

07. An insulating solid sphere of radius R has a uniform positive charge density ρ . The electric field intensity at a distance r ($r < R$) from the centre of sphere is :

- (1) $\frac{\rho \cdot r}{3 \epsilon_0}$ (2) $\frac{\rho}{\epsilon_0}$
 (3) $\frac{\rho \cdot R}{3 \epsilon_0}$ (4) $\frac{\rho}{3 \epsilon_0} (2R^2 - r^2)$.

08. An electric charge is placed at the centre of a cube of side a . The electric flux

- (1) through one of its faces $\frac{q}{6 \epsilon_0}$
 (2) through one of its faces $\frac{q}{\epsilon_0}$
 (3) through all of its faces $\frac{q}{3 \epsilon_0}$
 (4) through one of its faces $\frac{q}{2 \epsilon_0}$

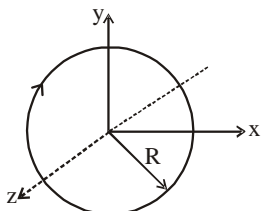
09. Two metal spheres of radii a and b are very far apart but are connected by a thin wire. Their combined charge is Q . Their absolute potential is

(1) $\frac{Q}{4\pi\epsilon_0 a}$ (2) $\frac{Q}{4\pi\epsilon_0 b}$
 (3) $\frac{Q}{4\pi\epsilon_0 (a+b)}$ (4) $\frac{Q(a+b)}{4\pi\epsilon_0 ab}$

10. An ammeter reads upto 1 ampere. Its internal resistance is 0.81 ohm. To increase the range to 10 A the value of the required shunt is
 (1) 0.09 Ω (2) 0.03 Ω (3) 0.3 Ω (4) 0.9 Ω

11. Water boils in an electric kettle in 15 minutes after switching on. If the length of the heating wire is decreased to $\frac{2}{3}$ of its initial value, then the same amount of water will boil with the same supply voltage in
 (1) 15 minutes (2) 12 minutes
 (3) 10 minutes (4) 8 minutes

12. The magnetic moment of current loop drawn in figure in x-y plane is



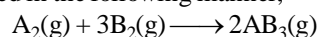
(1) $-\frac{\pi R^2}{2} \hat{j}$ (2) $\pi R^2 \hat{j}$
 (3) $\frac{\pi R^2}{2} (\hat{i} + \hat{j})$ (4) $-\pi R^2 \hat{k}$

13. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It
 (1) Will stay in north-south direction only
 (2) Will stay in east-west direction only
 (3) Will become rigid showing no movement
 (4) Will stay in any position

14. When an alternating emf $e = 300 \sin(100\pi t + \frac{\pi}{6})$ is applied to a circuit, the current I through it is $I = 5.0 \sin(100\pi t - \frac{\pi}{6})$ A. The average power consumed in the circuit is
 (1) 750 watt (2) 1500 watt
 (3) 375 watt (4) zero

15. An electric motor which is loaded has an effective resistance of 30Ω and an inductive reactance of 40Ω . If the motor is powered by a source with a maximum voltage of 420 V, the maximum current is
 (1) 6A (2) 8.4A
 (3) 10A (4) 12A

16. In a closed vessel, 5 moles of $A_2(g)$ and 7 moles of $B_2(g)$ are reacted in the following manner,



What is the total number of moles of gases present in the container at the end of the reaction?

- (1) 22/3 (2) 7/3 (3) 14/3 (4) 8/3

17. The quantum numbers $+\frac{1}{2}$ and $-\frac{1}{2}$ for the electron spin represent
 (1) rotation of the electron in clockwise and anti-clockwise direction respectively
 (2) rotation of the electron in anti-clockwise and clockwise direction respectively
 (3) magnetic moment of the electron pointing up and down respectively
 (4) two quantum mechanical spin states which have no classical analogue

18. A real gas has critical temperature and critical pressure as 40°C and 10 atm respectively, then liquefaction of gas is possible at
 (1) 50°C and 8 atm (2) 45°C and 8 atm
 (3) 25°C and 12 atm (4) 45°C and 12 atm

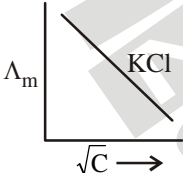
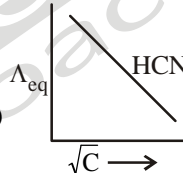
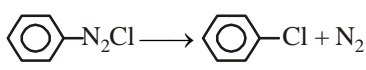
19. Consider the following statements.
 I. The water drop in vacuum is perfectly spherical.
 II. The shape of water drop is distorted due to gravity.
 III. Soaps and detergents drastically decrease the surface tension of water.
 IV. As temperature increases, surface tension also increases and becomes maximum at critical temperature.
 Select the correct statements.
 (1) I, II, III and IV (2) II, III and IV
 (3) I, II and III (4) Both I and III

20. In a process, a system does 140 J of work on the surroundings and only 40 J of heat is added to the system hence change in internal energy is
 (1) 180 J (2) -180 J (3) 100 J (4) -100 J

21. For the following equilibrium
 $2\text{Fe}(s) + 3\text{H}_2\text{O}(g) \rightleftharpoons \text{Fe}_2\text{O}_3(s) + 3\text{H}_2(g)$
 $K_c = 27$. Hence, ratio of molar concentration of $\text{H}_2(g)$ and $\text{H}_2\text{O}(g)$ is
 (1) 3 (2) 1 (3) 9 (4) 27

22. In the following,

$$[\text{Al}(\text{H}_2\text{O})_6]^{3+} + \text{HCO}_3^- \rightleftharpoons [\text{Al}(\text{H}_2\text{O})_5\text{OH}]^{2+} + \text{H}_2\text{CO}_3$$
 Species behaving as Bronsted-Lowry acids are
 (1) (A) and (D) (2) (B) and (C)
 (3) (B) and (D) (4) (A) and (C)

23. Which of the following are intramolecular redox reactions?
 I. $\text{PCl}_5 \longrightarrow \text{PCl}_3 + \text{Cl}_2$
 II. $2\text{KClO}_3 \longrightarrow 2\text{KCl} + 3\text{O}_2$
 III. $\begin{array}{c} \text{CHO} \\ | \\ \text{CHO} \end{array} + \text{OH}^- \longrightarrow \begin{array}{c} \text{COO}^- \\ | \\ \text{CH}_2\text{OH} \end{array}$
 IV. $\text{NH}_4\text{NO}_2 \longrightarrow \text{N}_2 + 2\text{H}_2\text{O}$
 (1) All except I (2) All except II
 (3) All except III (4) All except IV
24. The radius of a divalent cation M^{2+} is 94 pm and of divalent anion X^{2-} is 146 pm. Thus, $\text{M}^{2+} \text{X}^{2-}$ has
 (1) rock salt (NaCl) structure
 (2) zinc blende structure
 (3) anti-fluorite structure
 (4) bcc (CsCl) structure
25. Which is the incorrect statement?
 (1) Frenkel defect is favoured in those ionic compounds in which sizes of cation and anions are almost equal.
 (2) $\text{FeO}_{0.98}$ has non stoichiometric metal deficiency defect.
 (3) Density decreases in case of crystals with Schottky's defect.
 (4) NaCl (s) is insulator, silicon is semiconductor, silver is conductor, quartz is piezo electric crystal.
26. Which of the following statements comparing solutions with pure solvent is not correct?
 (1) A solution containing a non-volatile solute has a lower vapour pressure than pure solvent
 (2) A solution containing a non-volatile solute has a lower boiling point than pure solvent
 (3) A solution containing a non-volatile solute has a lower freezing point than pure solvent
 (4) A solution will have a greater mass than an equal volume of pure solvent if the solute has a molar mass greater than the solvent
27. Which of the following graph is/ are correct ?
 (1)  (2) 
 (3) Both (1) and (2) are correct
 (4) None of these
28. Which of the following reaction is not of first order?
 (1) $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$
 (2) 
 (3) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O} \longrightarrow \text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH}$
 (4) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \longrightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$

29. Select the incorrect statement(s)
 (1) Surface active agents like soaps and synthetic detergents are micelles
 (2) Soaps are emulsifying agents.
 (3) $\text{C}_{17}\text{H}_{35}$ (hydrocarbon part) and COO^- (carboxylate) part of stearate ion ($\text{C}_{17}\text{H}_{35}\text{COO}^-$) both are hydrophobic.
 (4) All of the above are incorrect statements
30. Select the correct statement(s).
 (1) In the decomposition of an oxide, into oxygen and gaseous metal, entropy increases.
 (2) Decomposition of an oxide is an endothermic change.
 (3) To make ΔG° negative, temperature should be high enough so that $T\Delta S^\circ > \Delta H^\circ$.
 (4) All of the above are correct statements.

BOTANY

31. In bryophytes and pteridophytes, transport of male gametes requires
 (1) Wind (2) Insects
 (3) Birds (4) Water
32. Which of the following genera is associated with coralloid roots?
 (1) Cycas (2) Taxus
 (3) Pinus (4) Sequoia
33. Match the following and select the correct option.
- | | Column-I | | Column-II |
|----|-----------|-------|--------------|
| a. | Pteris | (i) | Gymnosperm |
| b. | Cycas | (ii) | Bryophyte |
| c. | Sphagnum | (iii) | Algae |
| d. | Sargassum | (iv) | Pteridophyta |
- (1) a-iv; b-ii; c-i; d-iii (2) a-iv; b-i; c-ii; d-iii
 (3) a-ii; b-iii; c-iv; d-i (4) a-i; b-iv; c-iii; d-ii
34. The fusion of two gametes dissimilar in size, as in species of _____ is termed as _____
 (1) Chlamydomonas and isogamous
 (2) Spirogyra and isogamous
 (3) Udorina and anisogamous
 (4) Volvox and anisogamous
35. Commercial cork is obtained from
 (1) Berberis/Barberry (2) Salix/Willow
 (3) Quercus/Oak (4) Betula/Birch
36. In stems, the protoxylem lies towards the and the metaxylem lies towards the of the organ.
 (1) centre; periphery (2) periphery; centre
 (3) periphery; periphery (4) centre; centre

37. The type of diffusion in which substances move across the membrane along their concentration gradient in the presence of certain carriers or transport proteins is called as

- (1) simple diffusion (2) facilitated diffusion
(3) osmosis (4) active transport

38. Which of the following is/are pre-requisite(s) for imbibition?

- (a) Presence of mucilage in the adsorbent
(b) The affinity between the adsorbent and the liquid
(c) Water potential gradient between the adsorbent and the liquid
(d) Presence of cuticle on the surface of the adsorbent
(1) (b) and (c) (2) Only (b)
(3) (a), (b) and (c) (4) (a) and (d)

39. Reaction of α -ketoglutaric acid with ammonia to form glutamic acid is

- (1) Oxidative amination (2) Reductive amination
(3) Transamination (4) Ammonification

40. Match the Column-I with Column-II, and choose the correct combination from the options given below.

	Column-I (Minerals)		Column-II (Deficiency Symptoms)
A.	Ca	1.	Inhibition of cell division
B.	Fe	2.	Delay flowering
C.	S	3.	Necrosis
D.	Mo	4.	Chlorosis

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

41. Which statements about photosynthesis are correct?

- (a) First CO_2 acceptor in C_4 cycle is PGA
(b) In C_3 plants, first stable product of photosynthesis is RuBP
(c) Cyclic photophosphorylation results in formation of ATP
(d) Oxygen liberated during photosynthesis comes from water
(1) a and b alone are correct
(2) a and c alone are correct
(3) c and d alone are correct
(4) b and c alone are correct

42. Which of the following cell organelles is associated with photorespiration?

- (1) Mitochondria (2) Peroxisome
(3) Chloroplast (4) All of these

43. Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins?

- (1) Fructose 1, 6-bisphosphate
(2) Pyruvic acid
(3) Acetyl CoA
(4) Glucose-6-phosphate

44. Match the Column-I with Column-II, and choose the correct combination from the options given below.

	Column-I		Column-II
A.	Glycolysis	1.	Stroma
B.	Kreb's cycle	2.	Grana
C.	Calvin cycle	3.	Cytosol
D.	Photolysis of water	4.	Mitochondrial matrix
E.	ETS	5.	Inner mitochondria membrane

- (1) A-3; B-4; C-5; D-1; E-2
(2) A-4; B-3; C-5; D-2; E-1
(3) A-3; B-4; C-1; D-2; E-5
(4) A-1; B-2; C-3; D-4; E-5

45. Study the following statements.

I. 'X' hormone promotes root growth and root hair formation thus helping the plants to increase their absorption surface.

II. 'Y' hormone induces flowering in mango and also promotes rapid internode/petiole elongation in deep plants and hence helping leaves or upper parts of shoot above water.

III. 'Z' hormone inhibits the seed germination, increase the tolerance of plant to various stresses, play important role in seed development, maturation and dormancy.

Identify the correct names of hormones marked as 'X', 'Y' and 'Z'.

- (1) Y = ABA; X = Auxin; Z = GA
(2) Z = GA; X = Auxin; Y = C_2H_4
(3) Y = Auxin; X = C_2H ; Z = GA
(4) Y = C_2H_4 ; X = C_2H_4 ; Z = ABA

ZOOLOGY

46. Which of the following characteristic features always holds true for the corresponding group of animals?

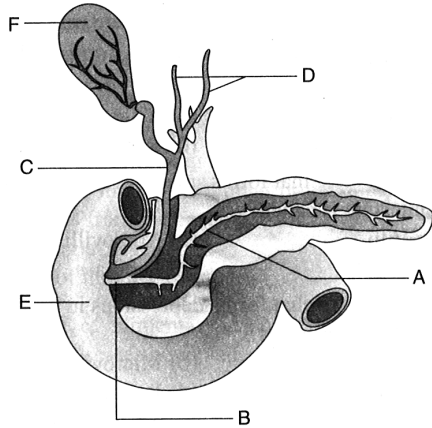
(1)	Viviparous	Mammalia
(2)	Possess a mouth with an upper and a lower jaw	Chordata
(3)	Three-chambered heart with one incompletely divided ventricle.	Reptilia
(4)	Cartilaginous endoskeleton	Chondrichthyes

47. The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in:

- (1) Fallopian tubes and Pancreatic duct
(2) Eustachian tube and salivary duct
(3) Bronchioles and Fallopian tubes
(4) Bile duct and Bronchioles

48. Which of the following is correct for epithelial tissue?
 (1) It is present only as inner lining.
 (2) It is present only as outer lining.
 (3) Contains very less intercellular matrix.
 (4) All of these

49. Identify A to F in the given figure.



- (1) A–Common bile duct, B–Gall bladder, C–Pancreatic duct, D–Duodenum, E–Hepatopancreatic duct, F–Ducts from liver
 (2) A–Pancreatic duct, B–Hepatopancreatic duct, C–Common bile duct, D–Ducts from liver, E–Duodenum, F–Gall bladder
 (3) A–Hepatopancreatic duct, B–Ducts from liver, C–Pancreatic duct, D–Gall bladder, E–Duodenum, F–Common bile duct
 (4) A–Gall bladder, B–Common bile duct, C–Duodenum, D–Pancreatic duct, E–Hepatopancreatic duct, F–Ducts from liver.

50. Which of the following statement is incorrect?
 (1) Faecal accumulation in the rectum initiates a neural reflex causing an urge for its removal.
 (2) Reflex of vomiting is controlled by medulla.
 (3) Irregular bowel movements cause constipation.
 (4) In diarrhoea, absorption of food is increased.

51. Fill in the blanks in the below table.

Blood Group	Antigens on RBCs	Antibody in Plasma	Donor Groups
A	A	Anti-B	A, O
B	B	II	B, O
AB	AB	NIL	A, B, ABO, O
O	I	III	IV

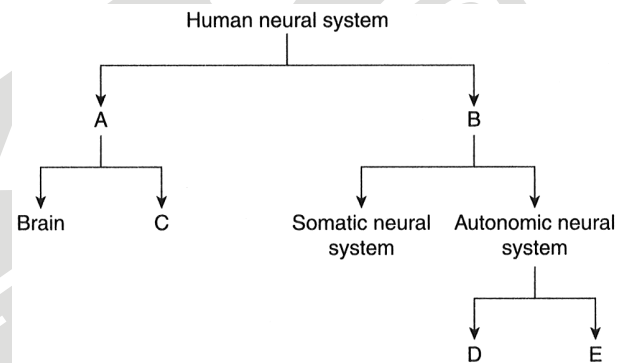
- (1) I–Nil; II–Nil; III–Nil; IV–O
 (2) I–Nil; II–Nil; III–Anti-A; IV–AB
 (3) I–Nil; II–Anti-B; III–Anti-B; IV–O
 (4) I–Nil; II–Anti-A; III–Anti-A and B; IV–O

52. Match the columns.

	Column-I		Column-II
(A)	Heart failure	(1)	Heart muscle is suddenly damaged by inadequate blood supply
(B)	Cardiac arrest	(2)	Chest pain due to inadequate O ₂ reaching the heart muscles
(C)	Heart attack	(3)	Atherosclerosis
(D)	Coronary artery disease	(4)	Heart not pumping blood effectively enough to meet the needs of body (CAD).
(E)	Angina pectoris	(5)	Heart stops beating.

- (1) A–4, B–5, C–1, D–3, E–2
 (2) A–4, B–5, C–3, D–1, E–2
 (3) A–4, B–3, C–5, D–2, E–1
 (4) A–5, B–4, C–2, D–3, E–1

53. Identify A, B, C and E in the following diagram.



- (1) A–Central nervous system (CNS), B–Peripheral nervous system (PNS), C–Spinal cord, D–Sympathetic neural system, E–Parasympathetic neural system.
 (2) A–Peripheral nervous system (PNS), B–Parasympathetic neural system, C–Central nervous system (CNS), D–Sympathetic neural system, E–Spinal cord.
 (3) A–Parasympathetic neural system, B–Spinal cord, C–Central nervous system (CNS), D–Sympathetic neural system, E–Peripheral nervous system (PNS).
 (4) A–Central nervous system (CNS), B–Spinal cord, C–Peripheral nervous system (PNS), D–Sympathetic neural system, E–Parasympathetic neural system.

54. Find out the incorrect statement from the following.

- (1) Lens is transparent and crystalline structure.
 (2) Iris is pigmented and opaque layer.
 (3) Aperture surrounded by iris is called pupil.
 (4) Twilight vision is the function of cones.

55. Ivan Pavlov performed experiments on

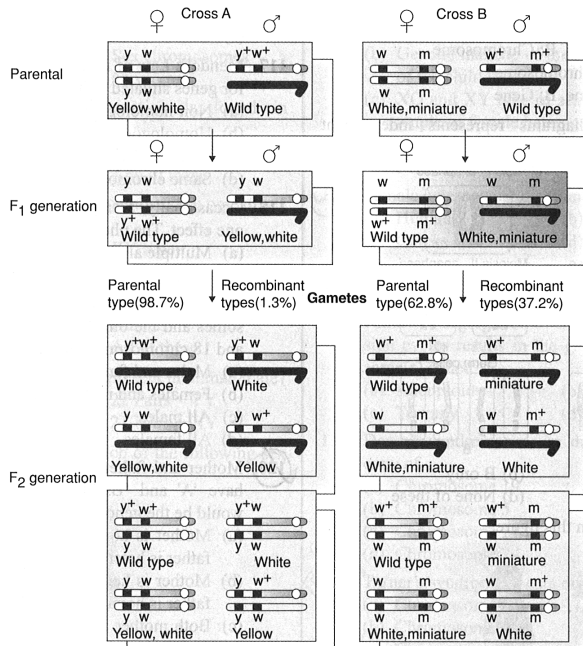
- (1) Simple reflexes (2) Conditioned reflexes
 (3) Cardiac reflexes (4) Origin of life

56. Match the following hormones with the respective disease:

(A)	Insulin	(i)	Addison's disease
(B)	Thyroxin	(ii)	Diabetes insipidus
(C)	Corticoids	(iii)	Dwarfism
(D)	Growth Hormone	(iv)	Goitre
		(v)	Diabetes mellitus

- (1) (A)–(ii); (B)–(iv); (C)–(iii); (D)–(i)
 (2) (A)–(v); (B)–(iv); (C)–(i); (D)–(iii)
 (3) (A)–(ii); (B)–(iv); (C)–(i); (D)–(iii)
 (4) (A)–(v); (B)–(i); (C)–(ii); (D)–(iii)

57. Which cross shows loosely incomplete linkage?



- (1) Cross A (2) Cross B
 (3) Both (1) and (2) (4) None of these

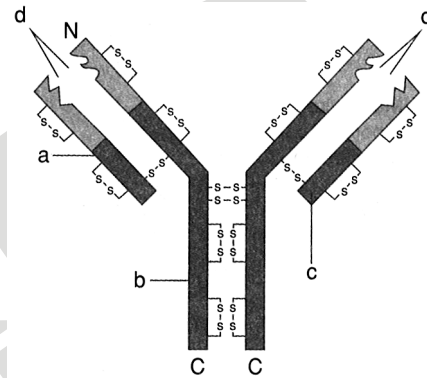
58. The following features belong to which syndrome?

- (A) Furrowed tongue
 (B) Palm is broad with characteristic palm crease
 (C) Physical, psychomotor and mental retardation
 (D) Short statured with small round head
 (1) Down's syndrome
 (2) AIDS
 (3) Turner's syndrome
 (4) Klinefelter's syndrome

59. Which of the following is true about Phenylketonuria?

- (1) Mental retardation
 (2) Accumulation of phenylpyruvic acid and other derivatives
 (3) Autosomal recessive trait
 (4) All the above

60. What is indicated by 'd' in the figure?



- (1) Light chain
 (2) Heavy chain
 (3) Antigen binding site
 (4) CMI