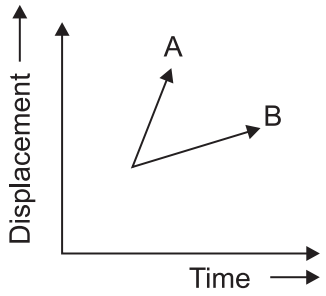
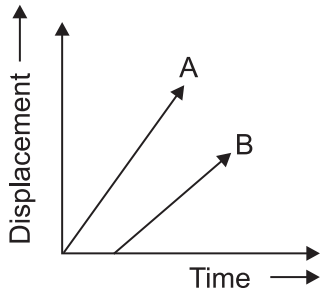
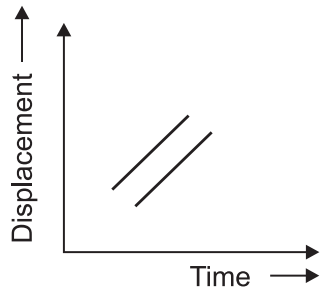
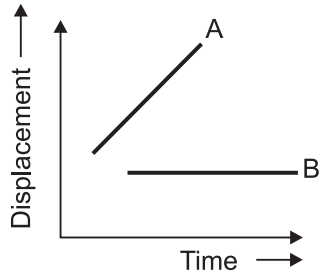
PHYSICS

1. Which of the following represents the displacement-time graph of two objects A and B moving with equal velocity?

(1) 

(2) 

(3) 

(4) 

2. A particle moves from position $\vec{r}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$ to position $\vec{r}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ under the action of force $4\hat{i} + \hat{j} + 3\hat{k}$ N. The work done by this force will be

(1) 100 J

(2) 50 J

(3) 200 J

(4) 75 J

3. Two particles of combined mass M, placed in space with certain separation, are released. Interaction between the particles is only of gravitational nature and there is no external force present. Acceleration of one particle with respect to the other when separation between them is R, has a magnitude

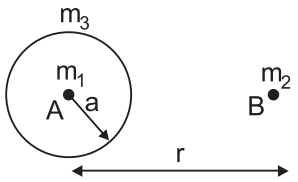
(1) $\frac{GM}{2R^2}$

(2) $\frac{GM}{R^2}$

(3) $\frac{2GM}{R^2}$

(4) not possible to calculate due to lack of information

4. Two point masses of mass m_1 and m_2 are placed at point A and B respectively as shown in figure. Point A is the centre of hollow sphere of uniformly distributed total mass m_3. Consider only gravitational interaction between all masses and neglect other gravitational forces. Select the incorrect alternative.



(1) Hollow sphere and point mass m_1 moves with same acceleration.

(2) m_1 and m_2 moves with same acceleration.

(3) Net force on m_1 is non-zero

(4) Net force on hollow sphere and point mass m_1 as a system is equal to force experienced by point mass m_2 in magnitude.

5. A bullet of mass 10 g is fired with a rifle. The bullet takes 0.003 s to move through its barrel and leaves with a velocity of 300 ms^{-1}. The force exerted on the bullet by the rifle is

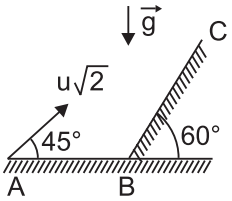
(1) 10^3 N

(2) 10^4 N

(3) 10^5 N

(4) zero

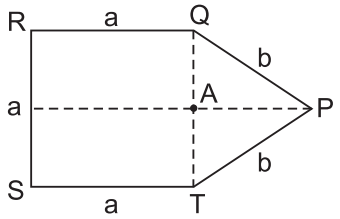
6. A particle is projected from point 'A' with velocity $u\sqrt{2}$ at an angle of 45º with the horizontal as shown in the figure. It strikes the inclined plane BC at right angle. The velocity of the particle just before the collision with the inclined is



(1) $\frac{\sqrt{3}u}{2}$ (2) $\frac{u}{2}$

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

7. A homogeneous plate PQRST is as shown in figure. The centre of mass of plate lies at midpoint A of segment QT. Then the ratio of $\frac{b}{a}$ is (PQ = PT = b; QR = RS = ST = a)



(1) $\frac{13}{4}$ (2) $\frac{13}{2}$

(3) $\sqrt{\frac{13}{2}}$ (4) $\sqrt{\frac{13}{4}}$

8. A household electric power outlet (assume 220 V constant voltage) is fused to cut at if the current equals or exceeds 20 ampere. A 2 kW heater, 1kW Air conditioner and three 100 W bulbs are already running at rated power. If now somebody wants to run a computer then computer can run without causing fuse to burn if power requirement of computer is (neglect losses in current carrying wire)

(1) 1000 W (2) 500 W

(3) 7000 W (4) 6500 W

9. In a certain system of units, 1 unit of time is 5 sec, 1 unit of mass is 20 kg and unit of length is 10 m. In this system, one unit of power will correspond to

(1) 16 watts (2) 17 watts

(3) 21 watts (4) 25 watts

10. Two identical balls P and Q moving in the $x-y$ plane collide at the origin ($x = 0$, $y = 0$) of the coordinate system. Their velocity components just before the moment of impact were, for ball P, $v_x = 6$ m/s, $v_y = 0$; for ball Q, $v_x = -5$ m/s, $v_y = 2$ m/s

As a result of the collision, the ball P comes to rest. The velocity components of the ball Q just after collision will be

(1) $v_x = v_y = 1$ m/s

(2) $v_x = 1$ m/s, $v_y = 2$ m/s

(3) $v_x = 2$ m/s, $v_y = 1$ m/s

(4) $v_x = 1$ m/s, $v_y = 3$ m/s

Paragraph for Q.No. 11 and Q.No. 12.

An ideal gas initially at pressure p_0 undergoes a free expansion (expansion against vacuum under adiabatic conditions) until its volume is 3 times its initial volume. The gas is next adiabatically compressed back to its original volume. The pressure after compression is $3^{2/3}p_0$.

11. The pressure of the gas after the free expansion is

(1) $\frac{p_0}{3}$ (2) $p_0^{1/3}$

(3) p_0 (4) $3p_0$

12. The gas is

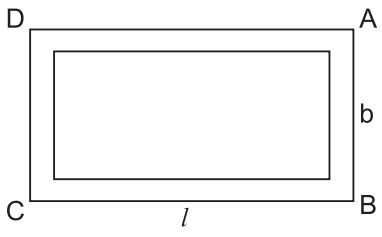
(1) monoatomic

(2) diatomic

(3) polyatomic

(4) type is not possible to decide from the given information

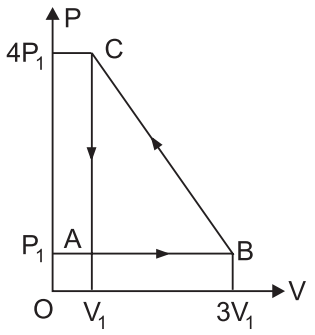
13. In the figure shown ABCD is a rectangular smooth tube kept fixed in a vertical plane. A particle is projected from point A to reach point C with some speed. At the corners B and D velocity changes its direction by 90º without any change of its magnitude at that corner. If time taken on paths ABC and ADC are t_1 and t_2 respectively, then (given $\ell > b$)



(1) $t_1 = t_2$ (2) $t_1 > t_2$

(3) $t_1 < t_2$ (4) $t_1 = 2t_2$

14. An ideal gas is taken via path ABCA as shown in Figure. The network done in the whole cycle is



(1) $3P_1V_1$ (2) $-3P_1V_1$

(3) $6\ P_1V_1$ (4) zero

15. What would be the most likely value for C_T, the molar heat capacity at constant temperature?

(1) 0

(2) $0 < C_T < C_V$

(3) $C_V < C_T < C_P$

(4) $C_T = \infty$

16. A rough vertical board has an acceleration *a* along the horizontal so that a block of mass M pressing against it does not fall. The coefficient of friction between block and the board is

(1) $> a/g$ (2) $< g/a$

(3) $= a/g$ (4) $\geq g/a$

17. If a car is moving at a speed of 20 ms^{-1}, and so within 15 s it accelerates uniformly and reaches speed of 50 ms^{-1}. So acceleration rate of car was

(1) 1 ms^{-1} (2) 2 ms^{-1}

(3) 3 ms^{-1} (4) 5 ms^{-1}

18. Dimensions of torque are

(1) $[M^2\ L^2\ T^2]$ (2) $[ML^2\ T^{-2}]$

(3) $[ML^2\ T^{-1}]$ (4) $[ML\ T^{-1}]$

19. For a satellite escape velocity is 11 km/s. If the satellite is launched at an angle of 60° with the vertical, then escape velocity will be

(1) 11 km/s (2) $11\sqrt{3}$ km/s

(3) $11/\sqrt{3}$ km/s (4) 33 km/s

20. A particle executes S.H.M. of amplitude A. At what distance from mean position its kinetic energy is equal to its potential energy?

(1) 0.51 A (2) 0.61 A

(3) 0.71 A (4) 0.81 A

CHEMISTRY

21. Which of the following oxidation number is not shown by Xenon (Xe)?

(1) +5

(2) +4

(3) +6

(4) 0

22. The equilibrium constant for the following two reactions are K_1 and K_2 respectively.

$XeF_6\ (g) + H_2O\ (g) \Leftrightarrow XeOF_4\ (g) + 2HF\ (g)$

$XeO_4\ (g) + XeF_6\ (g) \Leftrightarrow XeOF_4\ (g) + XeO_3F_2\ (g)$

The equilibrium constant for the given reaction is:

$XeO_4\ (g) + 2HF\ (g) \Leftrightarrow XeO_3F_4\ (g) + H_2O\ (g)$

(1) $K_1\ K_2^2$

(2) $K_1 - K_2$

(3) K_2 / K_1

(4) K_1 / K_2

23. Bonds present in $CuSO_4.\ 5H_2O(s)$ is

(1) electrovalent and covalent

(2) electrovalent and coordinate

(3) electrovalent, covalent and coordinate

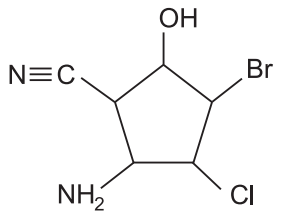
(4) covalent and coordinate

24. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm, the value of K is

(1) 0.18 atm (2) 1.8 atm

(3) 3 atm (4) 0.3 atm

25. The correct IUPAC name of the given compound is



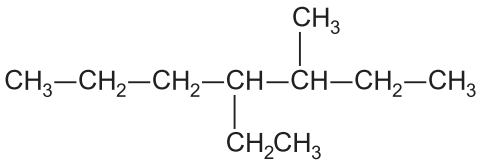
(1) 5-Amino-3-bromo-4-chloro-2-hydroxycyclopentane-1-carbonitrile

(2) 1-Amino-3-bromo-2-chloro-4-hydroxycyclopentane-5-carbonitrile

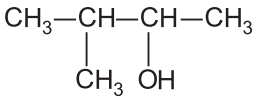
(3) 2-Amino-4-bromo-3-chloro-5-hydroxycyclopentane-1-carbonitrile

(4) 2-Amino-3-chloro-3-bromo-5-hydroxycyclopentane-1-nitrile

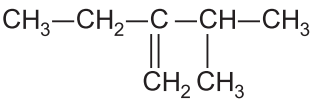
26. Names of some compounds are given. Which one is not as per IUPAC system?

(1) 

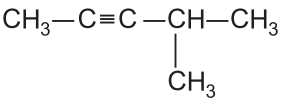
3–Methyl–4–ethyl heptane

(2) 

3–Methyl–2–butanol

(3) 

2–Ethyl–3–methyl–but–1–ene

(4) 

4–Methyl–2–pentyne

27. Which of the following atom(s) does not have maximum oxidation state as +7?

(1) Cl (2) F

(3) I (4) Br

28. Which of the following are polar?

(1) XeF_4 (2) SF_6

(3) $XeOF_4$ (4) XeF_5^-

29. The percentage of *p*-character in the orbitals forming P – P bonds in P_4 is

(1) 25 (2) 33

(3) 50 (4) 75

30. A gas cylinder containing cooking gas can withstand a pressure of 14.9 atmosphere. The pressure guaze of cylinder indicates 12 atmosphere at 27 ºC. Due to sudden fire in the building temperature starts rising. The temperature at which cylinder will explode is

(1) 372.5 K (2) 299.5ºC

(3) 200ºC (4) 472.5 K

31. A hydrogen - like atom has ground state binding energy 122.4 eV. Then:

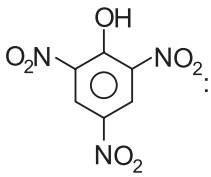
(1) its atomic number is 3

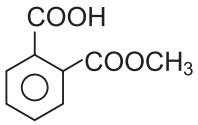
(2) a photon of 90 eV can excite it to a higher state

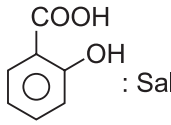
(3) a 80 eV photon can excite it to a higher state

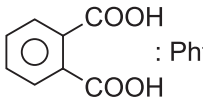
(4) both (1) and (3)

32. Which is not correctly matched with its common name?

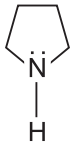
(1)  : Picric acid

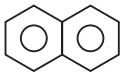
(2)  : Aspirin

(3)  : Salicylic acid

(4)  : Phthalic acid

33. Which of the following is aromatic compound?

(1)  (2) 

(3)  (4) All of these

34. The volume of oxygen required for complete combustion of 0.25 cm^3 of CH_4 at S.T.P. is

(1) 0.25 cm^3 (2) 0.5 cm^3

(3) 0.75 cm^3 (4) 1 cm^3

35. Which of the following has highest hydration energy?

(1) $MgCl_2$ (2) $CaCl_2$

(3) $BaCl_2$ (4) $SrCl_2$

36. Atomic models have been improved over the years. Arrange the following atomic models in the order of their chronological order:

(i) Rutherford's atomic model

(ii) Thomson's atomic model

(iii) Bohr's atomic model

(1) (i), (ii) and (iii)

(2) (ii), (iii) and (i)

(3) (ii), (i) and (iii)

(4) (iii), (ii) and (i)

37. A mixture contains one gm of each H_2, He and N_2, which gas will exert a greatest pressure in the container?

(1) H_2

(2) N_2

(3) He

(4) All will exert equal pressure

38. Approximately what percent of matter in the universe is believed to consist of hydrogen?

(1) 25% (2) 50%

(3) 75% (4) 90%

39. White phosphorus reacts with caustic soda. The products are PH_3 and NaH_2O_2.

(1) Oxidation

(2) Reduction

(3) Oxidation and Reduction

(4) Neutralisation

40. Vapours of ethyl alcohol when passed over phosphoric acid at 220 degree Centigrade gives

(1) diethyl phosphate

(2) methylene

(3) ethyl hydrogen phosphate

(4) ethylene

BIOLOGY

41. Plants absorb dissolved nitrates from soil and convert them into

(1) free nitrogen (2) urea

(3) ammonia (4) proteins

42. Out of 900 reported species of living gymnosperms, conifers are represented by about 500 species. About 2,50,000 species of angiosperms (flowering plants) have also been reported in the world. The vast and dominant woodlands in Europe, Asia, North America and mountains such as Himalayas are wooded with

(1) all gymnosperms, except conifers

(2) only angiosperms

(3) only conifers

(4) angiosperms and all gymnosperms except conifers

43. Other than spreading malaria, anopheles mosquitoes are also vectors of

(1) dengue fever (2) filariasis

(3) encephalitis (4) yellow fever

44. Out of proteins, lipids and carbohydrates present in a cell membrane, what is true?

(1) Lipids are maximum

(2) Carbohydrates are minimum

(3) Carbohydrates are maximum

(4) All three are in equal proportion

45. Most of the red, blue and purple colours of plants are due to a pigment called

(1) anthocyanin (2) carotene

(3) chlorophyll (4) xanthophylls

46. Poison glands of snakes are homologous to

(1) electric organs of fishes

(2) stings of rays

(3) sebaceous glands of mammals

(4) salivary glands of vertebrates

47. Radical vascular bundles are those in which

(1) xylem and phloem occur on the different radii

(2) xylem is surrounded by phloem

(3) phloem is surrounded by xylem

(4) xylem and phloem occur on the same radius

48. Oxyreductases, transferases, hydrolases, lyases, isomerases and ligases are all classes of

(1) hormones (2) enzymes

(3) proteins (4) vitamins

49. The region where bacterial genome resides is termed as

(1) nucleus

(2) cytoplasm

(3) nucleoid

(4) ribosome free region

50. Extra chromosomal, circular, double stranded, self-replicating DNA molecule in bacteria is called

(1) cosmid (2) plasmid

(3) phagemid (4) phasmid

51. Amphimixis in plants means development not a plant

(1) without fusion of gametes

(2) from stem cuttings

(3) from root cuttings

(4) from fusion of two gametes

52. One of the following shows one celled suspensor.

(1) Wheat (2) Petunia

(3) Hedera (4) Solanum

53. Which of the following organelle is involved in xenobiotic detoxification?

(1) Golgi (2) Lysosome

(3) SER (4) RER

54. Ribophorins are

(1) transmembrane glycoprotein on RER

(2) transmembrane glycoprotein on SER

(3) luminal proteins on RER

(4) luminal proteins on SER

55. An essential process connected with photosynthesis is

(1) synthesis of glucose

(2) photophosphorylation

(3) photolysis of water

(4) breakdown of glucose

56. The percentage of light energy fixed in photosynthesis is generally around

(1) 0.1% (2) 100%

(3) 10% (4) 1%

57. In adult man the total alveolar surface area in the lungs is

(1) 100 m^2 (2) 50 m^2

(3) 10 m^2 (4) 125 m^2

58. The movement of chloride ions into erythrocytes from the plasma to maintain osmotic balance during transport of gases is known as

(1) Chlorination

(2) CO_2 transport

(3) Hamburger phenomenon

(4) Passive transport

59. The exchange of respiratory gases in the lung occur in

(1) alveoli (2) trachea

(3) bronchiole (4) bronchi

60. Which of the following statements is true for the pollen tube?

(1) It shows only tip growth

(2) It is composed of three non-cellular zones

(3) It shows chemostatic movements

(4) It shows radial cytoplasmic streaming

41. If $|z - i| \le 2$ and $z_0 = 5 + 3i$ then the maximum value of $|iz + z_0|$ is

(1) 7 (2) $2 + \sqrt{31}$

(3) $\sqrt{31} - 2$ (4) 9

42. The value of $1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + ... + 99^2 - 100^2$ is

(1) –100

(2) –2500

(3) –5050

(4) –2520

43. The equation of circumcircle of an equilateral triangle is $x^2 + y^2 + 2gx + 2fy + c = 0$ and one vertex of the triangle is (1, 1). The equation of incircle of the triangle is

(1) $4(x^2 + y^2) = g^2 + f^2$

(2) $4(x^2 + y^2) + 8gx + 8fy = (1 - g)(1 + 3g) + (1 - f)(1 + 3f)$

(3) $4(x^2 + y^2) + 8gx + 8fy = g^2 + f^2$

(4) $4(x^2 + y^2) = 4(g^2 + f^2)$

44. The variance of 20 observations is 5. If each observations is multiplied by 2, then the new variance of the resulting observations is

(1) 10

(2) 20

(3) 30

(4) 40

45. Sita has 4 different and Simmi has 7 different toys. Number of ways in which they can exchange their toys so that each keeps her inital number of toys, is

(1) 329

(2) 334

(3) 332

(4) 345

46. In a series of 5 matches in football (A team has equal chances to win, lose or draw a match). The probability that a forecast selected at random has exactly 2 correct predictions, is

(1) $\frac{163}{243}$

(2) $\frac{40}{243}$

(3) $\frac{60}{243}$

(4) $\frac{80}{243}$

47. If $(t^2, 2t)$ is one end of a focal chord of the parabola $y^2 = 4x$, then which is true?

(1) Length of the focal chord is $\left(t + \frac{1}{t}\right)^2$.

(2) Slope of the focal chord is $\frac{2}{t-1}$.

(3) Mid-point of focal chord is focus.

(4) Focal-chord is angle bisector of tangent and the normal at $(t^2, 2t)$ to the parabola.

48. The last term in the binomial expansion of $\left(\sqrt[3]{2} - \frac{1}{\sqrt{2}}\right)^n$ is $\left(\frac{1}{3.\sqrt[3]{9}}\right)^{\log_3 8}$, then the fifth term is

(1) $2.{}^{10}C_4$ (2) ${}^{10}C_4$

(3) ${}^{10}C_7$ (4) $\frac{1}{\sqrt{2}}\,{}^{10}C_4$

49. The exhaustive range of values of 'a' such that the angle between the pair of tangents drawn from (a, a) to the circle $x^2 + y^2 - 2x - 2y - 6 = 0$ lies in the range $\left(\frac{\pi}{3}, \pi\right)$, is

(1) $(1, \infty)$

(2) $(-5, -3) \cup (3, 5)$

(3) $(-3, -1) \cup (3, 5)$

(4) $(-\infty, -2\sqrt{2}) \cup (2\sqrt{2}, \infty)$

50. If ${}^nC_4$, ${}^nC_5$, ${}^nC_6$, are in A.P, then a value of n is

(1) 11 (2) 14

(3) 18 (4) 8

51. If $z_1 = 5 + 12i$ and $|z_2| = 4$ then

(1) maximum $(|z_1 + iz_2|) = 19$

(2) minimum $(|z_1 + (1 + i)z_2|) = 15 - 4\sqrt{2}$

(3) minimum $\left|\dfrac{z_1}{z_2 + \dfrac{4}{z_2}}\right| = \dfrac{13}{4}$

(4) maximum $\left|\dfrac{z_1}{z_2 + \dfrac{4}{z_2}}\right| = \dfrac{13}{3}$

52. In a room containing 28 people, there are 18 people who speak English, 15 people who speak Hindi and 22 people who speak Kannada, 9 persons speak both English and Hindi, 11 persons speak both Hindi and Kannada whereas 13 persons speak both Kannada and English. How many people speak all the three languages?

(1) 6 (2) 7

(3) 8 (4) 9

53. The arithmetic mean of greatest and least integral values of λ so that $(\lambda^2 + 1, \lambda - 1)$ and origin lie on the same side of $x - 10y - 2 = 0$ is

(1) 0 (2) 4

(3) 5 (4) 8

54. In a beauty contest, half the number of experts voted for Mr. A and two thirds voted for Mr. B. 10 voted for both and 6 did not vote for either. How many experts were there in all?

(1) 24 (2) 36

(3) 18 (4) 48

55. Let R be a relation "$(x - y)$ is divisible by m", where x, y, m are integers and $m > 1$, then R is

(1) symmetric but not transitive

(2) partial order

(3) equivalence relation

(4) antisymmetric and not transitive

56. Which of the following statements is correct?

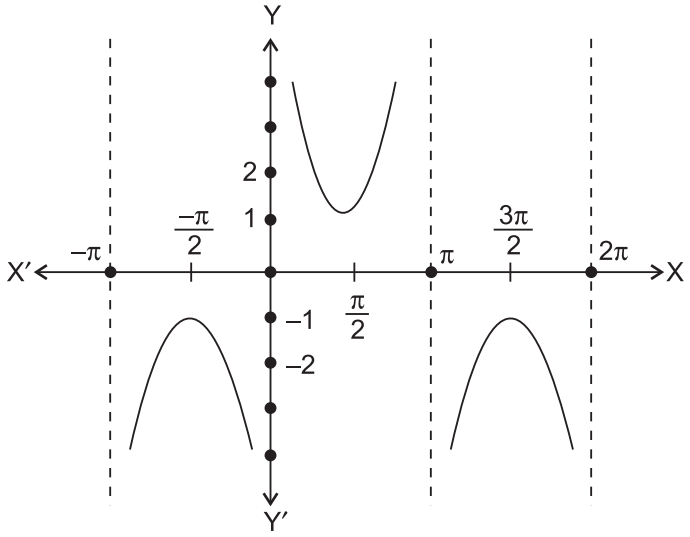
(1) The function $y = \sin x$ is periodic with period 2π.

(2) The function $y = \text{cosec}\, x$ is periodic with period $\pi/2$.

(3) The function $y = \cos x$ is periodic with period $3\pi/2$.

(4) The function $y = \tan x$ is periodic with period π.

57. The following graph represents



(1) cosec x (2) sin x

(3) cos x (4) sec x

58. Evaluate: $\lim\limits_{x \to \frac{\pi}{2}} (\sec x - \tan x)$

(1) 4 (2) 2

(3) 0 (4) 1

59. Evaluate: $\lim\limits_{x \to 0} \dfrac{\sin(2 + x) - \sin(2 - x)}{x}$

(1) 2 cos 2 (2) 2 sin 2

(3) 2 sin 4 (4) 2 cos 4

60. A box of fuses contains 20 fuses, of which 5 are defective. If 3 of the fuses are selected at random and removed from the box in succession without replacement, what is the probability that all three fuses are defective?

(1) $\dfrac{1}{114}$ (2) $\dfrac{3}{119}$

(3) $\dfrac{2}{117}$ (4) $\dfrac{3}{127}$

END OF THE EXAM