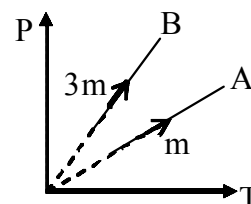


PART - I**PHYSICS**

1. During an experiment an ideal gas is found to obey an additional law $VP^2 = \text{constant}$. The gas is initially at temperature T and volume V , when it expands to volume $2V$, the resulting temperature is -

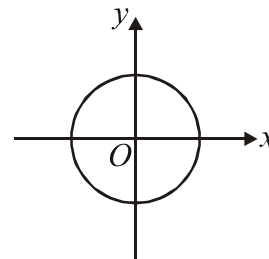
(a) $T/2$ (b) $2T$ (c) $\sqrt{2}T$ (d) $T/\sqrt{2}$

2. Two different masses m and $3m$ of an ideal gas are heated separately in a vessel of constant volume. The pressure P and absolute temperature T , graphs for these two cases are shown in the figure as A and B. The ratio of slopes of curves B to A is :



(a) 3 : 1 (b) 1 : 3
(c) 9 : 1 (d) 1 : 9

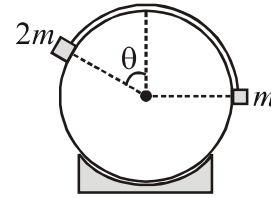
3. An object moves at constant speed along a circular path in a horizontal xy plane, with the center as origin. When the object is at $x = -2m$, its velocity is $-4\hat{j} m/s$. Its acceleration when it is at $y = 2m$ is



(a) $-8\hat{i} m/s^2$ (b) $-2\hat{j} m/s$
(c) $-8\hat{j} m/s^2$ (d) $2\hat{i} m/s^2$

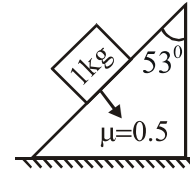
SPACE FOR ROUGH WORK

4. A mass $2m$ lies on a fixed, smooth cylinder. An ideal string attached to $2m$ passes over the cylinder to mass m . Then the value of angle θ for which system is in equilibrium



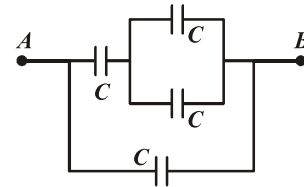
- (a) 40° (b) 45°
 (c) 60° (d) 30°

5. Find the contact force on the block having mass 1 kg. (Assume wedge to be fixed). Take $g = 10\text{ms}^{-2}$



- (a) $2\sqrt{5}N$ (b) $3\sqrt{5}N$
 (c) $4\sqrt{5}N$ (d) $5\sqrt{5}N$

6. Four equal capacitors, each of capacity C , are arranged as shown. The point A and B is connected with a battery of emf V volt. The work done by battery will be :



- (a) $\frac{5}{8}CV$ (b) $\frac{3}{5}CV$ (c) $\frac{5}{3}CV$

(d) CV

7. The optical path of a monochromatic light is the same if it goes through 2.00 cm of glass or 2.25 cm of water. If the refractive index of water is 1.33, what is the refractive index of glass ?

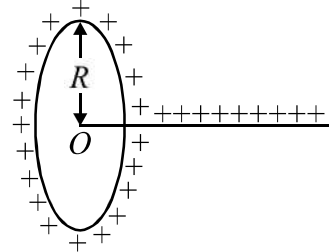
- (a) 1.4 (b) 1.5 (c) 1.6 (d) 1.38

SPACE FOR ROUGH WORK

12. The rms value of electric field of light coming from the sun is 720 NC^{-1} . The average total energy density of e.m. wave is :

- (a) $3.3 \times 10^{-3} \text{ Jm}^{-3}$ (b) $4.58 \times 10^{-6} \text{ Jm}^{-3}$ (c) $6.37 \times 10^{-9} \text{ Jm}^{-3}$ (d) $81.35 \times 10^{-12} \text{ Jm}^{-3}$

13. A ring of radius R carries a charge q uniformly distributed over it. A long thin wire carrying charge λ per unit length is held along its axis with one end coinciding with the centre of the ring. Find the interaction between the ring and the thread



(a) $\frac{q \lambda}{2 \pi \epsilon_0 R}$ (b) $\frac{2q \lambda}{\pi \epsilon_0 R}$

(c) $\frac{4q \lambda}{\pi \epsilon_0 R}$ (d) $\frac{q \lambda}{4 \pi \epsilon_0 R}$

14. A plano-convex lens has a focal length of 30 cm . Its convex surface is silvered. Point object is placed at a distance of 15 cm from it. Then, the magnification produced is : (given $\mu_g = 1.5$)

- (a) 0.2 (b) 0.4 (c) 0.5 (d) 0.6

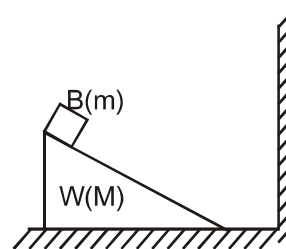
SPACE FOR ROUGH WORK

Set - A

15. The velocity of the image when the object and plane mirror both are moving towards each other with velocities 2ms^{-1} and 4ms^{-1} , is :

- (a) 5 m/s (b) 7 m/s (c) 10 m/s (d) 8 m/s

16. In the figure the block B of mass m starts from rest at the top of a wedge W of mass M . All surfaces are without friction. W can slide on the ground B slides down onto the ground, moves on it with a speed v , has an elastic collision with the wall, and climbs back onto W. Choose the wrong option:



(a) From the beginning, till the collision with the wall, the centre of mass of 'B plus W' does not move horizontally

(b) After the collision, the centre of mass of 'B plus W' moves with the velocity $\frac{2mv}{m+M}$

(c) B will reach the top of W again

(d) When B reaches its highest position on W, the speed of W is $\frac{2mv}{m+M}$

17. In Young's experiment, wavelength of red light is 7.8×10^{-8} cm and that of blue light is 5.2×10^{-8} cm. Value of n for which $(n + 1)$ th blue bright line coincides with n th red fringe is –

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

SPACE FOR ROUGH WORK

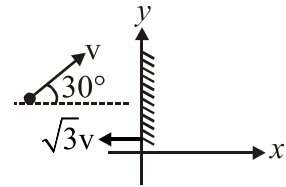
18. A wall has two layer A and B, each made of a different material. Both layers have the same thickness. The thermal conductivity of the material of A is twice that of B. Under thermal equilibrium, the temperature difference across the wall is 36°C . The temperature difference across layer A is

- (a) 6°C (b) 24°C (c) 10°C (d) 12°C

19. Two liquids of same volume take 324 s and 810 s respectively in cooling from 60°C to 50°C in identical circumstances. If the ratio of specific heats of these liquids is 3 : 4, then the ratio of their densities will be – (Water equivalent of calorimeter is negligible)

- (a) $\frac{3}{4}$ (b) $\frac{4}{9}$ (c) $\frac{8}{15}$ (d) $\frac{9}{20}$

20. An insect moves with a velocity v towards the plane mirror. Mirror is moving with velocity $\sqrt{3}v$ as shown. The velocity of the image will be :



- (a) $-v\hat{i} + \frac{\sqrt{3}}{2}v\hat{j}$ (b) $-\frac{v}{2}\hat{i} - \frac{\sqrt{3}}{2}v\hat{j}$
 (c) $-\frac{5\sqrt{3}}{2}v\hat{i} + \frac{1}{2}v\hat{j}$ (d) $-\frac{v}{2}\hat{i} + \frac{\sqrt{3}}{2}v\hat{j}$

SPACE FOR ROUGH WORK

CHEMISTRY

21. The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be :

- (a) 0.2×10^5 (b) 5.0×10^{-5} (c) 5.0×10^{15} (d) 5.0×10^{-15}

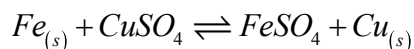
22. Arrange the following in **increasing** order of energy :

- (i) $n = 4, \ell = 2, m = -1, s = +1/2$ (ii) $n = 3, \ell = 2, m = -1, s = -1/2$

- (iii) $n = 4, \ell = 0, m = 0, s = +1/2$ (iv) $n = 5, \ell = 0, m = 0, s = -1/2$

- (a) $i < ii < iii < iv$ (b) $iii < ii < iv < i$ (c) $iii < iv < ii < i$ (d) $ii < iii < i < iv$

23. Calculate equilibrium constant (approx) at 25°C for the cell reaction :



Given : $E^\circ_{Fe/Fe^{2+}} = +0.453 \text{ volt}$; $E^\circ_{Cu/Cu^{2+}} = -0.3435 \text{ volt}$

- (a) 1.0×10^{25} (b) 1.0×10^{20} (c) 1.0×10^{27} (d) 1.0×10^{22}

SPACE FOR ROUGH WORK

24. PCl_5 dissociation in a closed container as :



If total pressure at equilibrium of the reaction mixture is P and degree of dissociation of PCl_5 is α , the partial pressure of PCl_3 will be :

(a) $P \cdot \left[\frac{\alpha}{\alpha+1} \right]$ (b) $P \cdot \left[\frac{2\alpha}{1-\alpha} \right]$ (c) $P \cdot \left[\frac{\alpha}{\alpha-1} \right]$ (d) $P \cdot \left[\frac{\alpha}{1-\alpha} \right]$

25. Two first order reaction have half-lives in the ratio 8:1. Calculate the ratio of time intervals $t_1 : t_2$.

The time t_1 and t_2 are the time period for $\left(\frac{1}{4}\right)^{\text{th}}$ and $\left(\frac{3}{4}\right)^{\text{th}}$ completion.

(a) 1 : 0.301 (b) 0.125 : 0.602 (c) 1 : 602 (d) none of these

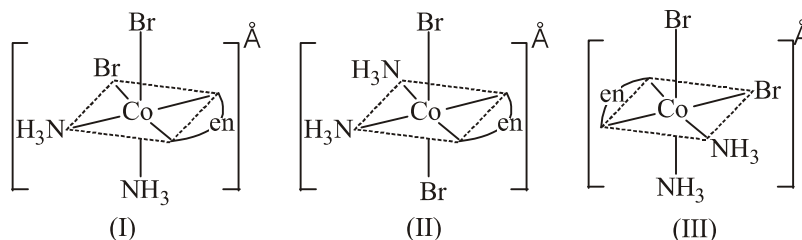
26. The pH of a buffer containing equal molar concentrations of a weak base and its chloride (K_b for weak base = 2×10^{-5} , $\log 2 = 0.3$) is :

(a) 5 (b) 9 (c) 4.7 (d) 9.3

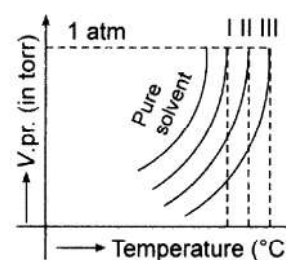
SPACE FOR ROUGH WORK

Set - A

27. Three arrangements are shown for the complex $[CoBr_2(NH_3)_2(en)]^+$. Which one is **wrong** statement?

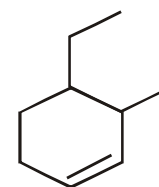


- (a) I and II are geometrical isomers (b) II and III are optical isomers
 (c) I and III are optical isomers (d) II and III are geometrical isomers
28. The vapour pressure curves of the same solute in the same solvent are shown. The curves are parallel to each other and do not intersect. The concentrations of solutions are in order of :



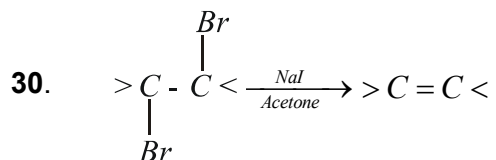
- (a) $I < II < III$ (b) $I = II = III$
 (c) $I > II > III$ (d) $I > III > II$

29. The systematic (IUPAC) name of the compound with the following structural formula shall be :

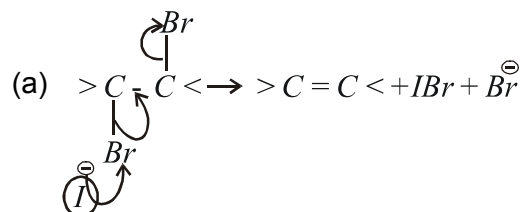


- (a) 1-ethyl-2-methylcyclohexene
 (b) 2-methyl-1-ethylcyclohexene
 (c) 3-ethyl-2-methylcyclohexene
 (d) 4-ethyl-3-methylcyclohexene

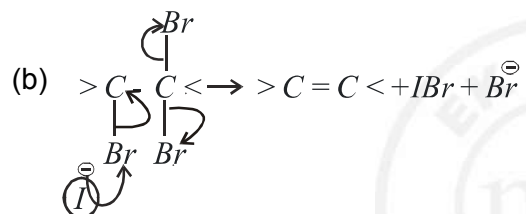
SPACE FOR ROUGH WORK



Which of the following orientations of elimination is preferred by this reaction ?



In this case, both Br atoms are anticoplanar leading to anti elimination

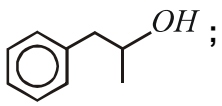


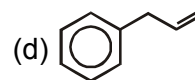
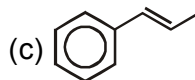
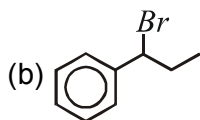
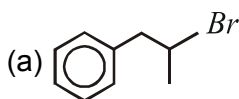
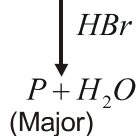
In this case, both Br atoms are synoplanar leading to syn elimination

- (c) both of these depending upon the situation
 (d) none of these

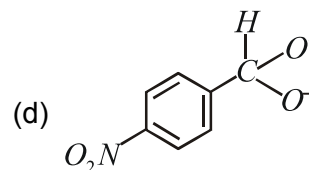
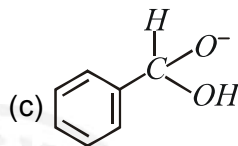
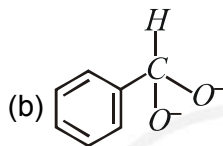
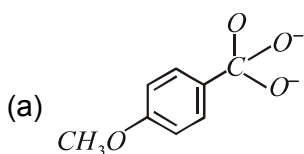
SPACE FOR ROUGH WORK

Set - A

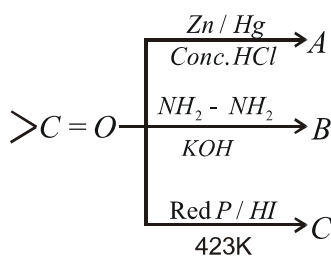
31.  ; P should be



32. In the Cannizzaro reaction, the intermediate that will be the **best** hydride donor is :



33. In the reactions :



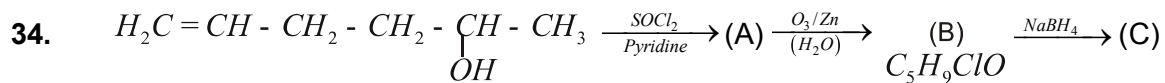
(a) A is an aldehyde; B is ketone and C is an alkene

(b) A , B and C are alkenes

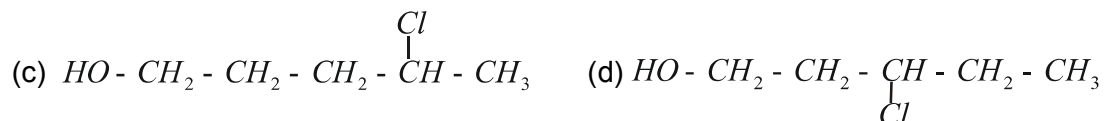
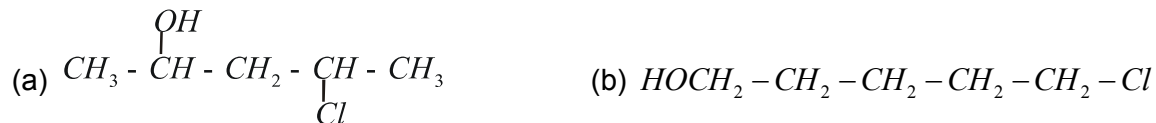
(c) A , B and C are alkanes

(d) A and B alkenes while C is an alkane

SPACE FOR ROUGH WORK



Compound (C) is :



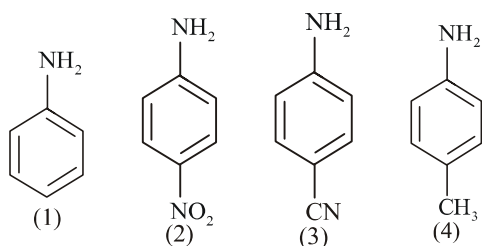
35. Which of the following molecules has longest $C = C$ strength ?



SPACE FOR ROUGH WORK

Set - A

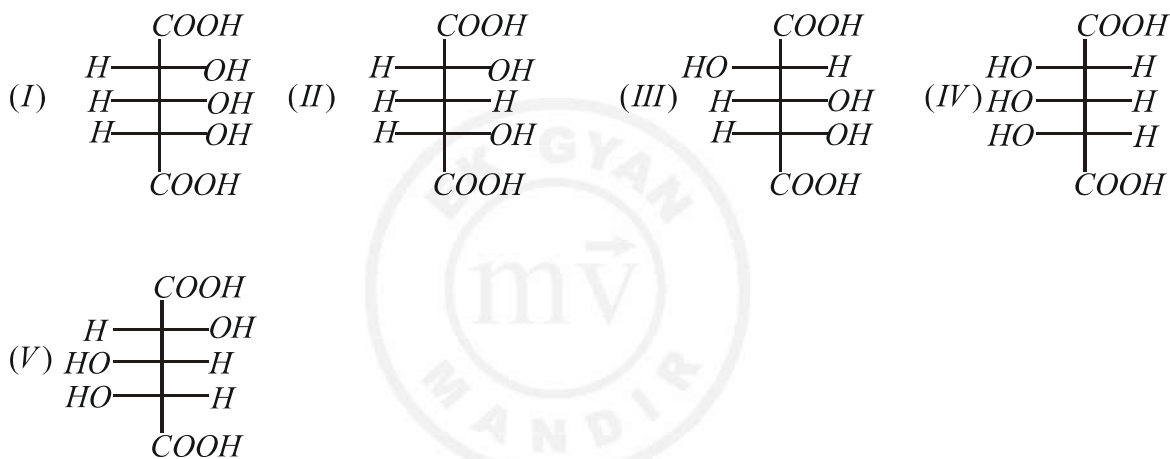
36. Consider the following compounds :



Arrange these compounds in decreasing order of their basicity :

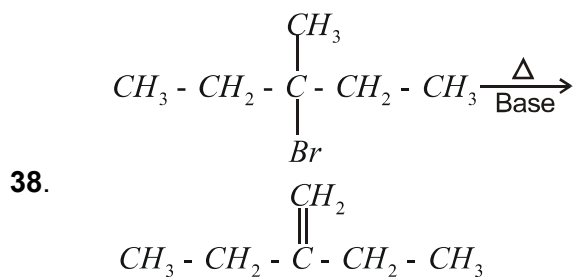
- (a) $1 > 2 > 3 > 4$ (b) $2 > 3 > 1 > 4$ (c) $4 > 1 > 3 > 2$ (d) $4 > 1 > 2 > 3$

37. Which compounds are both *meso* forms ?

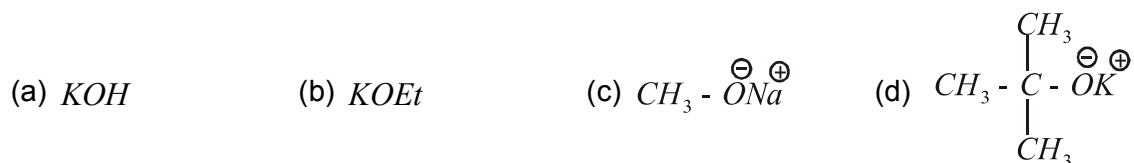


- (a) *IV* and *II* (b) *I* and *III* (c) *II* and *V* (d) *IV* and *V*

SPACE FOR ROUGH WORK



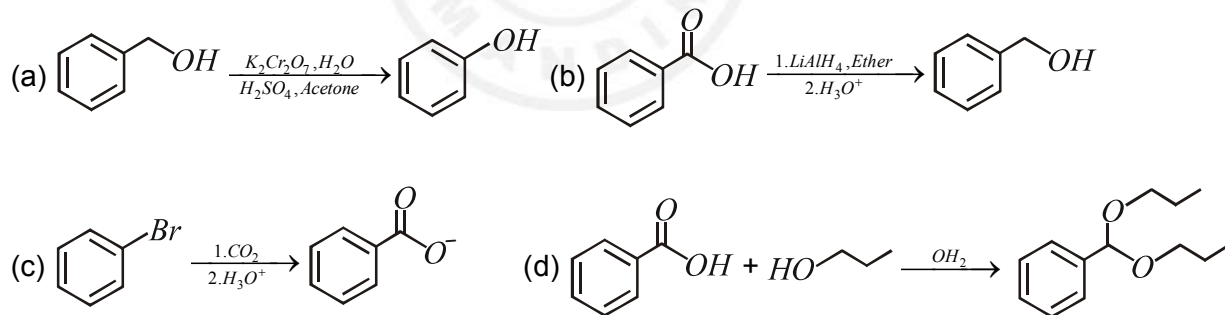
Which of the following bases is most suitable for this reaction ?



39. Compound (A) undergoes Cannizzaro reaction and (B) undergoes positive iodoform test. Therefore.

- (a) A = Formaldehyde ; B = 1-Pentanal (b) A = $\text{C}_6\text{H}_5\text{CH}_2\text{CHO}$; B = 3-Pentanone
 (c) A = Formaldehyde; B = 2-Pentanone (d) A = Propionaldehyde; B = 1-Pentanol

40. Choose the reaction that is **correctly** shown :



SPACE FOR ROUGH WORK

PART - III**BIOLOGY**

41. The bacteria which lack flagella and move by gliding are included in :
(a) Spirochaetes (b) Rickettsia (c) Myxobacteria (d) Edubacteria
42. Which of the following represents the correct sequence of the relative size in descending order?
(a) Chromosome, cell, nucleus, water molecule, oxygen atom
(b) Cell, nucleus, chromosome, water molecule, oxygen atom
(c) Cell, nucleus, water molecule, oxygen atom, chromosome
(d) Nucleus, water molecules, cell, chromosome, oxygen atom
43. The Golgi complex originates from :
(a) Cell membrane (b) Cytoplasm (c) Mitochondria (d) Endoplasmic reticulum
44. According to whom Air and Light are important for nourishment of plants ?
(a) Stephen Hales (b) Robert Mayer (c) Julius Sach (d) Von Helmont
45. Which of the followign is growth inhibitor :
(a) Gibberellic acid (b) Auxin (c) Cytokinin (d) Ethylene

SPACE FOR ROUGH WORK

46. For rooting of Leaves of *Bryophyllum*, the growth regulator used is :
(a) Indole butyric acid (b) Gibberellic acid
(c) Carotene (d) Lycopene
47. If there are 4 pollen mother cell in anther, what will be the number of pollen grains ?
(a) 8 (b) 4 (c) 16 (d) 12
48. Transfusion tissue is present in the leaves of :
(a) Dryopteris (b) Cycas (c) Pinus (d) Both 'b' and 'c'
49. Canada balsam used as a mounting material extracted from :
(a) Cycas (b) Abies (c) Pinus (d) Agathis
50. Amount of water in soil is measured by :
(a) Tensiometer (b) Potometer (c) Porometer (d) All of the above
-

SPACE FOR ROUGH WORK



Set - A

51. Typically all mammals have 7 cervical vertebrae except in :
(a) Elephant (b) Man (c) Rat (d) Sea cow
52. Bipolar nerve cell in the eye are found in :
(a) Sclerotic (b) Choroid (c) Retina (d) Yellow spot
53. These cells of retina can distinguish colour :
(a) Rods (b) Cones (c) Rods & cones (d) None of these
54. One of the following does the same work is done by nephridia in earthworm :
(a) Flame cells in liver fluke (b) Myotomes in fish
(c) Statocyst in prawn (d) Parotid gland in toad
55. Pellagra is caused due to deficiency of :
(a) Thiamine (b) Ascorbic acid (c) Niacin (d) Calciferol

SPACE FOR ROUGH WORK



56. Which one of the following conditions in humans is correctly matched with its chromosomal abnormality / linkage
- (a) Erythroblastosis foetalis - X - linked
 - (b) Down syndrome - 44 autosomes + XO
 - (c) Klinefelter's syndrome - 44 autosomes + XXY
 - (d) Colour blindness - Y - linked
57. Genotype of a Down's syndrome is
- (a) 45 + XX
 - (b) 44 + XY
 - (c) 44 + XXY
 - (d) 22 + XY
58. A population will not exist in Hardy-Weinberg equilibrium if
- (a) There are no mutations
 - (b) There is no migration
 - (c) The population is large
 - (d) Individuals mate selectively
59. $\alpha - 1$ antitrypsin is
- (a) An antacid
 - (b) An enzyme
 - (c) Used to treat arthritis
 - (d) Used to treat emphysema
60. The volume of blood each ventricle pumps out during a cardiac cycle is about
- (a) 70 ml
 - (b) 5000 ml
 - (c) 7 l
 - (d) 1200 ml

SPACE FOR ROUGH WORK