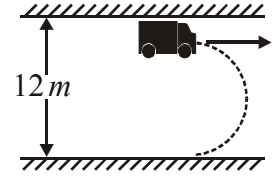


Set - A**PART - I****PHYSICS**

1. A small car make a U – turn with a constant speed in a circular path in a road of width 12 m . If the coefficient of friction between the tyres and road is 0.6 , then the minimum time of the U – turn will be :



- (a) 2.0sec (b) 3.0sec (c) 3.14sec (d) 3.6sec
2. A stone thrown upwards from ground level, has its equation of height $h = 490t - 4.9t^2$ where 'h' is in metres and t is in seconds respectively. What is the maximum height reached by it ?
- (a) 22500 m (b) 6125 m (c) 24500 m (d) 12250 m
3. If \vec{A} and \vec{B} are two non-zero vectors such that $|\vec{A} + \vec{B}| = \frac{|\vec{A} - \vec{B}|}{2}$ and $|\vec{A}| = 2|\vec{B}|$ then the angle between \vec{A} and \vec{B} is :
- (a) 37° (b) 53° (c) $\cos^{-1}(-3/4)$ (d) $\cos^{-1}(-4/3)$
4. A body takes 4 minutes to cool from 100°C to 70°C . If the room temperature is 15°C then how many minutes will it need to cool from 70°C to 40°C –
- (a) 4 (b) 5 (c) 6 (d) 7

SPACE FOR ROUGH WORK

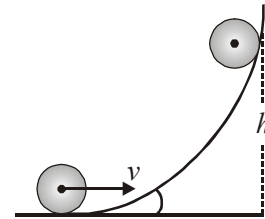
5. If a ball is dropped from rest, it bounces from the floor repeatedly. The coefficient of restitution is 0.5 and the speed just before the first bounce is 5ms^{-1} . The total time taken by the ball to come to rest finally is :
- (a) 1.5s (b) 1s (c) 0.5s (d) 0.25s
6. An open pipe is suddenly closed with the result that the second overtone of the closed pipe is found to be higher in frequency by 100 Hz , than the first overtone of the original pipe. The fundamental frequency of open pipe is :
- (a) 100 Hz (b) 300 Hz (c) 150 Hz (d) 200 Hz
7. A disc of mass M and radius R rolls on a horizontal surface and then rolls up an inclined plane as shown in the figure. If the velocity of the disc is v , the height to which the disc will rise will be :

(a) $\frac{3v^2}{2g}$

(b) $\frac{3v^2}{4g}$

(c) $\frac{v^2}{4g}$

(d) $\frac{v^2}{2g}$



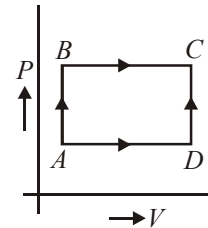
SPACE FOR ROUGH WORK

Set - A

8. A student is experimenting with resonance tube apparatus in Physics lab to find the speed of sound at room temperature. He got resonating lengths of air column as 17 cm and 51 cm, using tuning fork of frequency 512 Hz. Find speed of sound at room temperature and specify, whether the side water reservoir was moved upward or downward to obtain the second resonance (51 cm)?

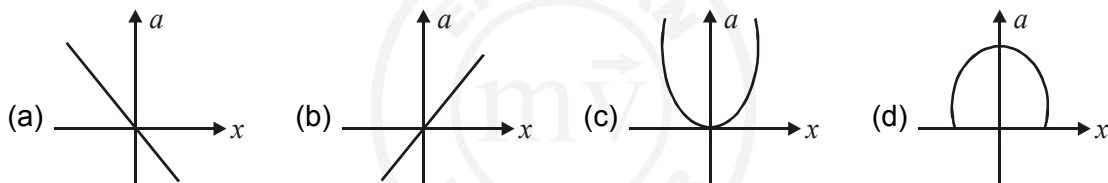
- (a) 348 m/s, downwards (b) 348 m/s, upwards
 (c) 332 m/s, downwards (d) 332 m/s, upwards

9. As shown in the figure, the amount of heat absorbed along the path ABC is $90 J$ and the amount of work done by the system is $30 J$. If the amount of work done along the path ADC is $20 J$ the amount of heat absorbed will be:



- (a) $80 J$ (b) $90 J$
 (c) $110 J$ (d) $120 J$

10. The variation of acceleration (a) and displacement (x) of the particle executing SHM is indicated the following curve :



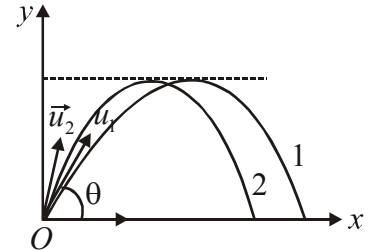
SPACE FOR ROUGH WORK

11. A mass of M kg is suspended by a weightless string. The minimum constant horizontal force that must be applied so that the string gets deviated by 45° with the initial vertical position is

- (a) $Mg(\sqrt{2} + 1)$ (b) $Mg\sqrt{2}$ (c) $\frac{Mg}{\sqrt{2}}$ (d) $Mg(\sqrt{2} - 1)$

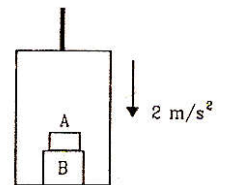
12. Trajectories of two projectiles are shown in figure. If T_1 and T_2 be their times of flights, then

- (a) $T_1 < T_2$
 (b) $T_1 = T_2$
 (c) $T_1 > T_2$
 (d) None of these



13. The elevator shown in figure is descending with an acceleration of 2m/s^2 . The mass of the block A is 0.5 kg , and the mass of block B is 1.0 kg . Then the force exerted by surface on the block B is :
 ($g = 10\text{m/s}^2$)

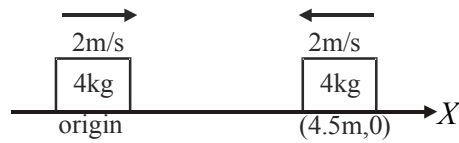
- (a) 4 N (b) 8 N
 (c) 12 N (d) None of these



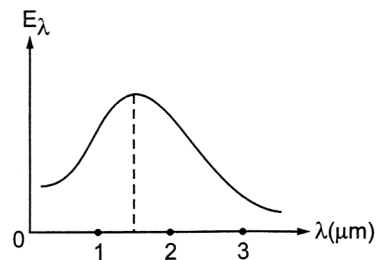
SPACE FOR ROUGH WORK

Set - A

14. Blocks A and B resting on a smooth horizontal surface are given equal speeds of 2m/s in opposite sense as shown in the figure. At $t = 0$, the position of blocks are shown, then the x -co-ordinates of centre of mass at $t = 3\text{ s}$ will be:



- (a) 1 (b) 3 (c) 5 (d) 2.25
15. Shown in the figure, the curve represents the distribution of energy density of a blackbody at a certain temperature. This curve corresponds to an approximate temperature of:



- (a) 1000 K (b) 2000 K
(c) 200 K (d) 5000 K
16. A pulse of sound wave travels a distance l in helium gas in time T at particular temperature. If at the same temperature a pulse of sound wave is propagated in oxygen gas, it will cover the same distance l in time
- (a) $4.36T$ (b) $0.23T$ (c) $3T$ (d) $0.46T$

SPACE FOR ROUGH WORK

17. A uniform cylindrical rod of length L , cross-sectional area A and Young's modulus Y is acted upon by three external forces shown in the figure. The elongation of the rod is

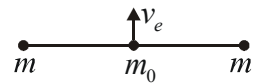


- (a) $\frac{3FL}{5AY}$ (b) $\frac{2FL}{5AY}$ (c) $\frac{3FL}{8AY}$ (d) $\frac{8FL}{3AY}$

18. The heat reservoir of an ideal Carnot engine is at 800K and its sink is at 400K. The amount of heat taken from heat reservoir in one second to produce useful mechanical work at the rate of 750J/sec is

- (a) 2250J (b) 1125J (c) 1500J (d) 750J

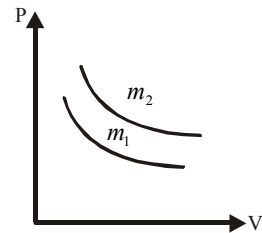
19. A system consists of two fixed particles of mass m distant r from each other. What is the escape velocity (v_e) for a point mass placed at a point mid-way the line joining the two particles? (consider only gravitational interactions among particles).



- (a) $\sqrt{\frac{Gm}{r}}$ (b) $\sqrt{\frac{Gm}{2r}}$ (c) $2\sqrt{\frac{2Gm}{r}}$ (d) $2\sqrt{\frac{Gm}{r}}$

20. Two different isotherms representing the relationship between pressure p and volume V at a given temperature of the same ideal gas are shown for masses m_1 and m_2 then

- (a) $m_1 > m_2$ (b) $m_1 = m_2$
 (c) $m_1 < m_2$ (d) Nothing can be predicted



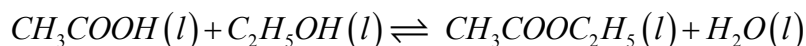
SPACE FOR ROUGH WORK

PART - II**CHEMISTRY**

21. A vessel contains 1.6 g of dioxygen at STP (273.15K, 1 atm pressure). The gas is now transferred to another vessel at constant temperature, where pressure becomes half of the original pressure. Calculate **volume** of the new vessel.

- (a) 2.24 L (b) 4.24 L (c) 6.24 L (d) 8.24 L

22. The formation of ethyl acetate from ethyl alcohol and acetic acid is represented by :



Calculate the equilibrium constant for the reaction if initial concentrations of acetic acid and ethyl alcohol are 1.0 mole and 0.180 mole respectively and equilibrium concentration of ethyl acetate in the **mixture** is 0.171 mole.

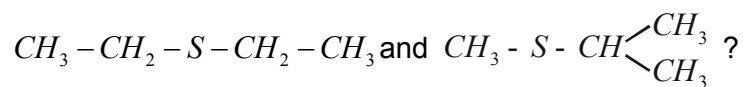
- (a) 2.119 (b) 4.919 (c) 3.919 (d) 5.197

23. While studying the properties of gaseous form $C_2Cl_2F_2$, a chemist cooled 1.25 g of the sample at 1 bar pressure from 323 K to 293 K. Calculate ΔH of the process. (C_p of $C_2Cl_2F_2 = 80.7 \text{ Jmol}^{-1}\text{K}^{-1}$)

- (a) $-22.75J$ (b) $-32.75J$ (c) $-42.75J$ (d) $22.75J$

SPACE FOR ROUGH WORK

24. What type of structural isomerism is **shown** by

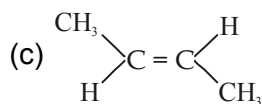
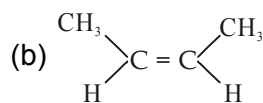
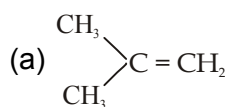


- (a) Chain (b) Ring Chain (c) Metamerism (d) Functional

25. How **many** meso forms are possible for an organic compound of the formula $C_6H_{12}Cl_2$?

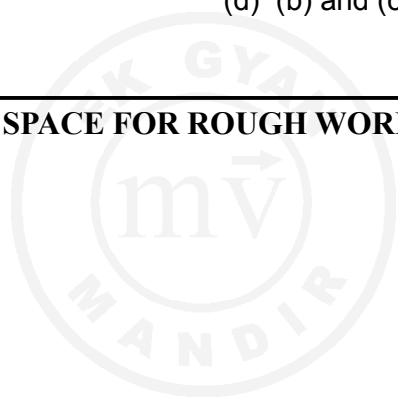
- (a) 1 (b) 2 (c) 3 (d) 4

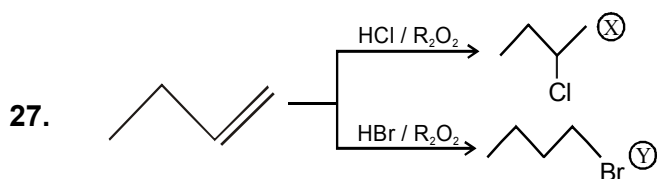
26. The alkene C_4H_8 on treatment with Bayer's reagent gave an optically inactive product. The alkene could be



- (d) (b) and (c) Both are correct

SPACE FOR ROUGH WORK



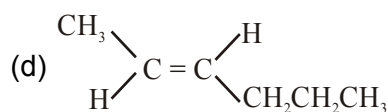
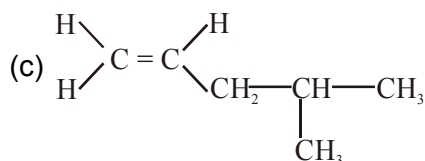
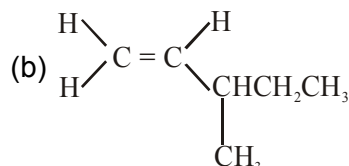
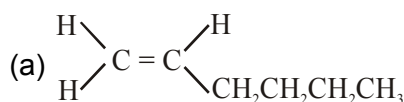
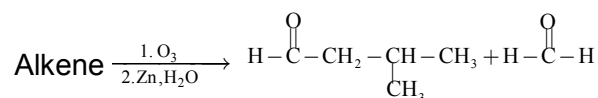
Set - A

Which is correct statement about (X) and (Y).

- (a) (X) is product of ionic reaction and (Y) is product of radical reaction.
(b) (X) and (Y) both are product of ionic reaction.
(c) (X) and (Y) both are product of radical reaction.
(d) (X) is obtain from radical reaction and (Y) is obtain from ionic reaction.
28. 2.79g of an organic compound when heated in Carius tube with conc. HNO_3 and H_3PO_4 formed converted into $MgNH_4PO_4$ ppt. on heating gave 1.332g of $Mg_2P_2O_7$. The percentage of P in the compound is
- (a) 23.33 (b) 13.33 (c) 33.33 (d) 26.66

SPACE FOR ROUGH WORK

29. Which alkene will undergo the following reaction



30. In compounds of type ECl_3 , where $\text{E} = \text{B, P, As or Bi}$, the angle $\text{Cl} - \text{E} - \text{Cl}$ for different E are in the order -

- (a) $\text{B} > \text{P} = \text{As} = \text{Bi}$ (b) $\text{B} > \text{P} > \text{As} > \text{Bi}$ (c) $\text{B} < \text{P} = \text{As} = \text{Bi}$ (d) $\text{B} < \text{P} < \text{As} < \text{Bi}$

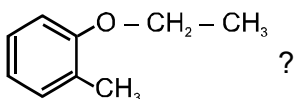
31. 1 mole of N_2H_4 loses ten moles of electrons to form a new compound Y . Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in Y ? (There is no change in the oxidation state of hydrogen).

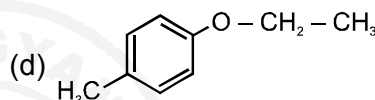
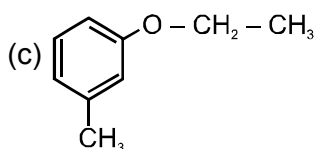
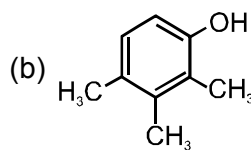
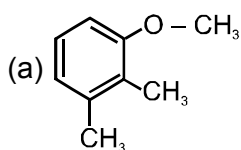
- (a) - 1 (b) - 3 (c) + 3 (d) + 5

SPACE FOR ROUGH WORK

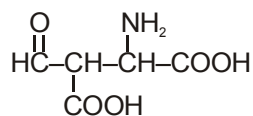
Set - A

32. For the reaction $2P + Q \rightarrow R$, 8 mol of P and 5 mol of Q will produce
(a) 8 mol of R (b) 5 mol of R (c) 4 mol of R (d) 13 mol of R
33. One litre of a solution contains 18.9 gm of HNO_3 and one litre of another solution contains 3.2 gm of NaOH. In what volume ratio must these solution be mixed to obtain a neutral solution?
(a) 3 : 8 (b) 8 : 3 (c) 15 : 4 (d) 4 : 15

34. Which one is **not** metamer of  ?



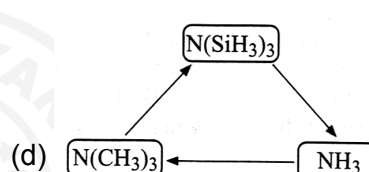
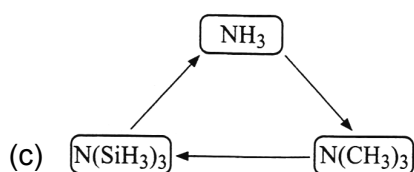
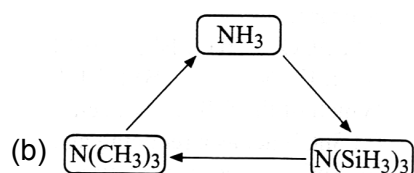
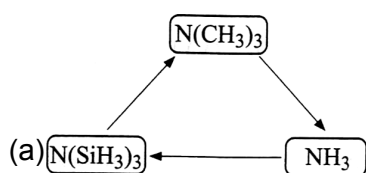
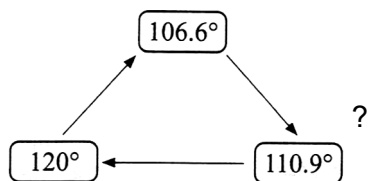
35. **Correct** IUPAC name of the following compound is



- (a) 2-Amino-3-Formyl butane-1,4-dioic acid (b) 2-formyl-3-amino butane-1,4-dioic acid
(c) 3-Amino-2-formyl butane-1,4-dioic acid (d) 2-Amino-3-carboxy-4-oxo butanoic acid

SPACE FOR ROUGH WORK

36. In which of the following diagram the change in the bond angle at nitrogen is observed as :



37. The first ionisation energies of alkaline earth metal are higher than those of the alkali metals. This is because:

- (a) there is increase in the nuclear charge of the alkaline earth metal
- (b) there is decrease in the nuclear charge of the alkaline earth metal
- (c) there is no change in the nuclear charge
- (d) none of these

SPACE FOR ROUGH WORK

Set - A

38. A compound (X) on heating gives a colourless gas. The residue is dissolved in water to obtain (Y). Excess CO_2 is bubbled through aqueous solution of (Y) (Z) is formed. (Z) on gently heating gives back (X). The compound (X) is:
- (a) CaCO_3 (b) Na_2CO_3 (c) $\text{Ca}(\text{HCO}_3)_2$ (d) K_2CO_3
39. Which of the following represents a pair of covalent hydrides ?
- (a) CsH , AlH_3 (b) KH , NaH (c) H_2S , HF (d) $\text{VH}_{0.56}$, NH_3
40. For the detection of sulphur in an organic compound sodium nitroprusside is added to the sodium extract. A violet color is obtained due to formation of
- (a) $\text{Fe}(\text{CN})_2$ (b) $\text{K}_3\text{Fe}(\text{CN})_5 \text{NS}$ (c) $\text{Na}_4[\text{Fe}(\text{CN})_5 \text{NOS}]$ (d) $\text{Na}_4[\text{Fe}(\text{CN})_6]$

SPACE FOR ROUGH WORK



PART - III

MATHEMATICS

41. If $ax^2 + bx + c$, $a, b, c \in \mathbb{R}$ has no real zeros, and if $c < 0$, then
(a) $a < 0$ (b) $a + b + c > 0$ (c) $a > 0$ (d) None of these
42. The principal argument of the complex number $\frac{(1+i)^3(1+\sqrt{3}i)^2}{-2i(-\sqrt{3}+i)}$ is
(a) $\frac{13\pi}{12}$ (b) $-\frac{7\pi}{12}$ (c) $\frac{-11\pi}{12}$ (d) none of these
43. $\frac{\cos 3\theta + 2\cos 5\theta + \cos 7\theta}{\cos \theta + 2\cos 3\theta + \cos 5\theta} + \sin 2\theta \tan 3\theta =$
(a) $\sin 3\theta$ (b) $\cos 2\theta$ (c) $-\cos 2\theta$ (d) $-\sin 3\theta$
44. A tower subtends an angle of 30° at a point on the same level as its foot, and at a second point 15 m above the first, the depression of the foot of tower is 60° . The height of the tower is
(a) $\frac{15}{\sqrt{3}}$ m (b) $\frac{15}{3\sqrt{3}}$ m (c) 5 m (d) 45 m

SPACE FOR ROUGH WORK

Set - A

45. The mean deviation about median from data 340, 150, 210, 240, 300, 310, 320 is
(a) 52.4 (b) 52.5 (c) 52.8 (d) None of these
46. The equation of the smallest circle passing through the intersection of $x^2 + y^2 - 2x - 4y - 4 = 0$ and the line $x + y - 4 = 0$ is
(a) $x^2 + y^2 - 4 = 0$ (b) $x^2 + y^2 - x - 2y = 0$
(c) $x^2 + y^2 - 3x - 5y = 0$ (d) None of these
47. Number of 6 digit even numbers greater than 6,00,000 can be formed from the digits 5,6,7,8,9,0, if repetition of digit is allowed, is
(a) 11664 (b) 15551 (c) 720 (d) 15552
48. Out of children born in 1996, two children were randomly picked. The probability that exactly one of them is born on 29th February is
(a) $\frac{365}{(366)^2}$ (b) $\frac{1}{366 \times 183}$ (c) $\frac{365}{366 \times 183}$ (d) none of these

SPACE FOR ROUGH WORK

49. The domain of the function $f(x) = \sqrt{4-x} + \frac{1}{|x|-5}$ is
- (a) $(-\infty, 4]$ (b) $(-\infty, -5) \cup (-5, 4]$ (c) $[4, \infty) - \{5\}$ (d) none of these
50. If $y = e^x \sin(\sqrt{3}x)$ then the value of $\frac{dy}{dx}$ is
- (a) $2e^x \sin(\sqrt{3}x + \pi/6)$ (b) $2e^x \sin(\sqrt{3}x, \theta/3)$
- (c) $\frac{1}{2} e^x \sin(\sqrt{3}x, \theta/3)$ (d) $2 e^x \sin(\sqrt{3}x, \theta/3)$
51. If $\tan A = 1/3$ and $\tan B = 1/7$ then the value of $2A + B$ is -
- (a) 30° (b) 60° (c) 45° (d) 135°
52. If α and β are the roots of the equation $x^2 - 10x + 5 = 0$ then the quadratic equation whose roots are $\frac{5}{10-\alpha}$ and $\frac{5}{10-\beta}$ is
- (a) $5x^2 - 10x + 1 = 0$ (b) $x^2 + 10x + 5 = 0$ (c) $x^2 - 10x + 5 = 0$ (d) none of these

SPACE FOR ROUGH WORK

Set - A

53. Between two numbers whose sum is $2\frac{1}{6}$, an even number of arithmetic means are inserted. If the sum of these means exceeds their number by unity, then the number of means is
(a) 12 (b) 10 (c) 8 (d) none of these
54. If $(3 + i)(z + \bar{z}) - (2 + i)(z - \bar{z}) + 14i = 0$, then $\bar{z}z$ is equal to-
(a) 10 (b) 8 (c) -9 (d) -10
55. Marks of 5 students of a tutorial group are 8, 12, 13, 15, 22 then variance is:
(a) 21 (b) 21.2 (c) 21.4 (d) None of these
56. From 5 consonants, 4 vowels and 3 numbers, the number of codes beginning with a number and containing 3 consonants and 2 vowels that can be made is
(a) 18880 (b) 21600 (c) 21680 (d) 180
57. The hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ passes through the point of intersection of the lines $x - 3\sqrt{5}y = 0$ and $\sqrt{5}x - 2y = 13$ and the length of its latus rectum is $\frac{4}{3}$ units. The coordinates of its foci are
(a) $(\pm 2\sqrt{10}, 1)$ (b) $(\pm 3\sqrt{10}, 0)$ (c) $(\pm 2\sqrt{10}, 0)$ (d) None of these

SPACE FOR ROUGH WORK

58. $A(1,2,3), B(0,4,1), C(-1,-1,-3)$ are the vertices of a triangle ABC . The point in which the bisector of the angle $\angle BAC$ meets BC , is

- (a) $\left(-\frac{3}{10}, \frac{5}{2}, -\frac{1}{5}\right)$ (b) $\left(\frac{3}{10}, \frac{5}{2}, -\frac{1}{5}\right)$ (c) $\left(\frac{3}{10}, \frac{5}{2}, \frac{1}{5}\right)$ (d) none of these

59. Five boys and three girls are seated at random in a row. The probability that no boy sits between two girls is

- (a) $\frac{1}{56}$ (b) $\frac{1}{8}$ (c) $\frac{3}{28}$ (d) None of these

60. If A and B are two sets such that $n(A \cup B) = 36$, $n(A \cap B) = 16$ and $n(A \cap B^c) = 15$, then $n(B)$ is equal to

- (a) 21 (b) 31 (c) 22 (d) 52

SPACE FOR ROUGH WORK

