

AMHARA NATIONAL REGIONAL STATE EDUCATION BUREAU CHEMISTRY MODEL
EXAMINATION FOR GRADE 12 STUDENTS (2014 E.C)

GENERAL DIRECTIONS

IN THIS MODEL EXAMINATION, THERE ARE 80 MULTIPLE-CHOICE QUESTIONS. EACH QUESTION IS FOLLOWED BY FOUR POSSIBLE ALTERNATIVES. READ EACH QUESTION CAREFULLY AND SELECT THE BEST ANSWER AND WRITE THE LETTER OF YOUR CHOICE ON THE SEPARATE ANSWER SHEET PROVIDED.

YOU ARE **ALLOWED** TO WORK ON THE EXAM FOR 2 1/2 **HOURS**. WHEN TIME IS CALLED. YOU MUST IMMEDIATELY STOP WORKING.

PHYSICAL CONSTANTS

- a. Planck's constant (h) = 6.626×10^{-34} JS
- b. Rydberg's constant (R_H) = 2.18×10^{-18} J
- c. Speed of light (C) = 3.00×10^8 m/s
- d. Faraday's constant (F) = 96500 C /mol
- e. $\log 2 = 0.3$
- f. $\log 5 = 0.7$

ATOMIC NUMBERS (Z) AND ATOMIC WEIGHTS (A)

Element	H	B	C	N	O	F	Si	P	S	Cl	K	Ca	Cu	Br	Ag	I	Au	Hg	
Z	1	5	6	7	8	9	14	15	16	17	19	20	29	35	47	53	79	80	
A	1	11	12	14	16	19	28	31	32	35.5	39	40	64	81	108	127	197	200	

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1. According to J.J Thomson's atomic model, an atom
 - A. is a solid indivisible mass.
 - B. has a very small massive positively charged center.
 - C. has an electron cloud around the nucleus.
 - D. is a sphere of positive charge with electrons stuck into the sphere.
2. What is the purpose of adding brine in the preparation of soap?
 - A. To hydrolyze the molecule of soap
 - B. To increase the rate of reaction between sodium hydroxide and oil.
 - C. To precipitate the molecules out of the solution.
 - D. To strengthen the hydrophilic part of the soap.
3. The actual density of aluminum at room temperature is 2.70 g.cm^{-3} . Which of the following measured data is most accurate?

Choice	Trial-1	Trial-2	Trial-3
A	2.63	2.65	2.67
B	2.82	2.86	2.84
C	2.43	2.47	2.49
D	2.91	2.93	2.92

4. The number $29.134 + 27.156 - 8.1222$ has ____ significant figures.

A.6

B.5

C.4

D.3
 5. Disregarding the relative feasibility of the following way of writing of a laboratory report, which of these orders is the most valid?
 - A. Title → objective → procedure → result → conclusion
 - B. Title → procedure → result → conclusion → objective
 - C. Title → objective → result → conclusion → procedure
 - D. Title → objective → result → procedure → conclusion
-

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6. A set of quantum numbers (in the order of n , l , m_l , m_s) not permissible for an electron for an atom are:

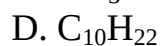
A. $5, 0, 0, +\frac{1}{2}$.

C. $4, 2, +2, -\frac{1}{2}$.

B. $3, 2, +2, -\frac{1}{2}$.

D. $3, 1, +2, +\frac{1}{2}$.

7. Which of the following compound is the most soluble in CCl_4 ?



8. Four students took 4 beakers A, B, C, and D half-filled with water. They add soil in A, chalk powder in B, sugar in C, and sodium chloride in D. Which statement is correct?

A. Both C & D are colloids

C. Both A & D are solutions

B. Both A & B are suspensions

D. A, C & D are suspensions

9. The solubility of oxygen gas in water at 25°C and 1.0 atm pressure is 0.04 g/L. The solubility of oxygen gas in water at 3.0 atm and 25°C is _____ g/L.

A. 0.12

C. 0.04

B. 3.0

D. 0.013

10. If solution A which contains 2% m/m NaCl is separated by a semi-permeable membrane from solution B which contains 10% m/m NaCl , which event will occur?

A. NaCl will flow from "A" to "B".

B. Water will flow from "A" to "B".

C. NaCl will flow from "B" to "A".

D. Water will flow from "B" to "A".

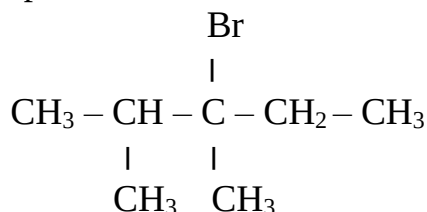
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11. What type of chemical bond will be formed by pairs of atoms of I, II, and III, respectively?

I) Si and O II) H and O III) K and O

- A. Covalent, ionic, covalent C. Covalent, Covalent, ionic
B. Covalent, ionic, ionic D. Ionic, ionic, covalent

12. The IUPAC name for the compound is



- A. 3-bromo-1,2-dimethyl pentane
B. 3,3-dimethyl-3- bromo pentane
C. 3-bromo-2,3-dimethyl pentane
D. 2,3,3-bromo dimethyl pentane

13. Identify the set of electromagnetic radiations arranged in increasing order of their energies.

- A. Microwave → Visible Light → X-rays
B. X-rays → Visible Light → Microwave
C. Microwave → X- rays → Visible Light
D. Visible Light → X- rays → Microwave

14. A certain metal ion, X^{3+} has an electron configuration of $[\text{Ar}] 3d^3 4s^0$. What is the electron configuration of metal X?

- A. $[\text{Ar}] 4s^2, 3d^4$ C. $[\text{Ar}] 4s^2, 3d^1$
B. $[\text{Ar}] 4s^1, 3d^6$ D. $[\text{Ar}] 4s^1, 3d^5$

15. What is the de Broglie wavelength associated with a cricket ball weighing 0.4Kg thrown at a speed of 25m/s?

- A. $6.626 \times 10^{-33} \text{m}$ C. $6.626 \times 10^{-35} \text{m}$
B. $6.626 \times 10^{-34} \text{m}$ D. $6.626 \times 10^{-36} \text{m}$

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16. Analyze the energy change corresponding to the relaxation of an electron from $n=2$ to $n=1$ energy state of Bohr hydrogen atom.

A. $-1.635 \times 10^{-18} \text{ J}$

B. $+1.635 \times 10^{-18} \text{ J}$

C. $-1.937 \times 10^{-18} \text{ J}$

D. $+1.937 \times 10^{-18} \text{ J}$

17. Waste water from cement factory with a density of 1.1 g/ml consists of 0.22 grams of Ca^{2+} per 100 L of sample. What is the concentration of Ca^{2+} in ppm?

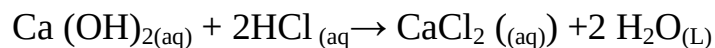
A. 2.2ppm

B. 2ppm

C. 0.022ppm

D. 0.02ppm

18. How many ml of 0.4M of $\text{Ca}(\text{OH})_2$ is needed to react exactly with 100ml of 0.1M HCl?



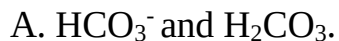
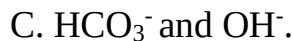
A. 75 ml

B. 25 ml

C. 12.5 ml

D. 400 ml

19. For the reaction, $\text{HCO}_3^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 + \text{OH}^-$, the Brönsted-Lowry acids are



20. What volume of water must be added in order to change the P^{H} of 40 mL of 0.1M HCl from $\text{P}^{\text{H}}=1$ to $\text{P}^{\text{H}}=2$ at 25 °C?

A. 400 mL

B. 60 mL

C. 160 mL

D. 360 mL

21. Why the first ionization energy of nitrogen (N) is higher than that of oxygen (O)? Because

A. nitrogen atom has a smaller size than oxygen atom.

B. nitrogen atom has a half-filled outer orbitals configuration.

C. nitrogen atom has a higher effective nuclear charge than oxygen atom.

D. the first electron of the nitrogen atom occupies s- subshell orbital.

D. 99.9949°C

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28. Which aqueous solution has the highest P^H value at 25°C ?

A. 0.05 M $\text{Ca}(\text{OH})_2$

C. 0.08M HCl

B. 0.05M H_2SO_4

D. 0.001 M NaOH

29. For a reaction to be spontaneous at any temperature

A. $\Delta H_{\text{rxn}} < 0$ and $\Delta S_{\text{rxn}} < 0$.

C. $\Delta H_{\text{rxn}} > 0$ and $\Delta S_{\text{rxn}} < 0$.

B. $\Delta H_{\text{rxn}} < 0$ and $\Delta S_{\text{rxn}} > 0$.

D. $\Delta H_{\text{rxn}} > 0$ and $\Delta S_{\text{rxn}} > 0$.

30. Which numerical value of P^{K_a} indicates the strongest acid?

A. $P^{K_a} = 4.2$

C. $P^{K_a} = 3.5$

B. $P^{K_a} = 5.1$

D. $P^{K_a} = 6.7$

31. If 20g of CaCO_3 and 20g of HCl are mixed according to the reaction:



How many grams of the excess reactant remain unreacted?

A. 5.4g

C. 4.6g

B. 6.5g

D. 7.5g

32. Which of the substances would react rapidly with bromine water?

A. 1-butene and 2-butene

C. benzene and methyl benzene

B. butane

D. 2-butene and benzene

33. Which molecule listed below has two sigma (σ) and two pi (π) bonds?

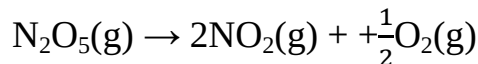
A. N_2

C. O_3

B. C_2H_4

D. HCN

34. Which one of the following is a valid relationship for the rate expression for the reaction equation below?



A. $\frac{\frac{1}{2}\Delta[\text{NO}_2]}{\Delta t} = \frac{\frac{1}{2}\Delta[\text{O}_2]}{\Delta t}$

C. $\frac{-2\Delta[\text{N}_2\text{O}_5]}{\Delta t} = \frac{\Delta[\text{NO}_2]}{\Delta t}$

B. $\frac{-2\Delta[\text{N}_2\text{O}_5]}{\Delta t} = 2\frac{\Delta[\text{O}_2]}{\Delta t}$

D. $\frac{\Delta[\text{NO}_2]}{\Delta t} = 2\frac{\Delta[\text{O}_2]}{\Delta t}$

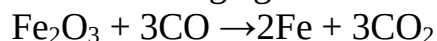
D. -1158 KJ

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40. Four electrolytic cells with inert electrodes that consist of AgNO_3 , Cu SO_4 , AuCl_3 , and HgCl_2 are connected in series. In which electrolytic cell do you expect the largest amount of metallic cation will be discharged?

- A. A cell with AuCl_3 electrolyte
- B. A cell with Cu SO_4 electrolyte
- C. A cell with AgNO_3 electrolyte
- D. A cell with HgCl_2 electrolyte

41. What is the reducing agent in the reaction?



- | | |
|-------|----------------------------|
| A. CO | C. CO_2 |
| B. Fe | D. Fe_2O_3 |

42. Which one of these statements about magnesium oxide is true?

- A. It reacts with sodium hydroxide to form a salt.
- B. It reacts with hydrochloric acid to form a salt.
- C. It reacts with water to form an acid.
- D. It reacts with basic oxide to form a base.

43. Which factor of rate of reaction affects the rate of reaction by changing the activation energy of that reaction?

- | | |
|-----------------|---------------------------|
| A. Pressure | C. Catalyst or inhibitors |
| B. Surface area | D. Temperature |

44. At 445°C , K_c for the reaction $2\text{HI}_{(g)} \rightleftharpoons \text{H}_{2(g)} + \text{I}_{2(g)}$

by decomposition of HI is 0.02.

Which one of the following is false for the system at equilibrium?

- A. $[\text{H}_2] = [\text{I}_2]$
- B. $[\text{H}_2] [\text{I}_2] = 0.02 [\text{HI}]^2$
- C. The value of $K_p = 0.02$
- D. The reaction favors the products

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45. For the reaction: $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$

At equilibrium 1 mol N_2 , 2mol H_2 , and 3mol NH_3 are found in two liters of the reaction vessel. What is the K_c value in $\text{L}^2\text{mol}^{-2}$?

- A. 3.05
B. 1.125

- C. 0.22
D. 4.5

46. For the overall reaction $\text{A} \rightarrow \text{P}$, by varying the initial concentration of A the half-life data in the table below were obtained at a particular temperature. What is the experimentally determined rate law?

$[\text{A}]_0$	2 M	1M	0.5M	0.25
$t_{1/2}$ in second	50	100	200	400

- A. Rate=k
B. Rate=k[A]²

- C. Rate=k[A]
D. Rate=k[A]

47. For which of the following processes will ΔS be negative?

- A. $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
B. $\text{NaCl}(\text{s}) \rightarrow \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$
C. $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
D. $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l})$

48. What is the change in internal energy of a system that absorbs 8.6 J of heat and does 2.7 J of work on the surroundings?

- A. + 11.3 J
B. -11.3 J

- C. + 5.9 J
D. - 5.9 J

49. When 60ml of 0.1M HCl is titrated with 40 mL of 0.1M NaOH, the P^{H} of the solution will be-----.

- A. 12.3
B. 1.7

- C. 1
D. 13

50. Which of the following substance cannot conduct electricity?

- A. Iron
B. Molten NaCl

- C. Solid KCl
D. H_2SO_4 (aq)

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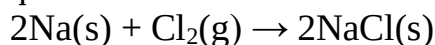
51. The main difference (s) between the electrolysis of a dilute solution of NaCl and a concentrated solution of NaCl by using inert electrodes is/are

- I. the nature of anion discharged at the anode.
- II. the nature of cation discharged at the cathode.
- III. P^H value of the remaining solution at $25^{\circ}C$.

A. I, II and III
B. I and II

C. II and III
D. I and III

52. The reaction equation:



is obeyed to which laws of chemical combination?

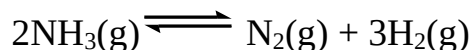
- A. The Law of Conservation of Mass
- B. The Law of Multiple Proportions
- C. The Law of Definite Proportions
- D. The law of constant composition.

53. The degree of freedom for pure liquid water is

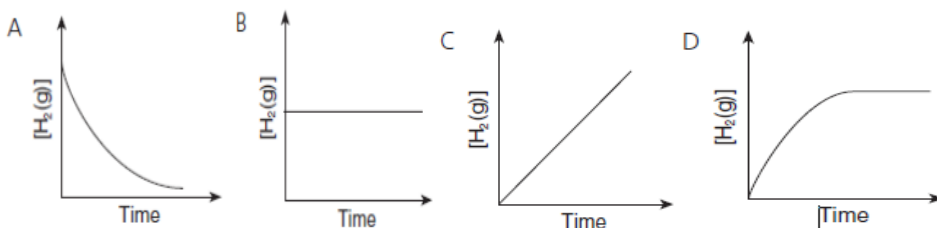
A. invariant
B. tri variant

C. uni variant
D. bi variant

54. Consider the following equilibrium system:



Which of the following graphs represents $[H_2(g)]$ after equilibrium has been established?



55. Identify the di atomic species with bond order equal to three.

A. N_2
B. H_2

C. O_2
D. F_2

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56. Which of the following explains why at room temperature, I_2 is a solid, Br_2 is a liquid and Cl_2 is a gas?

- A. Ionic bonding
B. Dipole-dipole force
C. London dispersion force
D. Hydrogen

57. What is the PH of an aqueous solution of 0.04M base at which the percentage of ionization of this base at $25^\circ C$ is 2.5%?

- A. 11
B. 3
C. 1.4
D. 12.6

58. Which of the following aqueous solutions has the lowest freezing point?

- A. 0.2 M NaCl
B. 0.2 M $FeCl_3$
C. 0.2M sucros
D. 0.2 M $CaCl_2$

59. What arrangement an electrolytic cell would be used to electroplate a silver coin with copper?

	Cathode	Anode	Electrolyte
A	Copper	Silver coin	$Cu SO_4$
B	Copper	Silver coin	$AgNO_3$
C	Silver coin	Copper	$Cu SO_4$
D	Silver coin	Copper	$AgNO_3$

60. In which cell the substances being oxidized and reduced are continuously supplied from an outside source?

- A. Primary cells
B. Solar cells
C. Fuel cells
D. Secondary cells

61. Which gas will diffuse faster, H_2S or PH_3 ?

- A. H_2S
B. PH_3
C. Both diffuse at an equal rate
D. Cannot be determined

62. Which of the following is a non-renewable resource:

- A. soil
B. plants
C. water
D. petroleum

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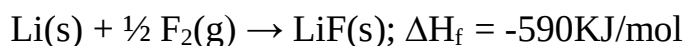
63. Which pairs of compounds are tri esters of long-chain carboxylic acids and glycerol?

- | | |
|-------------------------|-------------------------|
| A. starch and cellulose | C. enzymes and hormones |
| B. Fats and oils | D. rubber and plastics |

64. For comparable molecular masses, which oxygen-containing liquid hydrocarbons have the highest boiling points?

- | | |
|---------------------|------------|
| A. Carboxylic acids | C. Ketones |
| B. Alcohols | D. Esters |

65. For the reaction below



What is the enthalpy of sublimation of metallic Li?

Given the following data

$$\Delta H_{\text{EA}}, \text{F} = -328 \text{KJ/mol}$$

$$\Delta H_{\text{IE1}}, \text{Li(g)} = 520 \text{KJ/mol},$$

$$\Delta H_{\text{LE}} = -1016 \text{KJ/mol},$$

$$\Delta H_{\text{diss}}, \text{F}_2 = 158 \text{KJ/mol},$$

- | | |
|----------------|----------------|
| A. +120 KJ/mol | C. +155 KJ/mol |
| B. +160 KJ/mol | D. +175 KJ/mol |

66. Which of the following is a valid electron configuration?

- | | |
|------------|------------|
| A. 2,8,9,2 | C. 2,8,8,3 |
| B. 2,9,9,1 | D. 2,10,9 |

67. For the reaction:



The oxidation number of manganese changes from

- | | |
|-------------|-------------|
| A. +2 to +4 | C. -4 to -2 |
| B. +4 to +2 | D. -2 to -4 |

68. Which of the following cycle cannot be found in the atmosphere in the gaseous state?

- | | |
|-----------------|---------------------|
| A. carbon cycle | C. phosphorus cycle |
| B. water cycle | D. nitrogen cycle |

69. Which synthetic polymer is used to manufacture pipes, raincoats, and floor tills?

- | | |
|-------------|---------|
| A. Teflon | C. PMMA |
| B. Nylon-66 | D. PVC |

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70. Which pairs of metals alloy are used to prepare an anti-knocking agent for petrol by reacting with $\text{CH}_3\text{CH}_2\text{Cl}$?

- A. Na & Pb
B. Na & K
C. Sn & Pb
D. Fe & C

71. In plasma state

- A. matter can exist in molecule form.
B. because of the extreme temperatures needed for fusion, no material can exist
C. most or all of the atoms are electrons that exist in the ground state.
D. chemical changes can occur in it.

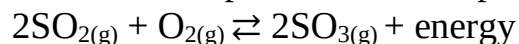
72. In which of the following substance and its process of preparation is not correctly matched?

Choice	Substance	Process
A	H_2SO_4	Contact
B	S	Frasch
C	HNO_3	Ostwald
D	NH_3	Hall

73. What happens when an ester is treated with LiAlH_4 ?

- A. One unit of alcohol and one unit of acid will be formed.
B. Two units of carboxylic acid will be formed.
C. Two units of alcohol will be formed.
D. Two units of aldehyde will be formed.

74. Consider one of the steps in the contact process

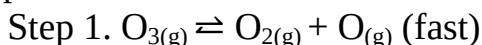
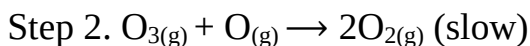


Which of the following two stresses will optimize the yield of SO_3 ?

- A. decreasing temperature and increasing pressure
B. decreasing temperature and decreasing pressure
C. increasing temperature and increasing pressure
D. increasing temperature and decreasing pressure

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75. The proposed reaction mechanism for the decomposition of ozone is:



Which of the following rate equations is consistent with the proposed mechanisms?

A. $\text{Rate} = k[\text{O}_3]$

B. $\text{Rate} = k[\text{O}_3]^2[\text{O}_2]^{-1}$

C. $\text{Rate} = k[\text{O}_3]^2[\text{O}_2]$

D. $\text{Rate} = k[\text{O}_2]$

76. A scientist is trying to eject electrons from metal by shining a light on it, but none are coming out. To eject electrons, he/she should change the light by

A. decreasing the frequency

B. increasing the intensity

C. increasing the wavelength

D. increasing the frequency

77. Identify the correct order in metallurgy:

A. Concentrating the ore $\rightarrow$ Pretreatment $\rightarrow$ Extracting the metal $\rightarrow$ Refining

B. Pretreatment $\rightarrow$ Concentrating the ore $\rightarrow$ Extracting the metal $\rightarrow$ Refining

C. Concentrating the ore $\rightarrow$ Extracting the metal $\rightarrow$ Pretreatment $\rightarrow$ Refining

D. Pretreatment $\rightarrow$ Extracting the metal $\rightarrow$ Concentrating the ore $\rightarrow$ Refining

78. Which one of the following is a thermosetting plastic?

A. Polyethylene

B. Bakelite

C. Polypropylene

D. Polystyrene

79. Which rubber has a monomer of 2-methyl-1,3-butadiene?

A. Butyl rubber

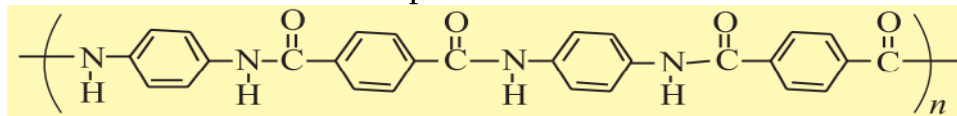
B. Neoprene

C. Natural rubber

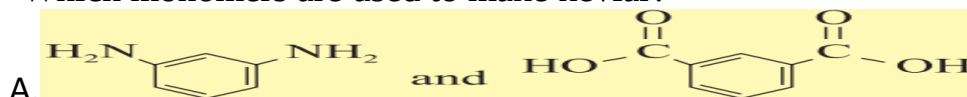
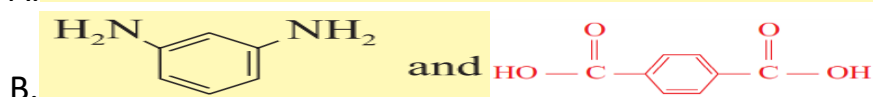
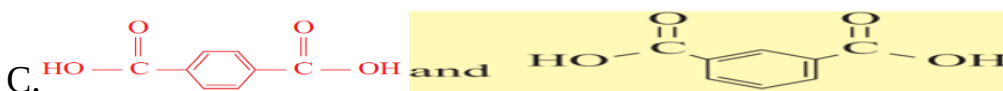
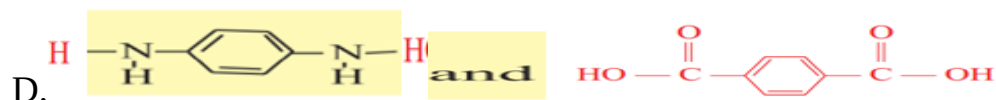
D. SBR

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80. Kevlar is used in bulletproof vests. The structure of Kevlar is:



Which monomers are used to make kevlar?



THE END