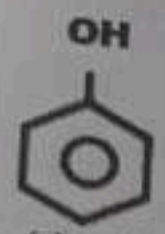
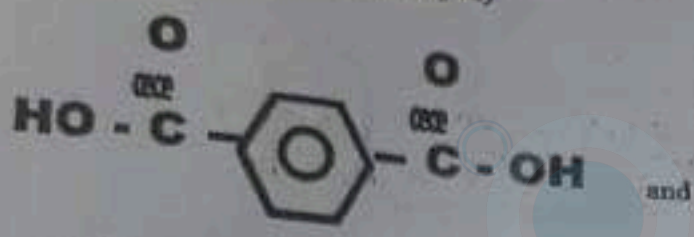
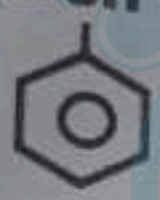
Consider the following monomers or pairs of monomers:

A. 

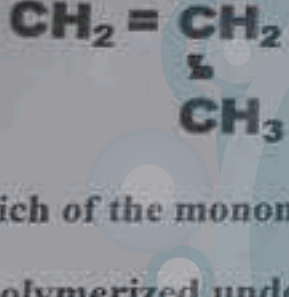
(phenol) and CH_2O (formaldahyde)

B. 

and $HO - CH_2 - CH_2 - OH$

C. 

(styrene) and $CH_2 = CH - CH = CH_2$ (butadiene)

D. 

31(1P) Which of the monomers (A-E) listed above gives a densely cross-linked network when polymerized under the appropriate conditions? B 2

32(1P). Which monomers form a polyester? C 2

33(1P). Which monomers are used to make a thermoplastic rubber? D 2

22.(1p) Which one of the following is the chemical formula for the repeating unit in polyethylene:
a- CH_2 b- C_2H_4 c- C_3H_6,
d- C_5H_8 e- C_8H_8?

23.(1p) Yield strength for polymers is defined by:
a- the maximum on curve just after the elastic region
b- the maximum on curve just after necking
c- the maximum on curve just before fracture
d- the maximum on curve

24.(1p) Because they are cross-linked, elastomeric polymers are:
a-natural rubber
b- thermosetting polymers
c-thermoplastic polymers
d-none of the above

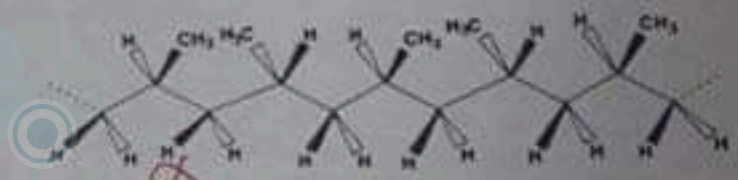
25.(1p) In thermoplastic polymers, both ductile and brittle fracture are possible. Brittle fracture is favored at:
a-lower temperatures
b- higher strain rates
c- at stress concentrators
d- all of them

26.(1p) Chose the correct answer regarding polymers:
a-fully amorphous polymers do not exhibit T_m
b- all polymers exhibit T_g
c-above Tg and Tm polymers are liquids
d- all of them are correct

27.(1p) Creep and Stress Relaxation occur as a result
a- the sudden sliding of polymer chains with respect to each other when loaded
b- the relatively gradual sliding of polymer chains with respect to each other when loaded
c- the relatively gradual sliding of polymer chains with respect to each other when reloaded
d- the relatively gradual sliding of polymer chains with respect to each other when relaxed

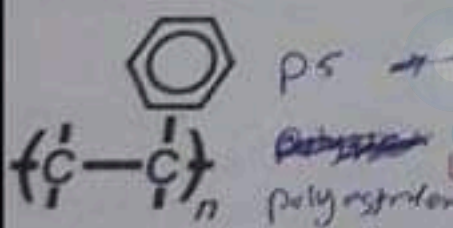
28.(1p) When polymer exits the die of the extruder it will swell, this action is caused by:
a- the relaxation of polymer chains
b- the time dependent stress relaxation
c- the sudden pressure release
d- all of them are correct

29.(1P) The segment of a polypropylene chain shown below suggests that this polymer is:

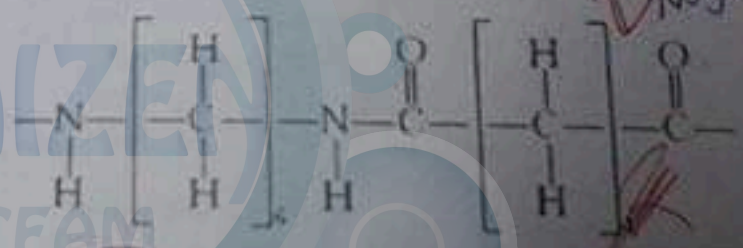


a-atactic b- isotactic c- syndiotactic
d-highly branched

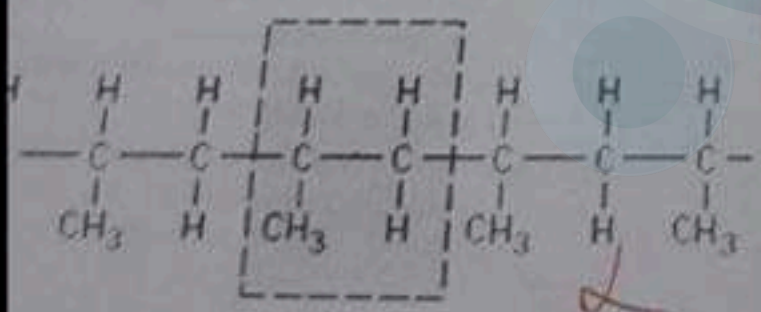
30.(4p) give the correct name of the following polymers:



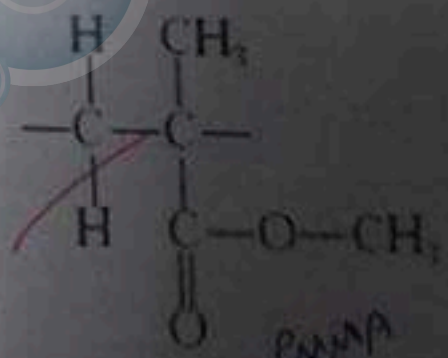
PS
Polystyrene



Nylon



PE
Poly Ethelen

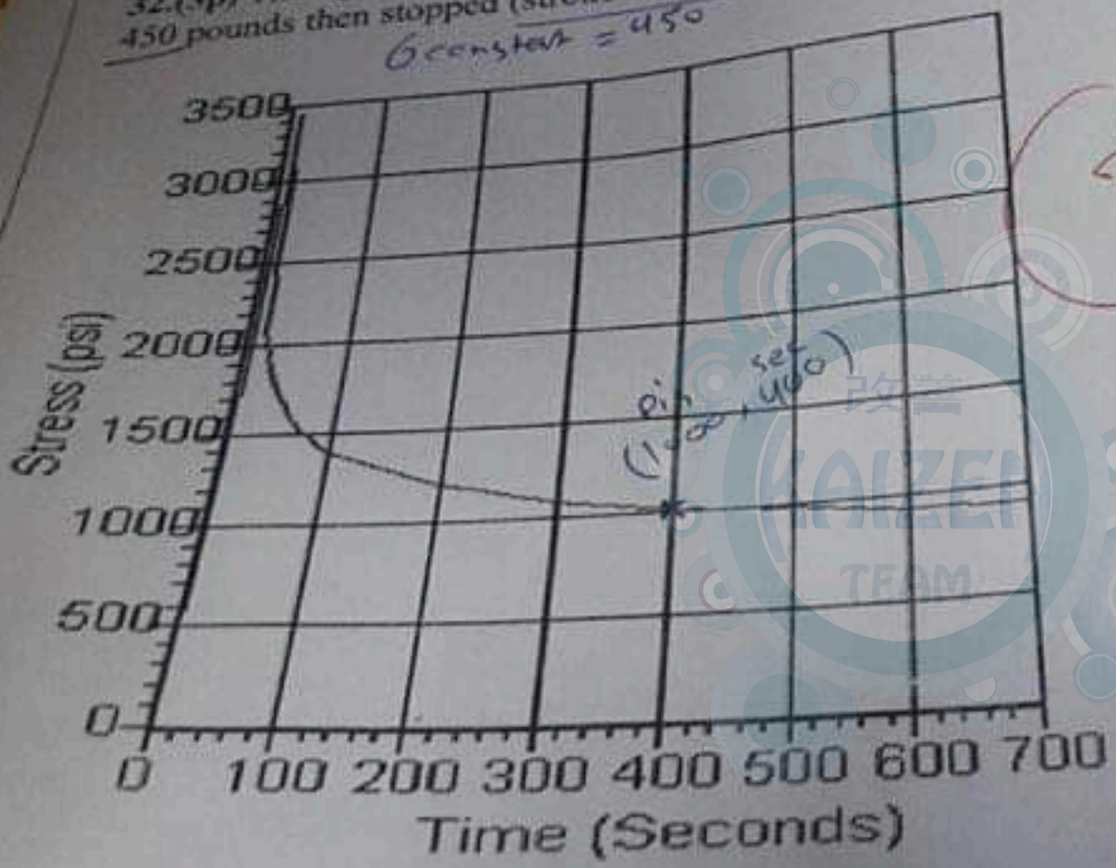


PMMA

$$Mw = \sum wiMi / \sum wi = \sum$$

$$Mn = (n1M1 + n2M2 + \ldots + niMi)/(n1+n2+\ldots+ni) = \sum niMi/\sum$$

32.(3p) The figure shown below presents the stress versus time results for a Acrylic sample that was loaded to 450 pounds then stopped (stroke held constant). Determine the relaxation time constant for the Acrylic sample.



$\sigma_{constant} = 450$

$\tau = \frac{\eta}{E}$

$1000 = 450\, e^{(-400/\tau)}$

$\frac{20}{9} = e^{-\frac{400}{\tau}}$) ln

$\ln\frac{20}{9} = \frac{-400}{\tau}$ (1)

$0.79850 = \frac{-400}{\tau}$

$\tau = 500,93$

at $t=0 \rightarrow F=450 \rightarrow \sigma=3500$

$\frac{1000}{3500} = e^{(-t/\tau)}$ $t=400$

$\sigma = \sigma_0 \exp[-t/\tau_t]$

$\sigma = \frac{F}{A}$

$\ln\left(\frac{2}{7}\right) = \frac{-400}{\tau}$

Answer (314,29 sec)

Name:

Student umber:

1(1p). a Polymer is
a-a long chain molecule made of many smaller molecules called monomers
b-a small molecule made of one atom
c-a large molecule made of twisted chains
d-a large molecule in the shape of the letter "P

2.(1p) Different polymers have different properties because they have:
a-different chemical compositions
b-different monomer units
c- differepr structures,
d-different ways of being fabricated,
e-all of the above

3.(1p) Which of the following is a cross-linked polymer:
a- PE b-Nylon 6 c-Phenol formaldehyde

4.(1p)Vinyl monomer is ... ly the ethylene molecule minus:
a-two hydrogen atoms b- three hydrogen atoms
c-one hydrogen atom ad one carbon atom
d-one hydrogen atom

5.(1p). The most important characteristic of viscoelastic materials is that their mechanical properties depend on:
a- time only b-time and temperature c- temperature only d- none of them is correct.

6.(1p) Viscosity is an important property of a polymer melt in plastics shaping processes. Upon what parameter or parameters does viscosity depend?
a- temperature b- shear rate, c- molecular weight of the polymer d- all three parameters.

7.(1p) Polymers are formed by linking monomers through chemical reaction called:
a- Epoxy b- polymerization
c- Melamine d-PU

8.(1p) Of the three polymer types, which one is the most important commercially:
a- thermoplastics b- thermosets c- elastomers

9(1p) Polyethylene is a :
a-Homopolymer b-Monomer
c-Copolymer d- none is correct

10.(1p) Degree of crystallinity is increased for
a-branched>linear>cross linked
b-cross linked>linear>branched
c-branched>cross linked>linear
d-Linear>branched>cross linked

11.(1p)Thermosetting Polymers:
a- form permanent crosslinks between chains when cured
b- are comparatively strong and stiff
c- can't be recycled
d-All of the above is true

12.(1p).More crystalline polymers tend to be:
a-more resistive to chemical dissolution only
b-less resistive to softening to heat only
c-mechanically stronger, and more resistive to chemical dissolution and softening by heat.
d- none of them is correct

13.(1p).Polystyren has the following group in its monomer:
a-CH3 b-C2H3
c- C2H2 d-Phenyl

14.(1p) Diene is a group of monomers that contain:
a- three double-covalent bonds
b-two double-covalent bonds
c- one double covalent bond
d-no double bonds

15.(1p)Vulcanization uses heat and sulphur to:
a- change the colour of polymers
b- reinforce the polymers
c- attain good mechanical strength
d-crosslink rubber

16.(1p)Examples of Thermoplastic Elastomers:
a-PVC b- segmented polyurethanes
c-Nylon 6, 6 d-none of the above

17.(1p) Polymers are used primarily at ambient temperatures because polymers have:
a- low density b- low strength
c- high mechanical damping ability. d- polymers are generally unable to withstand low or high temperatures

18.(1p) Crystallinity in polymers influences
a- stiffness and brittleness only
b- fracture strength and elongation at break only
c- solubility only
d- permeability of gases and water sorption only
e- all of the above

19.(1p) Kevlar is a:
a-natural polymer b- Phenolic polymer
c- aramid polymer d-polycarbonite polyme

20.(1p) the necked region of a polymer specimen wh loaded in tension is a result of:
a-the amorphous part b- the breaking of b
c- the alignment and straightening of the ch in the whole specimen
d- the alignment and straightening of the ch in the necked region

21.(1p) A polymer with the repeated unit -CH2-CHCl- is called:
a-PVC b-PP c-PE d-PCV

31(4P) A polydisperse sample of a polymer is prepared by mixing several samples with variable molecular weights, given in table below:

No. of Molecules	Mass of each Molecule
8	650,000
13	550,000
20	500,000
3	250,000

$\sum nMw = 23100000$

$\sum n = 44$

$\sum nMw^2 = 1,25 * 10^{13}$

nMw: 5200000

Calculate: 1. Mw= $\frac{1,25 * 10^{13}}{23100000} = 541125,5911$

2. Mn = $\frac{23100000}{44} = 525000$

3. PDI= $\frac{Mw}{Mn} = 1,0307$

4

$$Mw = \sum wiMi / \sum wi = \sum niMi^2 / \sum niMi$$

$$Mn = (n1M1 + n2M2 + \ldots + niMi)/(n1+n2+\ldots+ni) = \sum niMi/\sum ni$$

32.(3p) The figure shown below presents the stress versus time results for a Acrylic sample that was loaded to 450 pounds then stopped (stroke held constant). Determine the relaxation time constant for the Acrylic sample.

$\sigma_{constant} = 450$

$\tau = \frac{h}{E}$

$1000 = 450\, e^{(-400/\tau)}$

3500