

Name: _____

Unit X: Polymers Test 1.1

Multiple Choice

Questions 1 through 9 pertain to the reactions on the last two pages of this test. Where multiple answers exist only one need be reported.

- ___ 1. Which process produces a branched, addition, copolymer?
- ___ 2. Which of the processes describes the formation of a silicone?
- ___ 3. Which process describes the production of a branched polymer produced by a condensation reaction?
- ___ 4. Which process produces a linear polymer?
- ___ 5. Which process describes the formation of natural rubber?
- ___ 6. Which process describes the production of an unbranched addition polymer?
- ___ 7. Which process describes the crosslinking of a polymer which was probably originally made by an addition reaction?
- ___ 8. Which process describes the formation of a crosslinked condensation polymer?
- ___ 9. Which process describes the formation of a polymer that is made up of monomers having five carbon atoms and ten hydrogen atoms?
- ___ 10. What structural feature usually needs to be present in order for an addition polymer to be produced? (1) a carbon-carbon sigma bond; (2) a carbon-oxygen pi bond; (3) a carbon-oxygen sigma bond; (4) a carbon-carbon pi bond.
- ___ 11. Five polymers were produced in the lab. Three of them were discussed in class and a probable structure illustrated for each. One of the polymers produced was formed by adding the crosslinking agent sodium tetraborate. Which polymer was it? (1) nylon; (2) amine-aldehyde; (3) polypropene (polypropylene); (4) polyvinyl alcohol (PVA); (1,2) glyptal resin.
- ___ 12. A thermosetting plastic is one which (1) can be molded with the application of heat; (2) cannot be molded with the application of heat; (3) is hardened with the application of heat but can be molded at very low temperatures; (4) occurs only with addition polymers.

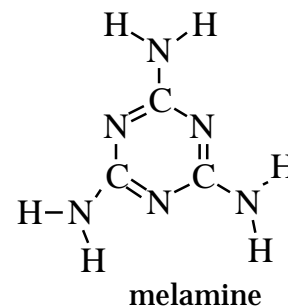
- ___ 13. Which of the following describes the cellulose acetate process for regenerating cellulose to produce such substances as rayon? (1) soaking cotton thread under tension in concentrated sodium hydroxide; (2) soaking waste cotton under tension in concentrated sulfuric acid; (3) treating waste cellulose with nitric and sulfuric acids then mixing the product with plasticizers; (4) treating cellulose with sodium hydroxide and carbon disulfide and then forcing the resultant solution through a small opening into a dilute acid solution; (1,2) treating purified cellulose with acetic acid, acetic anhydride, sulfuric acid, and acetone, then evaporating the acetone; (1,3) dissolving waste cellulose in nitromethane and then evaporating the solvent; (1,4) none of the above.
- ___ 14. Which of the following substances are added to rubber to toughen it? (1) graphite; (2) carbon black; (3) calcium carbonate; (4) zinc oxide; (1,2) both 1 and 3; (1,3) both 2 and 4; (1,4) sulfur.
- ___ 15. Which of the answers in question 13 best describes the cellulose nitrate process for reclaiming waste cellulose?
- ___ 16. Which of the processes in question 13 describes mercerization?
- ___ 17. Hard, rigid polymers are characteristic of (1) polymers with high molecular weight; (2) networked polymers; (3) polymers containing high intermolecular attractive forces; (4) both 1 and 2; (5) both 1 and 3; (1,2) both 2 and 3; (1,3) all of the above; (1,4) none of the above.
- ___ 18. Addition polymerizations are started by an initiator molecule (typically peroxides) which will form a free radical initiator. This free radical initiator reacts with the monomer to form an activated monomer which starts the process. Excess initiator molecules are sometimes added by the chemist to (1) control the length of the chain by bonding to the ends of the growing polymer molecule; (2) crosslink the polymer; (3) network the polymer; (4) form a thermosetting polymer
- ___ 19. Condensation polymerization involves the splitting out of a small molecule, usually water and (1) the presence of a carbon-carbon double bond; (2) the presence of a carbon-carbon triple bond; (3) two monomers that must be monofunctional, that is, contain only one reactive site each; (4) two monomers that must be at least difunctional, that is, contain a minimum of two reactive sites each; (1,2) cannot form without extensive crosslinking.
- ___ 20. A certain type of PVA, poly vinyl alcohol, (poly ethenol) has an average molecular weight of 150,000. What is the average number of monomers per molecule? (1) 1000; (2) 2000; (3) 2500; (3) 3000; (4) 3400; (5) 4000; (1,3) 4300; (1,4) 4500; (1,5) 5000
- ___ 21. Polyethylene (polyethene) has which of the following monomers? (1) CH_2 ; (2) C_2H_4 ; (3) CH_4 ; (4) C_2H_6 .
- ___ 22. Nylons are made from (1) diacids; (2) diamines; (3) polyethylene; (4) dacron; (5) both 1 and 2; (12) both 3 and 4; (13) none of the above.
- ___ 23. Which of the following is needed in order for a condensation polymer to be networked? (1) at least one of the starting molecules must be difunctional; (2) at least one of the starting molecules must be trifunctional; (3) both starting materials must be difunctional; (4) both

starting materials must only be monofunctional.

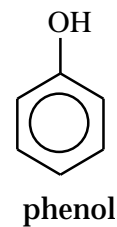
Short Answer

1. Show a possible structure for the condensation polymer produced when the following compounds react. In each case water is the by-product.

a) Cymel: formed when methanal and melamine react.

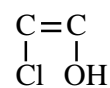


b) Bakelite: formed when phenol (hydroxybenzene) and methanal react.



2. Show the structure of each of the following addition polymers.

a) Lemol: poly (1, hydroxy 2, chloro ethene)

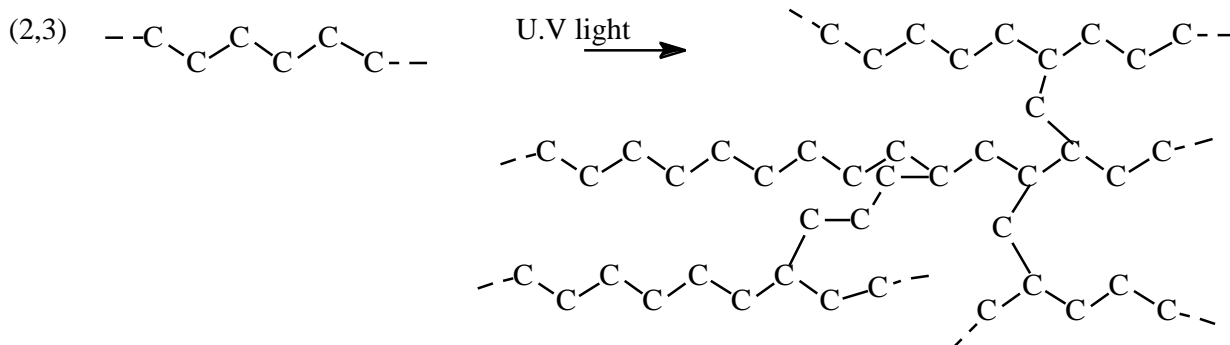
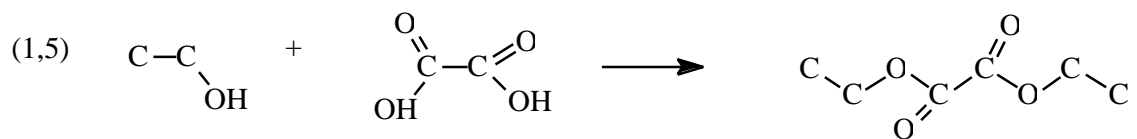
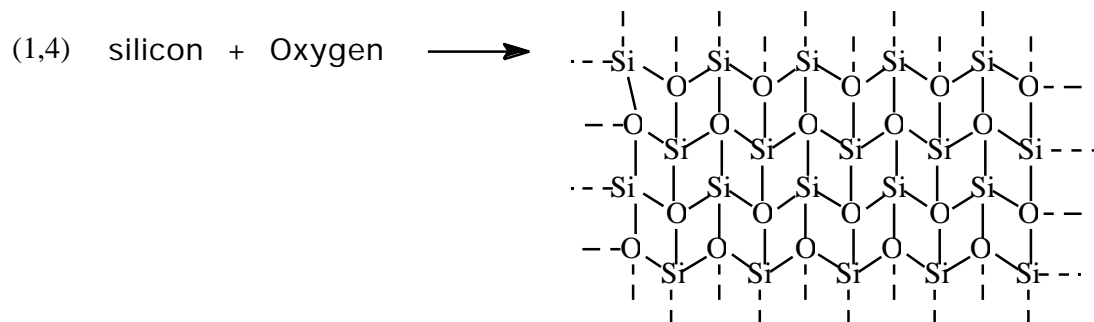


1, hydroxy 2, chloro ethene

b) Teflon FEP: This is produced by the copolymerization of tetrafluoroethene and hexafluorpropene.

Extra Credit

A large number of skinny girls named Ethyl



(2,4) answers (2), (3), (1,2), (1,3)

(2,5) answers (2), (3), and (5)

(3,4) answers (1,2), (1,3), and (1,4)

(3,5) answers (1), (2), (3), (4), (5), (1,2), (1,3),

(4,5) none of the above