POLYMER SCIENCE 406

TEST 1

1. Styrene is almost a unique monomer, in that it can be polymerized by practically all methods of chain polymerization.

   A) Free radical
   B) Anionic
   C) Cationic
   D) Co-ordination (i.e., with a catalyst)

   Which of these methods would you use to make isotactic polystyrene?

2. If you needed to synthesize a set of narrow molecular weight standards (i.e., ones with a polydispersity close to 1), which of the above methods would you use?

3. Commercial atactic polystyrene is synthesized by which of the above methods?

4. I mentioned in class that you need not know the difference between a racemic and meso diad. I lied!

   Alright, I suppose that's not fair. Below is figure 1.5 from the book, showing these diads.

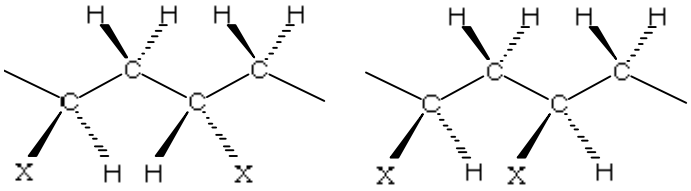

Figure 1.5 Schematic diagram depicting racemic and meso diads

An NMR analysis of a polystyrene sample showed that it had close to 100% racemic diads. the sample would be

A) Isotactic polystyrene
B) Syndiotactic polystyrene
C) Atactic polystyrene

5. A second sample had about 50% meso diads and 50% racemic. What is the most probable tacticity of this sample (A – C in Q4).

6. This polystyrene has a number average molecular weight of 100,000 and a polydispersity of 5. What is the weight average molecular weight?

   A) 20,000
   B) 100,000
   C) 500,000
   D) 100,005
   E) 5,000,000

7. Consider the following copolymers

   A) (B–B–B - - - B–B) (A–A–A - - - - A–A) (B–B - - - - B–B–B)
   ~5% ~90% ~5%

   B) A–A–A - - - - A–A – B–B - - - - B–B

   C) – – A – B – A – A – B – B – A – A – A – B – A

   D) – A – B – A – B – A – B – A – B – –

   E) – – A – A – A – A – A – A – A – A – – –
   | | |
   B B B
   | | |
   B B B
   | | |
   B B B
   ' ' '
   ' ' '
   ' ' '
   ' ' '
   B B B

   Which of these is a triblock copolymer?

8. If A = butadiene, a rubber, B = styrene, a glassy rigid polymer, this triblock copolymer will most likely be

   A) Semi-crystalline
   B) A glassy solid
   C) A vulcanized rubber
   D) A thermoplastic rubber
   E) An impact resistant glassy polymer

9. How would this polymer be synthesized?

A) Free radical polymerization
B) Anionic polymerization
C) Using a Ziegler Natta catalyst
D) By putting it into a bloody great pot and spitting on it
E) Condensation polymerization

10. Suspension free radical polymerization of styrene would be preferred over bulk polymerization to overcome the problem of

    A) Branching
    B) Cross-linking
    C) Stereo-isomerism
    D) Polymeric impurities
    E) Temperature control during polymerization

11. In emulsion polymerization, the principal place where the monomer polymerizes is

    A) Monomer droplets
    B) Aqueous phase
    C) Surfactant micelles
    D) Surface of reactor
    E) Air-liquid interface

12. Polypropylene produced commercially using a Ziegler-Natta catalyst is predominantly

    A) Atactic
    B) Isotactic
    C) Syndiotactic

13. Consider the properties of the following two polyethylene samples. Sample 1 was produced by a high pressure process while sample 2 was synthesized using a catalyst.

	Polyethylene 1	Polyethylene 2
Mol wt.	200,000	200,000
Density (g/cm^3)	0.92	0.96
Crystalline melting pt.	108°C	133°C
Stiffness ($lb/in^2 x 10^3$)	25	125
Hardness (Shore D)	45	65

    Which of the following statements is true?

    A) Sample 2 is more branched than sample 1
    B) Sample 1 is more branched than sample 2
    C) Sample 1 is more atactic
    D) Sample 1 is more isotactic
    E) Painter shouldn't set such easy gift questions

14. Which of these do you think would be more appropriate for use in making bottles for detergent?

    A) Sample 1
    B) Sample 2

15. Which would make a better film for wrapping up leftover food? (A or B in Q14).

16. Which of the following polymers is least likely to be optically transparent

    A) Atactic polystyrene
    B) Isotactic polystyrene
    C) An ethylene/propylene random copolymer (50/50 composition)
    D) A styrene/butadiene random copolymer

17. Consider the following copolymers

    A) {Styrene}-{butadiene}-{Styrene} triblock copolymer (10%; 80%; 10%)
    B) A cross-linked styrene/butadiene random copolymer (20%/80%)
    C) A 50/50 ethylene/propylene random copolymer (also cross-linked)
    D) A 50/50 ethylene (linear)/atactic polypropylene block copolymer

    Which of these copolymers is likely to have at least some crystallinity?

18. A sample of atactic polystyrene is separated into 5 fractions;

Fraction	Number of Moles	Molecular Weight
1	20	10,000
2	20	20,000
3	20	30,000
4	20	40,000
5	20	50,000

    What is the number average molecular weight?

    A) 2.33×10^4
    B) 3.0×10^4
    C) 3.66×10^4
    D) 4.33×10^4

19. What is the weight average? (A – D in Q17).

20. What is the polydispersity?

    A) 1
    B) 2
    C) 1.22
    D) 1.44