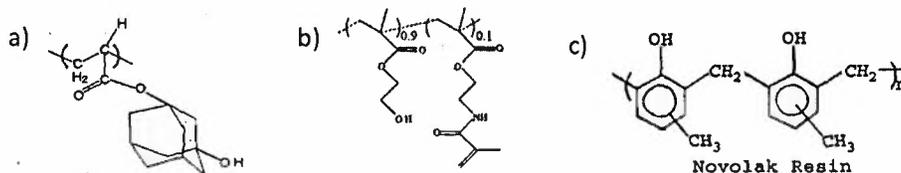


1. (a) Draw a typical setup for X-ray photoelectron spectroscopy (XPS). (2)
- (b) What is the reference used in XPS measurements? (1)
- (c) State two information that can be obtained from XPS analysis. (2)
- (d) Mention the important parameters to be considered during fitting of an XPS spectrum. (2)
- (e) Write the expression of electron binding energy. (1)
- (f) State the differences between spectroscopy and spectrometry. (2)

2. (a) What are acoustical and optical phonon vibrations? (2)
- (b) What are transverse optical and longitudinal optical modes? (2)
- (c) Draw and explain the instrumentation of a Raman spectrometer using an interferometer. (2)
- (d) What do you understand by polarizability and induced dipole moment? (2)
- (e) How to eliminate the effect of fluorescence during measuring a Raman spectrum? (1)
- (f) Draw a typical Raman spectrum (mentioning the wavenumbers) for a carbon sample with 50% each of sp^3 and sp^2 hybridized carbon. (2)
- (g) Show, how you can use Raman spectroscopy to measure the number of graphène sheets. Which other instrumental technique can be used for this purpose? (2)
- (h) How electromagnetic enhancement occurs in surface enhanced Raman spectroscopy? (2)

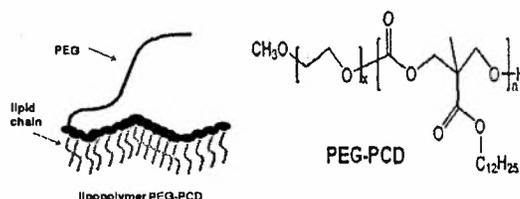
4. Based on following chemical structure, which one will be used for positive resist? (1)



- b) What is the role of PAG (Photo Acid Generator) in positive resist? (1)
- c) Draw and explain how a positive pattern is generated on a silicon surface? (1)
- d) What are the limitations of photolithography? (1)

5. How can you measure the molecular weight of a polymer? What is PDI? (2)
6. How do you differentiate polystyrene and acetylated polystyrene from the UV and FT-IR experiments? (2)

7. An amphiphilic block copolymer structures are given below. It is expected to self-assemble. It forms micelle in aqueous condition and it forms vesicle in water-THF system. Then i) How do you confirm the formation of aggregation? ii) Using which technique one can actually differentiate micelle and vesicle? Explain it with drawings, (4)

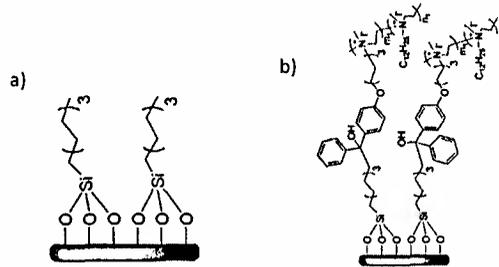


8. The contact angle (Θ) of polyethylene glycol treated silicon surface is 30° where as Teflon treated silicon surface is 120° . Why? Justify your answer. (2)

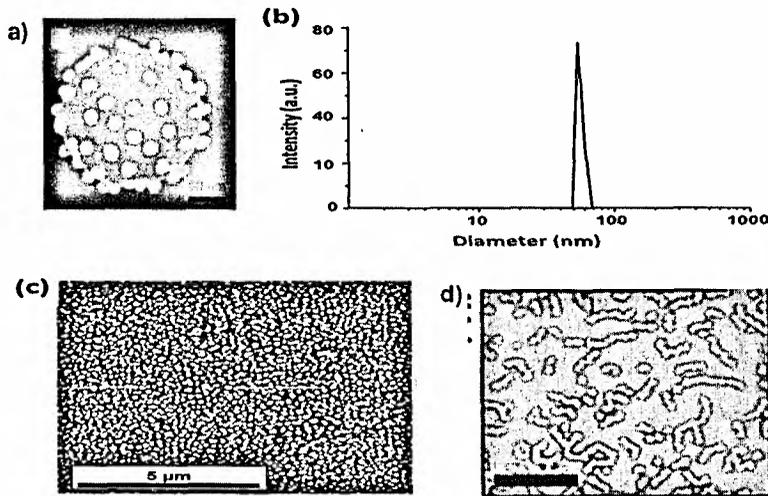
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9. You are injecting the following 4 samples with different Mn (10,000, 25,000, 40,000 and 50,000) together into the GPC instrument: Which sample will come first? Why? (2)

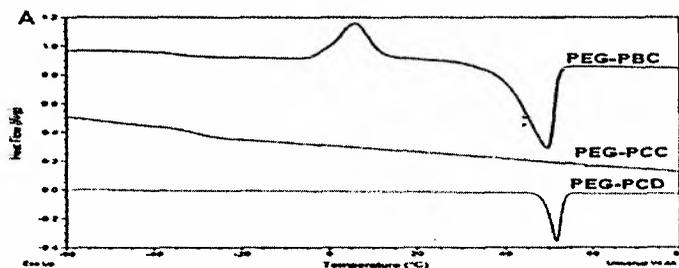
10. Using contact angle measurement, predict the Θ value of a) and b). Justify your answer. (2)



11. Give the name of the instrument from which the following information is obtained? (2)



12. From the following data, provide T_g , T_m and T_c . What is the name of the instrument? (2)



13. Why KBr is used for making pellets to do IR measurements? (1 Marks)

14. Using Evolved Gas Analysis (EGA) coupled with FT-IR, how do you differentiate the following two surfaces? (2 Marks)

