Question Examples for Nano-porous materials

1. Which of the following chemical forces is usually not responsible for the self-assembly of the pore-directing agent and the inorganic precursor in the preparation of mesoporous materials?
   (a) ionic bond (b) covalent bond (c) hydrogen bond
   (d) ion-dipole interaction

2. Which of the following statements about nanoporous materials is incorrect?
   (a) Zeolites contain micropores of uniform pore diameter
   (b) Mesoporous silica materials contain amorphous walls
   (c) Pillared clays are nanoporous materials
   (d) Microporous materials can be used as photonic crystals

3. Which of the following statements is correct about the nanoporous materials based on IUPAC classification?
   (a) microporous, $d < 2$ nm
   (b) mesoporous, $2 \text{ nm} < d < 50$ nm
   (c) macroporous, $d > 50$nm
   (d) nanoporous, $d < 100$ nm

4. Which of the following properties would change with the decrease of the material to the nano scale size?
   (a) number of surface atoms
   (b) optical properties
   (c) electronic properties
   (d) chemical properties

5. Which of the following applications is suitable for the mesoporous materials?
   (a) shape-selective catalysis
   (b) photonic crystal
   (c) controlled release of drugs
   (d) adsorbent

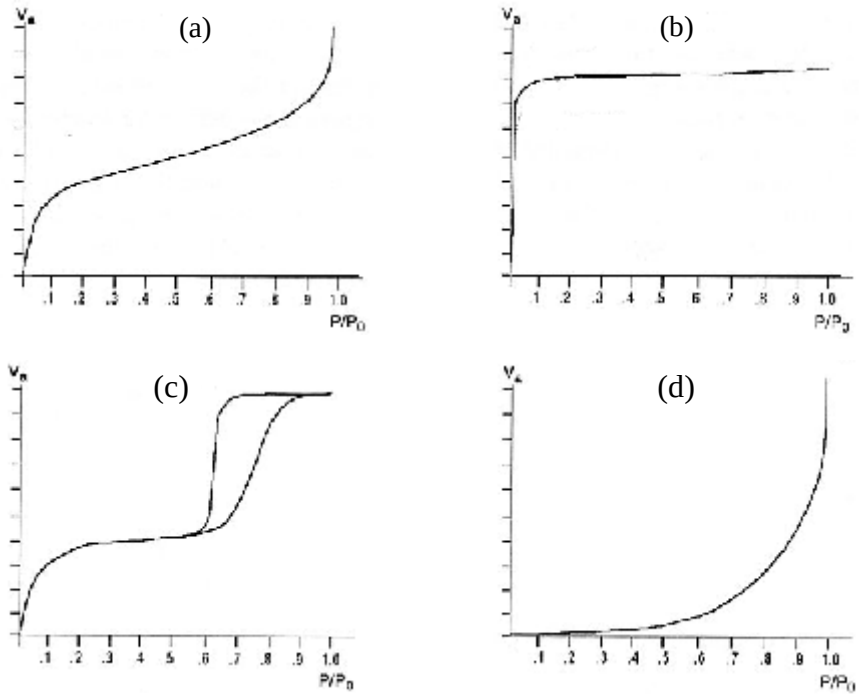
6. Which of the following oxides is most easily prepared as mesoporous materials through self-assembly of the pore-directing agent and the inorganic precursor?
   (a) Al_2O_3 (b) SiO_2 (c) TiO_2 (d) SnO_2

7. Which of the following techniques is commonly used in synthesis of zeolites?
   (a) hydrothermal (b) impregnation (c) solid state reaction
   (e) precipitation

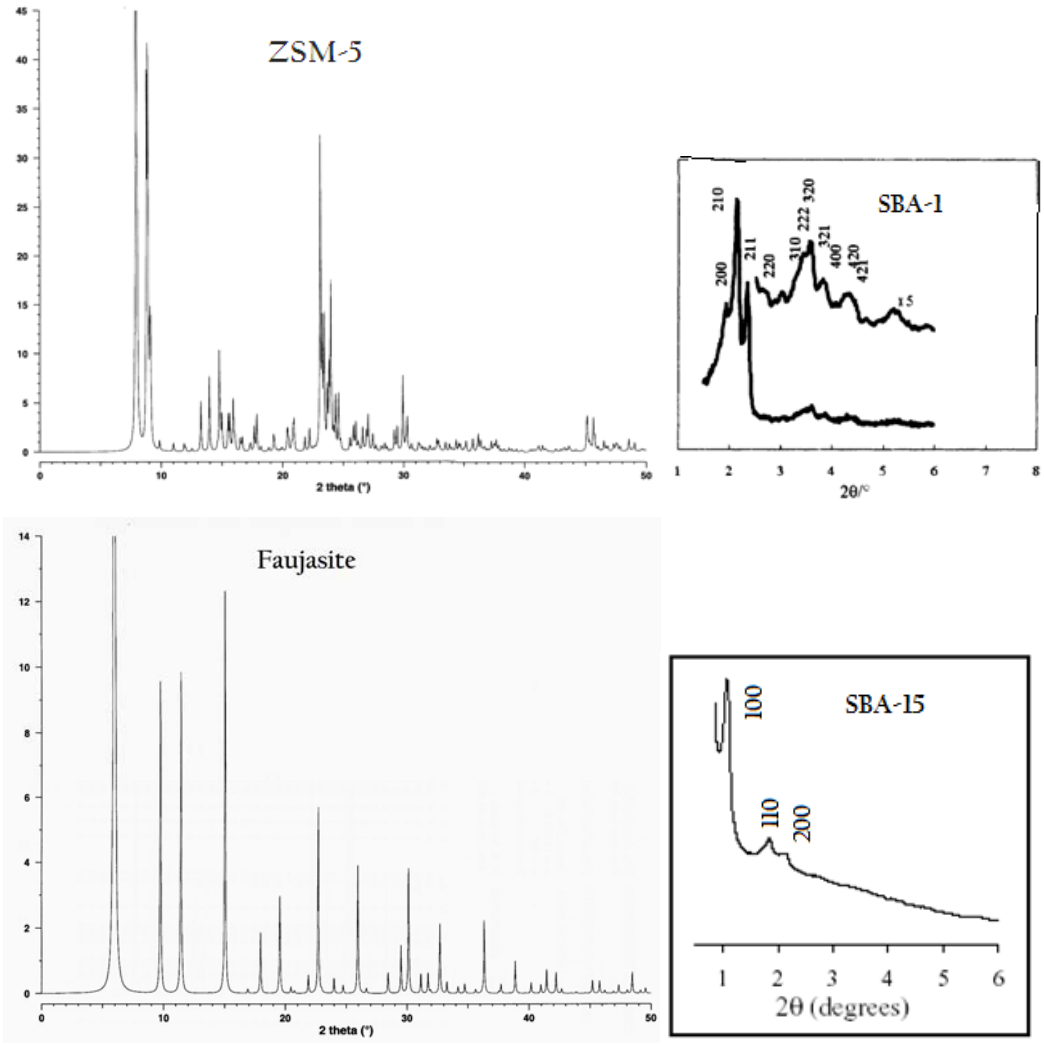
8. Which of the following techniques is used in synthesis of nanoporous TiO_2?
   (a) electrolysis (b) evaporation-induced self-assembly
   (c) solid state reaction (d) nanocasting

9. Which of the following compounds can be used as the pore-directing agent in synthesis of mesoporous SiO_2?
   (a) NaCl (b) TEOS (tetraethyl orthosilicate)
   (c) ethanol (d) $EO_{20}PO_{70}EO_{20}$

10. Which of the following N_2 sorption isotherms is typical for the materials containing micropores?



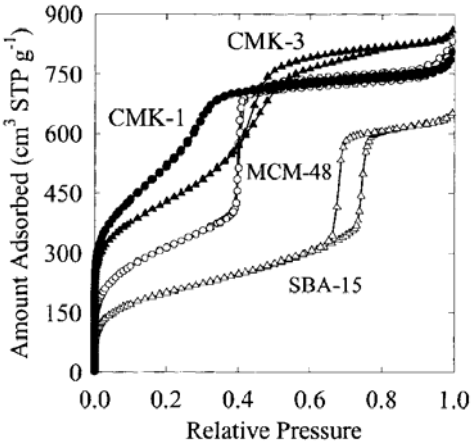
11. Based on the following XRD patterns, which of the shown materials has the smallest pore diameter?
   (a) ZSM-5 (b) Faujasite
   (c) SBA-1 (d) SBA-15



12. Based on the following N_2 sorption isotherms, which of the shown materials has the smallest pore diameter?

(a) CMK-1 (b) CMK-3

(c) MCM-48 (d) SBA-15



13. Which of the following properties is the reason that nano-porous materials can be used as a low *k* material?
    (a) The dielectric constant of air is low
    (b) The dielectric constant of water is low
    (c) The dielectric constant of silica is low
    (d) The dielectric constant of surface silanol groups is low

14. Which of the following techniques is suitable for elemental analysis of bulk materials?
    (a) X-ray diffraction (b) Raman spectra
    (c) Atomic emission spectra (d) XPS

15. Magic angle spinning is used for solid state NMR experiments in order to eliminate which of the following terms in magnetic field?
    (a) Zeeman interaction (b) Dipolar interaction
    (c) Chemical Shift (d) Quadrupolar interaction

16. Which of the following techniques is suitable for structural analysis in local bond distance and coordination number of materials, which do not have long-distance ordered atoms?
    (a) EXAFS (b) IR (c) X-ray diffraction (d) XPS

17. Which of the following techniques is suitable for determining the pore diameter of mesoporous materials?
    (b) X-ray diffraction (b) TEM (c) N_2 sorption isotherm (d) XPS

18. Which of the following techniques needs to use light source of single wavelength?
    (c) EXAFS (b) IR (c) X-ray diffraction (d) Atomic emission spectra