



Thermal Analysis (IARSCS-814)

First Semester, Marks: 50, Time allowed: 1 hours

Note: Attempt all questions

Name: _____ Surname: _____ Roll Number: _____

MCQs

- Modern instruments for thermogravimetry (TG) consists of different parts, write down one missing component, (1)
(A) Balance
(B) Purge Gas
(C) Microprocessor for instrument control and data acquisition and display
(D) _____
- In thermal analysis, the usual weight of sample is taken in range of, (1)
(A) 1 – 100 g
(B) 5 – 20 mg
(C) 100 – 500 g
(D) 200 – 1000 μ g
- The common selectable heating rates of furnace lies between, (1)
(A) 5 – 20 °C (B) 20 – 100 °C (C) 20 – 200 °C
- Crystallization is process of cooling in which, (1)
(A) Heat is absorbed (B) Heat is giving off (C) None
- The Crystallization represents, (1)
(A) Exothermic (B) Endothermic (C) None
- Glass transition is a process of, (1)
(A) Exothermic (B) Endothermic (C) None
- The enthalpy value of glass transition is, (1)
(A) $\Delta H = 10$ KJ/mol (B) $\Delta H = 0$ KJ/mol (C) $\Delta H = 100$ KJ/mol
- The use of nitrogen or argon gas causes the sample, (1)
(A) Oxidation (B) Reduction (C) Inert
- The Oxidation curve does not appear in thermograms, when, (1)
(A) Nitrogen gas is used throughout
(B) Oxygen is used partially or throughout
(C) Argon is used instead of nitrogen
- Why is the peak of glass transition not found in DTA, (1)
(A) Plus enthalpy (B) Zero enthalpy (C) Minus enthalpy
- Melting is the process of, (1)
(A) Exothermic (B) Endothermic (C) None



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12. The sample/reference holder is made of, (1)
(A) Aluminum (B) Platinum (C) Aluminum or Platinum (D) Stainless steel
13. Select the endothermic reaction of physical state, (1)
(A) Fusion, Vaporization, Sublimation (C) None
(B) Adsorption, Crystallization
14. Which chemical reaction falls in exothermic nature, (1)
(A) Polymerization, Catalytic reaction (C) None
(B) Dehydration, Decomposition
15. Why endothermic reaction or minima is found in DTA when the sample is compared with the reference, (1)
(A) Sample became hotter than the reference material
(B) Sample became cooler than reference material
16. In differential thermogram, the sulphur transforms from rhombic to monoclinic at the temperature, (1)
(A) 108 °C (B) 113 °C (C) 124 °C
17. The melting point of Sulphur is, (1)
(A) 113 °C (B) 124 °C (C) 446 °C
18. The boiling point of Sulphur is, (1)
(A) 113 °C (B) 124 °C (C) 446 °C (D) None
19. Differential thermal methods are simple, accurate and reproducible way of determining, (1)
(A) Boiling, melting, flash point
(B) Melting, boiling and decomposition
(C) Sublimation, melting, boiling
20. Differential scanning calorimetry or DSC is the technique to measure difference in, (1)
(A) Temperature (B) Mass (C) Energy
21. "The sample and reference are heated by separate heaters in such way that their temperatures are kept equal while these temperatures are increased (or decreased linearly)". The above statement represents the term, (1)



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- (A) Power compensated DSC (C) None
(B) Heat flux DSC
22. Match the term associated with following statement. “*The difference of heat flow in sample and reference is measured as the sample temperature is increased or decreased linearly*”, (1)
(A) Power compensated DSC (C) None
(B) Heat flux DSC
23. Constantan is an alloy made (of $\approx 60:40$ ratio) from, (1)
(A) Co:Ni (B) Cr:Cu (C) Cu:Ni (D) Cu:Al
24. (a) The calcium oxalate on its fragmentation gives calcium carbonate and carbon dioxide and the reaction is, (1)
(A) Exothermic
(B) Endothermic
(b) The purge gas used is,
(A) Oxygen
(B) Nitrogen
25. (a) The decomposition of calcium oxalate gives calcium carbonate and carbon monoxide and the reaction is, (1)
(A) Exothermic
(B) Endothermic
(b) The purge gas used is,
(A) Oxygen
(B) Nitrogen
26. The thermogram on decomposition of calcium oxalate in purge of nitrogen gives number of minima, (1)
(A) 2 (B) 3 (C) 4
27. Select number of maxima encountered in the decomposition of calcium oxalate in the environment of oxygen, (1)
(A) 1 (B) 2 (C) 3
28. Select number of minima encountered in the decomposition of calcium oxalate in the flow of oxygen, (1)
(A) 1 (B) 2 (C) 3



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29. In thermogram, mass of three anhydrous compounds CaC_2O_4 , SrC_2O_4 and BaC_2O_4 indicated are in range of, (1)
- (A) 320 – 400 °C (C) None
(B) 580 – 620 °C
30. The mass of three carbonates from CaC_2O_4 , SrC_2O_4 and BaC_2O_4 indicated are in range of, (1)
- (A) 320 – 400 °C (C) None
(B) 580 – 620 °C
31. The derivative curve may reveal information (that is not detectable in ordinary thermogram) of loss of mono hydrates from CaC_2O_4 , SrC_2O_4 and BaC_2O_4 at temperatures, (1)
- (A) 140 °C, 180 °C, 205 °C respectively
(B) 180 °C, 140 °C, 205 °C respectively
(C) 205 °C, 180 °C, 140 °C respectively
32. All these three CaC_2O_4 , SrC_2O_4 and BaC_2O_4 lose simultaneously their carbon monoxide and thus yield a single sharp peak at, (1)
- (A) 350 °C (C) None
(B) 450 °C
33. Which type of material is used in DTA as a reference against analyte of impure calcium oxalate, (1)
- (A) Pure calcium oxalate (C) None
(B) Alumina
34. Differential Scanning Calorimetric experiments are usually performed in the, (1)
- (A) Isothermal mode
(B) Temperature scan mode
35. What do you see in Isothermal mode, (1)
- (A) Variable temperature with time constant
(B) Holds temperature constant with variable time



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36. The plot of DSC thermogram in Isothermal mode is represented as, (1)
- (A) Differential power, mW against Time, *min.*
 - (B) Heat flow, mW against temperature, °C
37. The thermogram scale of Thermal Gravimetry (TG) is given by, (1)
- (A) Mass% vs Time
 - (B) Mass in mg vs Temperature
 - (C) Mass% vs Temperature
 - (D) All
38. The common hyphenated techniques of thermal analyzer is, (1)
- (A) GC-MSD
 - (B) FTIR
 - (C) XRD or SEM
 - (D) GC-MSD and FTIR

Descriptive Questions

1. Write the importance of thermal analysis and its techniques from selected course. (4)
2. Differentiate between Power Compensated DSC and Heat Flux DSC. (4)
3. Name 1 to 6 in sequence of different process occurring in the following thermogram, (4)

