Met- 4012 Principle of Mineral Processing
Sample Questions and Answers for Final Exam, 2008

1. Define the following:

(a) Flotation (Page-3)	(b) Bulk flotation(Page-32)
(c) Selective flotation(Page-31)	(d) Activation(Page-15)

2. (a)What are the stages involved in cyanidation ?

Ans; Page 41

(b) What can for conditioning and conditioning time effect the flotation recoveries? (On what factors does the size of a conditioning depend?)

Ans; Page 19

3. (a) What is cyanidation?

Ans; Page 41

(b) Draw flow sheet for (a) cyanidation (b) Amalgamation.

Ans; Page 40,42

4.(a) Classify the minerals?

Ans; Page 5

(b) Explain flotation and state the steps involved in concentration an ore by dressing?

Ans; Page 3,4

5. Explain flotation and state the steps involved in concentration an ore by dressing?

Ans; Page 3,4

6. Define collectors and name the different types of collectors with general structural formulae ?

Ans; Page 8,10

7.(a) Disuss briefly the reaction between Xanthate and galena?

Ans; Page 32,33

(b) Disuse briefly the reaction of Xanthate with sphalerite before and after activation with copper sulphate.

Ans; Page 35

9. Explain very briefly roughing, scavenging and clearing operations with a sketch of a flotation circuit ?

Ans; Page 24,25

10. Name the four methods of flotation machine currently in use (any two with neat sketch)

Ans; Page 36,37

11.A lead ore containing 10% PbS is to be concentrated by flotation at 500 tpd of ore. Pulp dilution of 2:1 with flotation time of 8 minutes in rougher and L:S = 4:1 with 15 minutes in scavenger are to be maintained. The products produced have the following compositions:

	%PbS	$\%SiO_2$
Feed	10	90
Concentrate	80	20
Rougher tailing	2	98
Scavenger concentrate	11	89
Final tailing	0.5	99.5

The density of PbS and SiO2 are 7.5 g/cc and 2.65 g/cc. The concentrate from the rougher cells is of acceptable purity, but the tailing are to be retreated in scavenger cells with return of the scavenger concentrate to the rougher.(at.wt. of Pb=207 g/mol, Si=28g/mol, S=32 g/mol)

Solution Example 4.1 Page 27

12.A 1000 tpd mill treats ore assaying 10% PbS using roughing and scavenging operations with the scavenger concentrate assaying 8% PbS being returns to the rougher. The rougher concentrate contains 80% PbS with pulp with dilution 1:1 and the final tailing assays 1% PbS. Also tailing from rougher analyzes 4% PbS. Rougher flotation time of 8 minutes with 30% pulp density and scavenging operation of 14 minutes with 25% pulp density are to be allowed. If the sp.gr. of the ore is 2.8, determine-(a) volume of rougher and scavenger cells in cu.ft, (b) weight of concentrate produced/day (c) percent of lead in ore lost in tailing.

Solution Sample solution Chapter 4 Problem 1 Page 12

13.A mill treats 500tpd of galena ore with sp.gr. 2.7. The pump from the classifier discharge is measured at 40% solids. Water is added to the conditioner to dilute the pulp to 30% solids. If the volume of the conditioner is 180 ft^3, calculate (a) rate of water added in ft^3/min (b) conditioning time in minutes, (c) daily water consumption in ft^3.

Solution Sample solution Chapter 3 Problem 4 Page 8

14.An agitaor receives pulp with L:S of 1.07:1 to be conditioned for 4 minutes with 0.12 lb/ton of collector. To dilute the pulp, water is added to the agitator at 21 gal/min. Compute (a) volume of agitator required for a 1000tpd mill if sp.gr. of ore is 2.7.(b) collector concentration in agitator in mg/l(c) pulp density existing in the agitator.

Solution Sample solution Chapter 3 Problem 6 Page 9

15. Define Flocculators(Page 17), Frother(Page 12), Heteropolar Compound

16.Define Sulphidizing , Flocculating , Critical pH and Amalgamation.

17.Explain about froth stability in flotation process.
Ans; Page 4

18. Explain application of contant angle.
Ans; Page 6

19.What are the flotation reagents? Explain any one.
Ans; Page

20. Define dispersion and what are the dispersion agents.
Ans; Page 16

21.(a) Example 3.1 Page 20
(b) Example 3.2 Page 21

22.Example 3.3 Page 22

23.Problem 3.1
Solution Sample solution Chapter 3 Problem 1 Page 6

24. Problem 4.2 Page 29
Solution Sample solution Chapter 4 Problem 2

25. Problem 4.3 Page 29
Solution Sample solution Chapter 4 Problem 3

26.Problem 4.4 Page 30
Solution Sample solution Chapter 4 Problem 4

27.Define the following
i) Bulk oil process Ans; Page 5
ii) Slime coating Ans; Page 16
iii) Hydrophobic surface Ans; Page 3

28.A lead ore containing 10% PbS is to be concentrated by flotation at 500 tpd of ore. Pulp dilution of 2:1 with flotation time of 8 minutes in rougher and L:S = 4:1 with 20 minutes in scavenger are to be maintained. The products produced have the following compositions:

	%PbS	$\%SiO_2$
Feed	10	90
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Rougher tailing	2	98
Scavenger concentrate	11	89
Final tailing	0.5	99.5

The density of PbS and SiO2 are 7.5 g/cc and 2.65 g/cc. The concentrate from the rougher cells is of acceptable purity, but the tailing are to be retreated in scavenger cells with return of the scavenger concentrate to the rougher.(at.wt. of Pb=207 g/mol, Si=28g/mol, S=32 g/mol)
Ans; Similar with Example 4.1 Page 27

29.From Example 3.3 Page 22,if the feed to the conditioner is 450 tpd of calculate (a) volume of conditioner in cu ft (b) collector concentration in mg/l and (c) collector dosage in lb/ton of ore.
Ans; Similar with Example 3.3 Page 22

30. From Example 3.3 Page 22,if the feed to the conditioner is 550 tpd of calculate (a) volume of conditioner in cu ft (b) collector concentration in mg/l and (c) collector dosage in lb/ton of ore.
Ans; Similar with Example 3.3 Page 22

Met-4014 Foundry Technology III
Sample Questions and Answers for Final Exam, 2008

1. Explain the melting practices generally employed for steel castings?
Ans; Chapter 6 Page 58

2.(a)How do you understand the modulus of casting ? Explain briefly with a typical steel casting?
Ans; Chapter 7 Page 74
(b)Using the modulus method, design a risering system, that will produce sand casting with maximum yield for the following steel castings, (a) a cube of dimension 10.63" x 10.63"x 10.63". (b) a ball mill liner of dimensions 40"x50"x2"

3. Write short note an heat treatment of steel casting ?
Ans; Chapter 8 Page 88,89

4.(a) What is meant by precipitation hardening or artificial aging ?
Ans; Chapter 8 Page 86,87
(b) Briefly explain the following.
(i) White heart or European process
(ii)Black heart or American Process
Ans; Chapter 8 Page 90

5.Describe the advantages of gold layout for foundry?
Ans; Chapter 9 Page 92

6. Write short notes on the following :(a) Deoxidation (b) Inclusions (c) Gas porosity (d) Impurities
Ans; Chapter 6 Page 63

7. Draw a neat sketch of foundry august for the malleable iron foundry by referring the following data (1) Capacity of the furnace- 1 Ton/hr cupola
(2) Available oven – unlimited
(3) Fuel capacity –coke, fuel oil are available.
Ans; Similar with Chapter 9 Page 96

8.(a) Discuss the importance of computer applications in foundry to ensure the soundness and productivity of the casting?
Ans; Chapter 10 Page 99
(b) Write short note on the SOLSTAR system in foundry?
Ans; Chapter 10 Page 99

8. What are the steps necessary in planning a foundry layout?
Ans; Chapter 9 Page 93

9. Compare the difference between arc furnace and Induction furnace in melting.
Ans; Chapter 6 Page 61,62

10.Write short notes on the following :(a) Hydrogen (b) Nitrogen (c) Carbon monoxide
(d) Hot tearing
Ans; Chapter 6 Page 64,65

11.Describe the types of ladle used for steel castings in foundry. Briefly explain them.
Ans; Chapter 6 Page 65,66

12.(a) Should we consider the ladle linings on what factors?
Ans; Chapter 6 Page 66
(a) Which data are necessary to calculate the feed volume requirement for steel?
Ans; Chapter 7 Page 76

13. Draw a layout of a small grey iron foundry with suitable data and equipment as possible as you know.
Ans; Chapter9 Page 96

14.Discuss the important of plant layout in foundry industries to improve the quality and production rate.
Ans; Chapter 9 Page 92

15.(a)Define Chvorinov's rule.
Ans; Chapter 7 Page 74
(b) High alloy steels may be divided into three main groups. How do you understand them?
Ans; Chapter 6 Page 60

16. (a)What are the advantages of application of computer software in designing, pattern making, and solidification in making a casting?
Ans; Chapter 10 Page 104
(b) Define Plant layout.
Ans; Chapter 9 Page 92
(c) Describe non-destructive testing of steel casting.
Ans; Chapter 6 Page 67

17.(a) What are the four possible situations of feeding distance in steel casting.
Ans; Chapter 7 Page 72
(b) What are the main objectives of heat treatment?
Ans; Chapter 8 Page 84

18. Write short note an heat treatment of steel casting ?
Ans; Chapter 8 Page 88,89

19.Describe the three types of heat treatment which may be given to magnesium casting alloys.
Ans; Chapter 8 Page 86

20.Describe the heat treatment procedures for cast iron and explain any two.
Ans; Chapter 8 Page 89

21. Describe the aim of computer modeling .

22. Briefly discuss the different types of plain carbon steels and alloy steel in foundry practice.
Ans; Chapter 6 Page 59,60

23. Briefly discuss about the modulus extension factor (MEF)
Ans; Chapter 8 Page 75

24. Why is thermal analysis one of the important factor in SOLSTAR?
Ans; Chapter 10 Page 101

25.What is the most extensively used inspection technique.Why?
Ans; Chapter 6 Page 67

26. What are the role of solid modeling in the SOLSTER program?
Ans; Chapter 10 Page 100

27. Briefly explain "Natural and Aided" feeders.
Ans; Chapter 9 Page 92

28. Which data are necessary to calculate the feed volume requirement for grey and ductile iron?
Ans;Chapter 7 Page 82

29.Chapter 7 Example Page 76

30. Discus about the modulus formulae for some common shapes as possible as you can.
Ans; Chapter 7 Figure 7.5 Page 75

Met – 04015 Metallurgical Heat Transfer
Sample Questions and Answers for Final Exam, 2008

1. Define or briefly explain the following.
   (1)Prandtl number (Page 47) (5) Logarithmic mean temperature difference (Page 60)
   (2) Nusselt number (Page 51) (6) No-slip condition (Page 45)
   (3) Reynolds number (Page 51) (7) Hydraulic diameter (Page 64)
   (4) Film temperature (Page 57) (8) Convection coefficient (Page 49)

2. Air at 30˚C flows with a velocity of 6 m/s over a 2.5 m x 8 m flat plate whose temperature is 120 ˚C. Determine the rate of heat transfer from the plate if the air flows parallel to the (a) 8 m long side and (b) the 2.5 m side.

Given K= 0.0297W/m˚C, ρr = 0.706 , $\mu/\rho = 2.06 \times 10^{-5}\ m^2/s$

Ans; the time tem; = (120+30)/2 = 75+273 = 348 K

At 348K, (a) When the air flows parallel to the long side L=8m

$Re = LV\rho/\mu = (8x6)/2.06 \times 10^{-5} = 2.33 \times 10^6 > 4000$

The flow is turbulent

$Nu = 0.036\ Re^{0.8}\ Pr^{0.33}$

$=0.036(2.33x10^6)^{0.8}(0.706)^{0.33} = 39.88.89$

Nu = hL/K

$h = NuK/L = 14.79\ W/m^2{}^\circ C$

$Q = hA\Delta T = 14.79(2.5 \times 8)(120\text{-}30) = 26622\ W$

(b) When the air flows parallel to the 2.5 m long side, L= 2.5m

$Re = LV\rho/\mu = (2.5 \times 6)/ 2.06 \times 10^{-5} = 7.28 \times 10^6 > 4000$

The flow is turbulent

$Nu = 0.036\ Re^{0.8}\ Pr^{0.33}$

$=0.036(7.28 \times 10^6)^{0.8}(0.706)^{0.33} = 1571$

Nu = hL/K

$h = NuK/L = 18.67\ W/m^2{}^\circ C$

$Q = hA\Delta T = 18.67(2.5 \times 8)(120\text{-}30) = 33595\ W$

3.(a) Define Radiosity.

Ans; Radiation Page 32

(b) A 25 cm diameter stainless steel ball $\rho = 8055\ Kg/m^3$, Cp = 480 J/Kg˚C is removed from the oven at a uniform temperature of 300˚C. The ball is then subjected to the flow of air at 1 atm pressure and 27˚C with a velocity of 3 m/s . The surface temperature of the ball eventually drops to 200˚C. Determine the average convection heat transfer coefficient during this cooling process, and estimate how long this cooling process will take.

Ans; Example 2 Page 58

4.(a) What is forced convection? How does it differ from natural convection?

Ans; Chapter 3 Page 41

Show that the Reynolds number for flow in a circular tube of diameter D can be expressed as

Re = 4 m / лDμ.

Ans;can calculate by usingthe following formula, mass flow rate= ρAV

$\rho = m/AV$

$Re = DV\rho / \mu$

(b) The two very large parallel plates are maintained at uniform temperature T = 800˚K and T_2 =500˚K, and have emissivities ϵ_1 = 0.2 and ϵ_2= 0.7 respectively. Determine the net rate of radiation heat transfer between the two surfaces per unit area of the plates.

Ans; Radiation Example 8 Page 28

5. Hot air at atmospheric pressure and 80˚C enters an 8 m long uninsulated square duct of cross-section 0.2 m x 0.2 m that passes through the attic of a house at a rate of 0.15 m^3/s. The duct is observed to be nearly isothermal at 60˚C. Determine the exit temperature of the air and the rate of heat loss from the duct to the attic space.

Ans; Chapter 3 example Page 64

6. (a) When is heat transfer through a fluid conduction and when is it convection? For what case is the rate of heat transfer higher?

Ans; Chapter 3 Page 41

(b)Consider an iron block coming out of a furnace. Will the block cool faster or slower with a fan blowing air over its top surface instead of letting it cool naturally in the cooler air in the room? Explain.

Ans; Chapter 3 Page 42

7. Define or briefly explain the following

(1) Black body (Page 4)
(2) Gray body (Page 12)
(3) Specular reflection(Page 10)
(4) Emissivity (Page 12)
(5) Space resistance(Page 36)
(6) Summation rule(Page 21)
(7) Superposition rule (Page 22)
(8) Diffuse reflection (Page 11)
(9) Stefan-Boltzmann law (Page 6)
(10) Black body radiation function (Page 7)

8.(a) Consider a 20cm diameter spherical ball at 800K suspended in the air. Assuming that the ball closely resembles a blackbody , determine (a) the total blackbody emissive power, (b) the total amount of radiation emitted by the ball in 5 minutes, and (c) the spectral blackbody emissive power at a wavelength of 3 μm.

Ans; Radiation Example 1 Page 6

(b)Determine the view factors from the base of the pyramid to each of its four side surfaces. The base of the pyramid to each of its four side surfaces. The base of the pyramid is a square, and its side surfaces are isosceles triangles.

Ans; Radiation Example 6 Page 25

9.(a) The spectral emissivity function of an opaque surface at 800K is approximated as

$\epsilon_\lambda = \epsilon_1 = 0.3 \qquad 0 \le \lambda < 3\ \mu m$

$\epsilon_\lambda = \epsilon_2 = 0.8 \qquad 3 \le \lambda < 7\ \mu m$

$\epsilon_\lambda = \epsilon_3 = 0.1 \qquad 7 \le \lambda < \alpha$

Determine the average emissivity of the surface and its emissive power.

Table Black body Radiation Functions f_λ

λT, μm	f_λ
1600	0.019718
2000	0.066728
2400	0.140256
2800	0.227897
3200	0.318102
3600	0.403607
4000	0.480877
4400	0.548796
4800	0.607559
5200	0.658970
5600	0.701046
6000	0.737818
6400	0.769234

Ans; Radiation Example 3 Page 15

(b) Consider an enclosure consisting of five surfaces. How many view factors does this geometry involve? How many of these view factors can be determined by the application of the reciprocity and summation rules?
Ans; Similar with Radiation Example 4 Page 22

10.(a)Consider a 5m x 5m x 5m cubical furnace whose surfaces closely approximate black surfaces. The base, top and side surfaces of the furnace are maintained at uniform temperatures of 800˚K.,1500˚K and 500˚K, respectively. Determine (a) the net rate of radiation heat transfer between the base and the side surfaces, (b) the net rate of radiation heat transfer between the base and the top surface, and (c) the net radiation heat transfer from the base surface.
Ans; Radiation Example 8 Page 28
(b) Radiation Example 7 Page 28

11.A 20 cm diameter stainless steel ball ρ = 8055 Kg/m^3, Cp = 480 J/Kg˚C is removed from the oven at a uniform temperature of 250˚C. The ball is then subjected to the flow of air at 1 atm pressure and 27˚C with a velocity of 3 m/s . The surface temperature of the ball eventually drops to 250˚C. Determine the average convection heat transfer coefficient during this cooling process, and estimate how long this cooling process will take.
Ans; Similar with Example 2 Page 58

12.Que;Chapter 3 Forced Convention Example 3.1 Page 52
Ans; Chapter 3 Forced Convention Example 3.1 Page 52

13. Que;Chapter 3 Forced Convention Example 1 Page 57
Ans; Chapter 3 Forced Convention Example 1 Page 57

14.A long 8cm diameter pipe whose external surface temperature is 90˚C possess through some open area that is not protected against the winds. Determine the rate of heat losses from the pipe per unit of its length when the air is at 1 atm pressure and 7˚C and the wind is blowing across the pipe at a velocity of 50km/h.

Given K = 0.0275, ρr = 0.71 , $\mu/\rho = 2.77 \times 10^{-5}\ m^2/s$
Ans; Similar with Chapter 3 Forced Convention Example 1 Page 57

15. Que; Forced Convention Example Page 62
Ans; Forced Convention Example Page 62

16. Que; Sample Que; 15 Page 67
Ans; D= 15 cm = 0.15m
K = 0.0261, ρr = 0.0712 , $\mu/\rho = 1.57 \times 10^{-5}\ m^2/s$
$\rho = 8055 kg/m^3$
Cp = 480J/kgC
$\mu_\alpha = 1.85 \times 10^{-5}$ kg/ms
$\mu_s = 2.945 \times 10^{-5}$ kg/ms
$Re = DV\rho/\mu = (0.15 \times 6) / 1.57 \times 10^{-5} = 58000$
$Nu = 2 + [0.4 Re^{0.5} + 0.06 Re^{2/3}] Pr^{0.4}[\mu_\alpha / \mu_s]^{1/4}$
$= 2 + [0.4 (58000)^{0.5} + 0.06 (58000)^{2/3}] (0.0712)^{0.4}[1.85 / 2.945]^{1/4} = 145.7$

h = NuK/D = (145.7 x 0.0261)/0.15 = 25.35 W/m˚C
Ts = (350=250)/2 = 300˚C
$A = \Pi D^2 = \Pi (0.15)^2 = 0.0706$
Q˚ave = hA(Ts-T$_\alpha$) = 25.35 x 0.0706(300-30 0 = 573.4 W˚C
Q˚total = mCp ΔT
$m = \rho V = 8055 \times \Pi(0.15)^3/6 = 14.234$ kg

17.Que; Sample Que; 16 Page 67
Ans; D= 3mm = 0.003m
K = 0.0363, ρr = 0.7 , $\mu/\rho = 3.18 \times 10^{-5}\ m^2/s$
Tf = Ts + T$_\alpha$/2 = (350+35)/2 = 192.5+273 = 465.5 K
$Re = DV\rho/\mu = (0.003 \times 6) / 3.18 \times 10^{-5} = 537$
From table,C = $0.683 \times 567^{0.466} \times 0.7^{1/3} = 11.64$
h = NuK/D = (11.64 x 0.0363)/0.003 = 140.8 W/m˚C
A = PL = Π DL = Π x 0.003 x1 = 9.42 x 10-3 m2
Q˚ = hA ΔT
$= 140.8 \times 9.42 \times 10^{-3} \times (350-35) = 418$ W

18.(a)What are the generally accepted values of the critical Reynolds numbers for (a) flow over a flat plate,(b) flow over a circular cylinder, and c) flow in a tube.
Ans; Radiation Page 51,61,62
(b) Radiation Example 2 Page 7

19. Radiation Example 9 Page 40

20. (a) Radiation Example 16 Page 57
(b) Radiation Example 17 Page 59

21.(a)Describe several kinds of heat losses from the furnace chamber.
Ans;Radiation Page 60

(b) The two very large parallel plates are maintained at uniform temperature T_1 = 600˚K and T_2 =400˚K, and have emissivities ϵ_1 = 0.5 and ϵ_2= 0.9 respectively. Determine the net rate of radiation heat transfer between the two surfaces per unit area of the plates.
Ans; Similar with Radiation Example 8 Page 28

22.Hot air at atmospheric pressure and 90˚C enters an 6 m long uninsulated square duct of cross-section 0.2 m x 0.2 m that passes through the attic of a house at a rate of 0.15 m^3/s. The duct is observed to be nearly isothermal at 70˚C. Determine the exit temperature of the air and the rate of heat loss from the duct to the attic space.
Ans; Similar with Chapter 3 example Page 64

23.A long 10cm diameter pipe whose external surface temperature is 110˚C possess through some open area that is not protected against the winds. Determine the rate of heat losses from the pipe per unit of its length when the air is at 1 atm pressure and 4˚C and the wind is blowing across the pipe at a velocity of 8km/h.
Given K = 0.0283 W/m˚C, ρr = 0.708 , $\mu/\rho = 1.86 \times 10^{-5}\ m^2/s$
Ans; Similar with Chapter 3 Forced Convention Example 1 Page 57

24.Radiation Example 14 Page 48

25.Radiation Example 13 Page 46

26.Radiation Example 12 Page 43

27.Radiation Example 11 Page 41

28.Radiation Example 5 Page 23

29.Chapter 3 Example 3.3 Page 55

30. Chapter 3 Example 3.2 Page 53

<u>Met- 4016 Ferrous Metallurgy</u>
<u>Sample Questions and Answers for Final Exam, 2008</u>

1.(a)Define the following
(i) Agglomeration (ii) Palletizing (iii) Sintering (iv) Coke and coking
Ans; Page 3 to Page 11
(b) Write short notes on the following
(i) Blast Furnace Gas (ii) Coke Over Gas (iii)Natural Gas
Ans; Page 13 to Page 14

2.(a) Define the differences types of refractory bricks and explain briefly their properties.
Ans; Page 24 to Page 27

(b) Describe all main operations parts of a blast furnace with a neat sketch and explain the reactions that take place in different zones.
Ans; Page 29 to Page 32 Page 36 to Page 44

3.(a) Describe briefly "magnesium base reagents " and " calcium base reagents".
Ans; Page 47 to Page 49

(b) Discuss the production of iron by divert reduction process and draw the flow charts of solid reduction and gaseous reduction processes.
Ans; Page 51 to Page 53

4.(a) Describe the major elements in steels and explain briefly the influence of these elements on steels properties.
Ans; Page 55 to Page 58

(b) Define the different sources of oxygen for steel making and explain briefly each.
Ans; Page 60

5.(a) Define the followings.
(i) Decarburization (ii) Desiliconization (iii) Dephosphorization
(iv)Desulphurization
Ans; Page 61 to Page 63

(b)Define the types of raw materials used in open hearth furnace.
Ans; Page 69 to Page 70

6.(a) Write short note on " basic fluxes" and oxidizing fluxes " for steel making in open hearth furnace .
Ans; Page 69 to Page 70
(b)Explain the reasons for the increased popularity of the basic electric are process.
Ans; Page 76 to Page 77

7.(a)Discuss the disadvantages of the basic electric are process.
Ans; Page 77

(b)Describe briefly the single slag practice (or) the double slag practice
Ans; Page 80 to Page 81

8.(a) Write short note or BOF refectories
(b)Define the major parts and their functions of the BOF with a neat sketch.
Ans; Page 83 to Page 84

9.(a) Explain briefly the production of stainless steel by Are Furnace Practice.
Ans; Page 91 to Page 92

(b) What are the advantages or benefits of vacuum degassing of steels.
Ans; Page 97 to Page 98

10. An iron blast furnace produces pig iron of the following composition .

pig iron%		Ore%		Flux % (1/4 the weight of ore)		Coke % (900kg pre tons of pig iron)	
Fe	92.8	Fe_2O_3	78	$CaCO_3$	96	C	88
C	3.8	SiO_2	84	$MgCO_3$	2	SiO_2	9
Si	2.1	MnO	0.6	SiO_2	2	Al_2O_3	1
P	0.9	Al_2O_3	5.0			H_2O	2
Mn	0.4	P_2O_5	1.7				
		MgO	1.2				
		H_2O	5.1				

The gases carry 2 parts of CO to 1 part CO2. Assume that 99.5% of the iron is reduced, 0.5% slagged.
Refined: Per ton (1000 kg) of pig iron made:

(i) The weight of ore used
(ii) The weight of slag made its parentage composition (Fe=56, O = 16, Si = 28, Mn =55.P =31, Mg = 24 , Ca =40 g/mol)
(iii) Volume of air required
(iv) The volume and percentage composition of the blast furnace gas.

Ans; Metallurgical problem Example 1 Page 104

11. An acid Bessemer converter blows 20 metric tons of the following pig iron.

C	4%
Mn	1.2%
Si	1.4%
Fe	93.4%

Besides the limitations there is oxidized iron epcivalent to 1.5% of the pig, assume the iron oxidized at a uniform rate. There-fourths of the carbon goes to CO and one- fourth to CO_2. The gases leaves the converter at 1500˚C.Neglect heat in the incoming air. The blast is supplied at a constant rate of 600cu-m per minute, measured at standard conditions.

Required : 1. The total volume of air used

2. The time of each of the two periods.

3. The weight and percentage compositions of the slag.

Ans; Metallurgical problem Example 2 Page 110

12. Problem No.1(Page 107)
Ans; Similar with Metallurgical problem Example 1 Page 104

13. Problem No.2(Page 107)
Ans; Similar with Metallurgical problem Example 1 Page 104

14. Problem No.3(Page 107)
Ans; Similar with Metallurgical problem Example 1 Page 104

15. Converter Problem No.1(Page 111)
Ans; Similar with Metallurgical problem Example 2 Page 110

16. Converter Problem No.2(Page 111)
Ans; Similar with Metallurgical problem Example 2 Page 110

17. Que; Principles of Steel making Sample Que; 15
Ans; Principles of Steel making Page 55,56

18. Que; Principles of Steel making Sample Que; 16
Ans; Principles of Steel making Page 64,65

19. Briefly explain the construction of an open hearth furnace with the neat sketch diagram.
Ans; The basic open hearth process (BOH) Page 67 to 69

20. Describe how to control temperature, carbon content and sulphur to produce steel in the basic open-hearth furnace.
Ans; The basic open hearth process (BOH) Page 71 to 73

21.Explain briefly the "blocking a heat".
Ans; The basic open hearth process (BOH) Page 73 to 74

22. Define the parts used in arc furnace and explain each their functions with a neat sketch
Ans; The basic electric arc process (EF) Page 78 to 79

23.Describe the advantages and disadvantages of Basic Electric Arc Process (EAF) and discuss the types of refractories and their behavior using in electric arc furnace.
Ans; The basic electric arc process (EF) Page 76 to 77

24.Explain briefly the chemistry and thermo chemistry of the basic oxygen process (BOF).
Ans; The basic oxygen process (BOF) Page 85 to 86

25.Briefly explain the application of the bottom blown basic oxygen process. Compare it to the top blown basic oxygen process.
Ans; The basic oxygen process (BOF) Page 87 to 89

26. Briefly explain the production of stainless steel by AOD furnace practice.
Ans; Production of high alloy steels Page 92 to 94

27. Describe briefly the production of high carbon steel by arc furnace practice.
Ans; Production of high alloy steels Page 94 to 95

28. Describe briefly the production of high carbon steel by AOD furnace practice.
Ans; Production of high alloy steels Page 95

29. Briefly explain how carbon vacuum deoxidation occur.
Ans; Vacuum Degassing of steels Page 98 to 99

30.Describe the difference types of vacuum degassing methods. Explain briefly each with a neat sketch.
Ans; Vacuum Degassing of steels Page 99 to 102

Met 4017 Nonferrous Metallurgy
Sample Questions and Answers for Final Exam, 2008

1. What are the ores of tin, gold and silver ?
Ans; Chapter 1 Page 85

2. List and compare the physical properties of Sn, Au & Ag.
   (a) Melting point.
   (b) Boiling point
   (c) Atomic weight
   (d) Specific gravity
   (e) Color
   (f) Crystal structure

3. Draw a flows sheet of tin leaching and smelter flow sheet.
Ans; Chapter 1 Page 95

4. Explain the refining of crude tin from tin smelter.
Ans; Chapter 1 Page 93,94

5. Explain the difficulty that arises during tin smelting and explain also why two stage reduction smelting is employed.
Ans; Chapter 1 Page 90

6.Describe briefly how gold is extracted from its ore by the cyanidation process.
Ans; Chapter 1 Page 90,91

7. Describe briefly one of the refining operations used in metallic tin production.
Ans; Chapter 2 Page 102,103

8. Discuss the important factors that have to be followed when recovering gold by the cyanidation process.
Ans; Chapter 2 Page 102,103

9. Discribe briefly how gold and silver is extracted from bullion by the chlorination process.
Ans; Chapter 2 Page 107

10. How would you separate gold and silver from Dore? Explain.
Ans; Chapter 3 Page 116

11. Describe briefly how the precious metals are collected in a Dore from the electrolytic slimes.
Ans; Chapter 3 Page 113

12. Compare the two electrolyte processes (the Balbach- Thum Process and the Moe bius Process)
Ans; Chapter 3 Page 115,116,117

13. A cyaniding mill treats per month 2,000 tons of ore containing 12.27 oz of silver per ton with no gold. There is obtained 6,800 tons of solution, from which the silver is precipitated with zinc shavings. The extraction of silver by the leaching is 87 percent, and the solution after precipitation still carries 0.15 oz of silver per ton. The consumption of NaCN in leaching is 2.43 lb per ton of ore, and the leaching solution at the start carries 0.25 percent NaCN. The solution entering the zinc boxes contains 0.68lb of NaCN per ton. The consumption of zinc is 1.34 lb per ton of ore

Required (1). The percentage of the silver in the ore that is recovered in the precipitate.

(2) The amount of leaching solution and of wash water used.

(3) The percentage of the NaCN consumed that is actually used in dissolving silver.

(4) The percentage of the zinc consumed that is actually used in precipitating silver.

Ans; Chapter 1 Page 119,120

14. Silver ore containing 14.03 oz of silver with no gold is given a single leach with strong cyanide solution (5 lb/ton) and then washed with water. The total amount of solution obtained is 7.36 tons per ton of ore treated. The extraction of silver by the solvent is 93% . The solutions and washings are precipitated down to 0.13 oz per ton in zinc boxes, and the solution is then discarded. The leaching consumed 3lb of NaCN per ton of ore treated, and 1.38 lb of zinc per ton of ore is consumed in the precipitating boxes. Solution entering the zinc boxes carries 0.88 lb of NaNC per ton of ore treated.

Required (1) The recovery of silver

(2) The amount of leaching solution and wash water used.

(3) The percentage of NaCN and zinc consumed that is theoretically required by the solution and precipitation reaction.

Ans; Chapter 3 Page 120

15. What methods of treatment are necessary for tin load deposit to arrive at economic grade.

Ans;Chapter 1. Page. 87

16. Write a short note about the treatment of thin slag.

Ans: Chapter 1 Page. 90

17. Briefly explain the electrolysis refining of tin.

Ans: Chapter 1Page. 91,92

18. What is thickening? Explain the separation of solution and solid by using thickener.

Ans: Chapter. 2. Page 105

19. Briefly explain the gold electrolysis refining.

Ans: Chapter 2. Page. 102

20. Draw a flow sheet of the extraction of silver from lead .

Ans: Chapter 3. Page. 114.

21. List and compare the physical properties of tin, gold and silver. (Atomic weight, modulus of elasticity, specific gravity, thermal conductivity, electrical conductivity, specific heat)

22. Briefly explain the uses of coinage of silver.

Ans: Chapter 3. Page. 115

23.Explain why extensive cleaning of slag is required in tin smelting?
Ans: Chapter 1 Page. 88,89

24. Briefly explain how you would extract metallic tin from its ore combined with schellite/ wolframite.
Ans: Chapter 1. Page. 91

25 Explain why the recovery of gold is rather low in the amalgamation process.
Ans: Chapter 2. Page. 101

26. What are the methods available for refining of oxide gold? Describe the chlorination method.
Ans: Chapter 2 Page. 107

27. Briefly explain the refining methods of gold which yield a high order of purity (+999 fine).
Ans: Chapter 2. Page. 107,108

28. Discuss the important factors that have to be followed when recovering silver by the cyanidation process.
Ans: Chapter 3. Page. 111

29. Construct a chart showing the various uses of tin.
Ans: Chapter 1. Page. 99

30. Draw a flow sheet for the slime treatment of gold.
Ans: Chapter 2. Page. 104

Met - 4023 Composites and Ceramics
Sample Questions and Answers for Final Exam, 2008

1.(a) A 96% silica glass has a viscosity of 10^8 ρ at its softening point of 1420˚C and the activation energy is 382 kilojoules per mole for the viscous flow of this glass in this temperature range. Calculate the viscosity at its annealing point of 950˚C .($\eta sp = 10^8$P, R=8.314J/mol.K)
Solution Similar with Chapter 1 Example 7.1 Page 56,57
(b) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (360g) , after soaking in water (385g) and while suspended in water (224g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.
Solution Chapter 1 Example 1.2 Page 16

2.(a) A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8000 V. The separation distance between the plates is to be 0.3 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9) ($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)
Solution Chapter 4 Example 4.1 Page 34
(b) A 96% silica glass has a viscosity of 10^{13} ρ at its annealing point of 940˚C and viscosity of 10^8 ρ at its softening point of 1470˚C. Calculate the activation energy in kilojoules per mole for the viscous flow of this glass in this temperature range.($\eta ap = 10^{13}$ P, $\eta sp = 10^8$P,R=8.314J/mol.K)
Solution Similar with Chapter 1 Example 7.1 Page 56,57

3.(a) Metallic materials and polymers are not suitable for certain engineering applications. For such conditions ceramics are used, why is this so?
Solution Chapter 1 Page 3
(b)Why is bonding ceramics stronger than that of metallic?
Solution Chapter1 Page 5

4.(a) State the allotropic forms of silica and draw the pressure- temperature phase diagram for silica
Solution Chapter 1 Fig(1.9) Page 10
. (b)Sketch heat diagrams of the different point defects. Explain the frenkel and schottley defects.
Solution Chapter 1 Fig(1.6) Page 14,15

5.(a) Explain why dislocations do not move easily in ceramic materials.
Solution Chapter 1 Page 15
(b)Briefly explain (i)apparent porosity (ii)true porosity (iii)bulk density.
Solution Chapter 1 Page 16

6.(a) Name the basic steps that are employed in the processing of ceramics.
Solution Chapter 2 Page 17
(b) Sintering is an essential step in the manufacturing of most ecramic products. Explain the mechanism of sintering.
Solution Chapter 2 Page 21,22

7(a). Calculate the density of NaCl from a knowledge of its crystal structure, the ionic radii of Na+ and Cl^- ions and the atomic masses of Na and Cl. The ionic radius of Na^+ = 0.102 nm that of Cl^- = 0.181nm. The atomic mass of Na = 22.99g/mol and that of Cl = 35.45 g/mol.

Solution Chapter 1 Example 1.1 Page 5,6

(b) A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8300 V. The separation distance between the plates is to be 0.8 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9)
($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34.

8.(a) Write short notes on the following ceramics insulator materials (1) electrical porcelain (2) steatite (3) Alumina

Solution Chapter 4 Page 34,35

(b) Ceramic materials possess inherently low toughness. Explain with examples the method used to improve the toughness of ceramic materials .

Solution Chapter 5 Page 38

9.(a) Classify the refractory materials and give example of their application.

Solution Chapter 6 Page 45,46,47

(b) Compare the difference between solidification behavior of a glass and a crystalline solid.

Solution Chapter 7 Page 49

10.(a)Give the compositions, special properties and application of the following glasses. (1) fused silica (2) borosilicate (3) lead silicate.

Solution Chapter 7 Page 53 Table 7.1

(b) A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8050 V. The separation distance between the plates is to be 0.3 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9)
($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34

11.(a) Ceramics are given by chemical formulas such as; AX,A_2X,ABX_3,AB_2X_4,etc, what does A,B and X stand for? Give examples of AX,AX_2, A_2X_3 and AB_2X_4.

Solution Chapter 1 Page 2,3

(b) A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8050 V. The separation distance between the plates is to be 0.1 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9)
($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34

12. (a)Discuss the factors that reduce the creep resistance in crystalline ceramics.

Solution Chapter 5

(b) Que; Chapter 1 Sample Que; 2
Ans; Chapter 1 Page 3

13.(a) Que; Chapter 1 Sample Que; 3
Ans; Chapter 1 Page 3

(b) Que; Chapter 1 Sample Que; 7
Ans; Chapter 1 Page 6

14.(a) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (340g) , after soaking in water (395g) and while suspended in water (234g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.

Solution Similar with Chapter 1 Example 1.2 Page 16

(b) Que; Chapter 2 Sample Que; 2
Ans; Chapter 2 Page 17,18,19

15.(a) Que; Chapter 2 Sample Que; 3
Ans; Chapter 2 Page 18,19
(b) Que; Chapter 3 Sample Que; 1
Ans; Chapter 3 Page 26

16.(a) A 96% silica glass has a viscosity of 10^{13} ρ at its annealing point of 950˚C and viscosity of 10^8 ρ at its softening point of 1410˚C. Calculate the activation energy in kilojoules per mole for the viscous flow of this glass in this temperature range.($\eta ap = 10^{13}$ P, $\eta sp = 10^{8}$P,R=8.314J/mol.K)

Solution Similar with Chapter 1 Example 7.1 Page 56,57

(b) Que; Chapter 4 Sample Que; 1
Ans; Chapter 4 Page 31,32

17.(a) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (350g) , after soaking in water (385g) and while suspended in water (214g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.

Solution Similar with Chapter 1 Example 1.2 Page 16

(b) Que; Chapter 6 Sample Que; 2
Ans; Chapter 6 Page 47,48

18.(a) A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8150 V. The separation distance between the plates is to be 0.5 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9) ($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34

(b) Que; Chapter 7 Sample Que; 5
Ans; Chapter 7 Page 57

19.(a)Que; Chapter 5 Sample Que; 1
Ans; Chapter 5 Page 38

(b) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (370g) , after soaking in water (375g) and while suspended in water (214g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.

Solution Similar with Chapter 1 Example 1.2 Page 16

20.(a) Que; Chapter 1 Sample Que; 8
Ans; Chapter 1 Page 7

(b) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (330g) , after soaking in water (365g) and while suspended in water (204g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.

Solution Similar with Chapter 1 Example 1.2 Page 16

21.(a) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (320g) , after soaking in water (355g) and while suspended in water (218g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.

Solution Similar with Chapter 1 Example 1.2 Page 16

(b) A 96% silica glass has a viscosity of 10^{13} ρ at its annealing point of 920˚C and viscosity of 10^8 ρ at its softening point of 1450˚C. Calculate the activation energy in kilojoules per mole for the viscous flow of this glass in this temperature range.($\eta ap = 10^{13}$ P, $\eta sp = 10^{8}$P,R=8.314J/mol.K)

Solution Similar with Chapter 1 Example 7.1 Page 56,57

23.(a) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (340g) , after soaking in water (395g) and while suspended in water (200g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.

Solution Similar with Chapter 1 Example 1.2 Page 16

(b) A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8100 V. The separation distance between the plates is to be 0.2 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9) ($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34

24.(a) Que; Chapter 7 Sample Que; 4

Ans; Chapter 7 Page 58,59

(b)A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8200 V. The separation distance between the plates is to be 0.6 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9) ($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34

25(a) Draw the Mg_2SiO_4-Fe_2SiO_4 phase diagram and state what type it belongs to.

Solution Chapter 3

(b) Define the following viscosity reference points (1) working (2) softening .(3) annealing (4) strain.

Solution Chapter 7 Page 56

26.(a)A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8250 V. The separation distance between the plates is to be 0.7 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9) ($\varepsilon_o = 8.85 \times 10^{-12}$ F/m)

Solution Similar with Chapter 4 Example 4.1 Page 34

(b) Briefly explain (i) capacitances (2) dielectric constant (3) dielectric strength (4) dielectric low factor k .
Solution Chapter 4 Page 31,32,33

27.(a)A simple parallel-plate capacitor is to be made to store $5x10^{-6}$ C at a potential of 8350 V. The separation distance between the plates is to be 0.9 mm. Calculate the area (in square meters) that the plates must have if the dielectric between the plates is (a) a vacuum (k =1) and (b) Alumina(k=9) (ε_o = 8.85 x 10^{-12} F/m)
Solution Similar with Chapter 4 Example 4.1 Page 34
(b) A 96% silica glass has a viscosity of 10^{13} ρ at its annealing point of 910˚C and viscosity of 10^8 ρ at its softening point of 1460˚C. Calculate the activation energy in kilojoules per mole for the viscous flow of this glass in this temperature range.($\eta ap = 10^{13}$ P, $\eta sp = 10^{8}$P,R=8.314J/mol.K)
Solution Similar with Chapter 1 Example 7.1 Page 56,57

28.(a) Silicon carbide particles are compacted and fired at a high temperature to produce s strong ceramic shape. The specific gravity of SiC is 3.2 g/cm^3 . The ceramic shape subsequently is weighted when dry (310g) , after soaking in water (345g) and while suspended in water (212g). Calculate the apparent porosity, true porosity and the fraction of the pore volume that is closed.
Solution Similar with Chapter 1 Example 1.2 Page 16
(b)A 96% silica glass has a viscosity of 10^{13} ρ at its annealing point of 930˚C and viscosity of 10^8 ρ at its softening point of 1430˚C. Calculate the activation energy in kilojoules per mole for the viscous flow of this glass in this temperature range.($\eta ap = 10^{13}$ P, $\eta sp = 10^{8}$P,R=8.314J/mol.K)
Solution Similar with Chapter 1 Example 7.1 Page 56,57

29(a)A 96% silica glass has a viscosity of 10^{13} ρ at its annealing point of 950˚C and viscosity of 10^8 ρ at its softening point of 1420˚C. Calculate the activation energy in kilojoules per mole for the viscous flow of this glass in this temperature range.($\eta ap = 10^{13}$ P, $\eta sp = 10^{8}$P,R=8.314J/mol.K)
Solution Similar with Chapter 1 Example 7.1 Page 56,57
(b) Que; Chapter 3 Sample Que; 3
Ans; Chapter 3 Page 28,29,30

30.(a) What are the engineering or technical ceramics composed of? Give examples of some important engineering ceramics.
Solution Chapter 3 Page 27
(b) Define Activator and Sulphidizer
Ans; Page 15

Met 4033 Physical Metallurgy III
Sample Questions and Answers for Final Exam, 2008

1. What are the different grades of gray cast iron? How are they produced?
Ans; Page 3,5,10,12

2. What are the various methods by which strength of copper can be increased? Give examples of each method.
Ans; Page 25

3. Why is the of aluminium increasing at a faster rate? Name three most common applications of aluminium and its alloys.
Ans; Page 56

4. Write short note on the following alloys giving their important constitutes, properties and application.
Ans; Page 69,In table 4.1

5.How can you aluminium coatings on steel?
Ans; Page 55

6.What are the relative advantages of gray cast iron over other types of iron?
Ans; i)excellent fluidity ii) high damping capacity iii) good machinability

7. What are the raw materials used for the production of following metals and alloys?
i) Copper ii)Oxygen free high conductivity copper iii)Steel iv)Bell metal
Ans; i) Copper

The raw materials of copper are sulphides ore, sulphate ore, silicate ore, oxide ore and carbonate ore.

ii)Oxygen free high conductivity copper

Raw materials of oxygen free high conductivity copper (OFHC) is cathode copper.

iii)Steel

Raw material of steel is pig iron and scrap iron.

iv)Bell metal

Bronzes are used for the manufacture of bell. Tin content is about 20%.

8. Titanium is very costly metal today. Can you justify its high cost and give a few typical applications of this metal.
Ans; Page 64

9. Write short note on the following alloys giving their important constituents, properties and application. i) Nichrome ii) Constantan
Ans; Page 69

10.Give Electrical applications where Al alloys are extensively used.
Ans; Page 56

11. Write short note on the white cast Iron.
Ans; Page 3, Page 4

12. What are the raw materials used for the production of following metals and alloys?
i) German Silver ii) Stainless steel iii)Phosphor bronze iv)Muntz metal
Ans;i) German Silver

German silver is copper-nickel-zinc alloys. Copper-Zinc alloys is added by nickel

ii) Stainless steel

Raw material of stainless steel are chromium and nickel. The basic composition of stainless steel are 1.8 % Nickel and 0.8 Chromium.

iii)Phosphor bronze

Raw material of phosphor bronze is tin. Copper-tin alloys containing up to25% tin are called tin-bronzes.Tin bronzed is called as phosphor bronze because phosphorous is always present up to 0.3%.

iv)Muntz metal

Raw material of Muntz metal is Zinc. Muntz metal is called alpha-beta brassed and composition is (60%Cu,40% Zn)

13.What is the contribution of light metals and their alloys for solving the problems related to corrosion? Give a few examples.
Ans; Page 39

14. Give three important applications of lead where it may be difficult to find a substitute for lead.
Ans; Page 71

15. Write down typical compositions, properties and applications of Titanium and its alloy.
Ans; Page 64

16. What is graphitization? How isit produce in iron-carbon alloys?
Ans; Page 5

17. Give a few applications where copper and its alloys are extensively used.
Ans; Page 24

18. Give applications where magnesium and its alloys are extensively used.
Ans; Page 62

19. Give important constitutes and properties of Wood’s metal and type metal.
Ans; Page 73-Table 4.3

20. Briefly explain inherent corrosion resistance of aluminium and aluminium alloys.
Ans; Page 54

21. What is the role of manganese in cast irons?
Ans; Page 3
22. What is the raw materials used for the production of following metals and alloys?
i) Pig Iron ii) Steel iii) Stainless steel

23. Give Auto-motive applications where aluminium and aluminium alloys are extensively used.
Ans; Page 57

24. Why can the strength of lead and Zinc not be increased by cold working at room temperature while copper and aluminium are strengthened by cold working.
Ans; Page 40,71

25. How would you identify a piece of gray cast iron without using a microscope or breaking the sample?
Ans; Page 5

26.Write short noteson the followings.i) Season Cracking ii)Dezincification
Ans; Page 30

27.How can you use aluminium and aluminium alloys at elevated temperature?
Ans; Page 57

28.Write down the applications of gray iron.
Ans; Page 9

29. How would cementite decomposed into iron and carbon for gray cast iron.
Ans; Page 5

30.Write short notes on the followings;i) Naval ii) Spring hard iii) Copper beryllium spring
i) Naval

Naval brass composition is 60%Cu, 39% Zn ,1% Sn. A two-phase (alpha-beter) brass type with the addition of 1%Sn.

ii) Spring hard

Bronze spring possess high tensile strength, high fatigue limit and excellent corrosion resistance. Bronze structure consists of hard and soft phase. Composition is Cu 7% and Sn 30%.