

1. The three major ingredients of a paint are:
1. (Pigment) 2. (Binder) 3. (Thinners)
2. The main functions of a paint are: 1. (protection)
and 2. (decoration)
3. Other functions are: 1. (lighting), (safety)
and 2. (sanitation) (temperature control)
4. The two types of film formers are: 1. (thermoplastic)
and 2. (conversion); an example of each is 1. (shellar)
and 2. (drying oils). The solid film
former is sometimes called the (binder) when used
in a pigmented paint.
5. Three ways a paint may dry are: 1. (Air drying) (oxygen conversion)
2. (heat conversion) and 3. (solvent evaporation)
6. Latex Paints (water based) dry by evaporation of water and
(coalescence) of the paint particles.
7. (varnish) and (lacquer) are names given to solutions
of a film former in a solvent. When used with pigments these
solutions are called (vehicle)
8. Some of the names given to pigmented finishes are: 1. (primer)
2. (enamel) 3. (paint) 4. (filler)
and 5. (surfacers)
9. Paints may be classified by their end use as 1. (trade)
Sales paints, 2. (industrial) products or 3. (maintenance)
paints.
10. The F & F Department classifies their paint products into five
groups 1. (Trade) Sales, 2. (Automotive)
3. (Industrial) 4. (Refinish) and 5. (Industrial)

DU PONT CONFIDENTIAL

UNIT ONE - Continued

TECHNICAL INFORMATION

11. An oil is a combination of long chain fatty acids with glycerol.
12. Write the formula for an oil using any fatty acid.
- $$\begin{array}{|l} \text{O}-\text{C}^{\text{O}}\text{R} \\ \text{O}-\text{C}^{\text{O}}\text{R} \\ \text{O}-\text{C}^{\text{O}}\text{R} \end{array}$$
13. Name six oils used in paints.
- | | |
|---------------------|-------------------------------|
| 1. <u>Tung</u> | 4. <u>Coconut</u> |
| 2. <u>Linseed</u> | 5. <u>Castor</u> |
| 3. <u>Soya Bean</u> | 6. <u>Oiticica (Tall Oil)</u> |
14. Oils may be classed for paint use as Non drying or drying oils.
15. Fatty acids which promote drying are: 1. eleostearic
2. linoleic and 3. linolenic
16. Tung oil is a valuable oil because it contains a large proportion of eleostearic acid which has three double bonds.
17. Castor oil has a fatty acid called ricinoleic which contains a hydroxyl group. Due to this group Castor Oil can be dehydrated to produce conjugated double bonds which increases its drying property.
18. Oils are used as the binder in outside House Paint, a part of an alkyd resin and as a plasticizers for nitrocellulose lacquers.
19. Besides oils, film formers used in paint manufacture can be classed as natural resins and synthetic resins.
20. Among the converting type of resins used by the F & F Dept. are:
1. Oil Modified alkyds 2. Urea formaldehyde
and 3. melamine formaldehyde.

TECHNICAL INFORMATION (Acrylic)

21. Nitrocellulose and vinyl resins are examples of thermoplastic or non converting type film formers.
22. The volatile portion of a paint may be divided into two classes:
1. solvent and 2. diluents
This later group is used to reduce cost.
23. Water is the only inorganic solvent used in paint manufacture.
24. The two most widely used types of organic solvents are:
1. hydrocarbons and 2. oxygenated solvents
25. The hydrocarbon type solvents are:
1. aliphatic and 2. aromatic
26. Two of the most common aliphatic solvents are:
1. Mineral Spirits and 2. V M and P Naptha
27. Aromatic solvents include 1. toluol and 2. xylol
28. The three most important properties of solvents for paint use are: 1. solvency 2. volatility and 3. flash point
29. Highly polar compounds 1. alcohols 2. esters
3. ketones 4. ethers are good solvents for nitrocellulose resins.
30. Benzene and Methanol are used sparingly in paint because of their toxic properties.
31. The functions of pigments in a paint are to 1. hide (obscure)
2. decorate and 3. protect the surface upon which the paint is applied (substrate) to increase the durability of a paint and to reduce the cost of a paint.

DU PONT CONFIDENTIAL
TECHNICAL INFORMATION

UNIT ONE - Continued

32. Besides white Prime pigments, white extender pigments are used extensively in paints. These extender pigments are used to control the gloss of a paint and to reduce the cost of a paint.
33. The four types of white Prime Pigments are: 1. white lead
2. lithopone 3. TiO_2 and 4. zinc oxides
34. The five white extender types are: 1. silicates 2. barium sulfate
3. calcium sulfate 4. calcium carbonate and 5. Silica
35. Hiding power (ability to obscure a surface) of a white pigment is due to the difference in refractive index between the clear vehicle and the dry pigment.
36. Colored pigments hide as a result of color absorption
37. titanium dioxide has the highest hiding power of any white pigment.
38. Two of the important properties of a colored pigment are: fastness and tinting strength.
39. Most black pigments are some form of carbon.
40. The inorganic pigments are either earth colors or are manufactured by a Fire process or chemical precipitation.
41. Some of the organic pigments are Phthalocyanine blue, Phthalocyanine green, Toluidine red and Hansa yellow.

UNIT TWO - Exercises

1. The raw materials assigned the following permanent prefix codes are:

a. "G"-

1. Natural Gums
2. Synthetic Resins
3. Blacks
4. Waxes
5. Driers and Hardness
6. Abrasives, Bodying Agents
7. Chemicals
8. Dyes
9. Processing Materials

b. "H"

1. Oils
2. Solvents and thinners
3. Plasticizers

c. "W"

1. Pigments
2. Extenders
3. Metal Powders

d. "PX"

1. Nitrocellulose
2. Temporary codes use the prefix K followed by G, H, or W to indicate the nature of the Material.
3. Sequential code blocks are assigned to various plants; the G-1600 to G-1699 block is assigned to Philadelphia and the H-1 to H-349 block is assigned to Parlin.

UNIT TWO - Continued

4. In the parenthesis following the color code number in column 2, show the letter referring to the color in column 2.

Column 1	Column 2
a. Red	100 (b)
b. White	200 (g)
c. Blue	300 (a)
d. Yellow	<i>Blow</i> 400 (f)
e. Green	500 (c)
f. Brown	600 (d)
g. Black	700 (e)
	800 (a)

5. Give a Dupont raw material code for the following:

1. Glycerol	<u>H-2</u>
2. Linseed Oil	<u>H-253</u>
3. Rosin	<u>G-40</u>
4. Methanol	<u>H-41</u>
5. Mineral Spirits	<u>H-287</u>
6. Phthalic Anhydride	<u>G-243</u>
7. Burnt Sienna	<u>W-377</u>
8. Iron Blue	<u>W-533</u>

6. The F & F Dept. uses Nine kinds of linseed oil.
7. Describe the differences between H-19 and H-253 linseed oils and between H-22, H-120 and H-156, castor oils.
- H-19 - Alkali Refined Oil
- H-253 - Raw Linseed Oil
- H-22 - Refined Castor Oil
- H-120 - Blown Castor Oil
- H-156 - Dehydrated Castor Oil

UNIT TWO - Continued

8. Indicate the Dupont name and write the chemical formula for the following:

W-301 Red Iron Oxide 98% Fe_2O_3

W-349 Hi-Oxide Red Lead 97% Pb_3O_4

W-843 Cadmium Red Maroon Cd S CdSe BaSO_4

9. The "S" classification indicates the type of Protective equipment to be worn in handling materials.
10. What are the 8 fundamental safety rules to be followed in handling raw materials.
- See Page 2 PTSP #9
11. Strong oxidizing agents such as Benzoyl Peroxide should not accidentally come in contact with other raw materials especially organic materials since they may react explosively.
12. Table 1 of PTSP #9 lists 10 classes of hazards. This classification is the Manufacturing Chemist Association (MCA) method of defining the hazard by 1 Type of Hazard.
2 Precautions in handling and in 3 Storage.

UNIT TWO - Continued

13. The MCA Class and the "S" class can be obtained from raw material Specification sheets or in the Raw Material Code List.

14. List the MCA Class and "S" class for the following raw material:

	<u>MCA</u>	<u>S</u>
1. G-201	3,7	5
3. G-213	6	1
6. G-405	6,7,10	4
9. G-675	3,7,10	5
13. G-688	-	-
2. H-18	1C	-
10. H-41	1B, 4,10	2
11. H-284	3, 7, 10	5
4. H-428	1C, 4, 8	2
7. H-735	1C	-
8. W-114	6	1
12. W-307	10	-
5. W-384	6	1
14. W-1021	6	1
15. W-785	-	-

15. Besides classifying our products according to their hazardous nature by the M.C.A. and "S" system of classification, the Interstate Commerce Commission also requires that materials be classified for shipping purposes. This information must be shown on all formulas. What classification would you apply to the following raw materials?

a. H - 202	<u>+ 80L</u>
b. G - 663	<u>COR</u>
c. G - 748	<u>OXY.M</u>
d. H - 35	<u>- 20L</u>

UNIT TWO - Continued

e. G - 781 POIS.B

f. H - 583 + 80L

16. The Raw Material Code List has a column titled Preference. On the first page of the list are shown the codes and their definitions. Indicate the classification for each of the following codes

<u>R. M. Codes</u>	<u>Preference Class</u>
1. G - 12	A
2. G - 243	C
3. G - 304	C
4. G - 419	B
5. H - 12	C
6. H - 154	C
7. H - 200	
8. W - 120	Obs.
9. W - 139	Obs.
10. W - 362	B
	A

17. You have developed several new formulations and you have found that the following raw materials are required. Under the conditions listed determine whether you can use these based on simplification procedures. You may have to get W. P. Colio permission to use some of these materials. Contact him and determine whether you can use the raw materials under the specified circumstances.

- Yes 1. H - 19 as an ingredient in a new resin.
- Yes 2. W - 316 in a new red metal fence paint.
- No 3. W - 851 in an Automotive Enamels. It is used now only in 794 - 12345 and 794 - 23456.
- No 4. W - 191 in a black finish for A.C. Spark Plug Div.
- Yes 5. G - 18 in a Chemical Resistant Finish for The Chambers Works.

UNIT TWO - Continued

18. You need certain raw materials with the following specific properties. Indicate below the raw material code meeting the desired properties.

- a. A hydrocarbon solvent with an aniline point of 33-37°C (1/1 dilution)
- b. An extender with a particle size of 96-100% below 10 microns and 0.0035% sodium content.
- c. An organic non bleeding red pigment.
- d. A 60% solid alkyd resin, having A.N. of 18-25 and a Gardner Holdt Viscosity of Z to Z-2.
- e. An Epoxy resin having a melting pt. of 125°-135°C and epoxy equivalent of 1900-2450.
- f. A drying oil having an iodine No. of 177 min. acid number 4 max, Sofonification No. of 189-195 and color of 14 max.

<u>Product</u>	<u>Code</u>
a.	<u>H-758</u>
b.	<u>W-12</u>
c.	<u>W-399, W-879</u>
d.	<u>G-1098</u>
e.	<u>G-1050</u>
f.	<u>H-253</u>

19. Letter designations are assigned to designate plants for accounting, formula and batch card purposes. Match the letter designations with the names of the Finishes Plants.

1. Chicago	a. J (5)
2. Everett	b. F (3)
3. Flint	c. P (6)
4. Fort Madison	d. T (8)
5. Parlin	e. L (9)
6. Philadelphia	f. M (4)
7. S. San Francisco	g. E (2)
8. Toledo	h. C (1)
9. Tucker	i. S (7)

UNIT TWO - Continued

20. Give the total consumption and the consumption by plants for 1967 of the following codes:

	<u>G-12</u>	<u>W-123</u>	<u>H-200</u>
Total	574,666 lbs	6,735,093 lbs	1,683,922 lbs
Chicago	125,790	704,687	--
Everett	36,670	165,166	108.335
Flint	8,739	5418	648,089
Fort Madison	97,104	1,275,812	580,807
Parlin	447	34303	--
Philadelphia	188,360	1,619,293	20,538
S. San Francisco	55,085	687,965	191,305
Toledo	19,616	1,719,717	--
Tucker	42,855	522,732	134,848

21. The Pigments Dept. has advised the F & F Dept. that they have on hand 1,000 tons of a rutile TiO_2 which is slightly off in color. They have asked us to use this off in our products. a. If we were to substitute this material for the TiO_2 with the greatest amount of consumption and used at the most number of plants, what coded TiO_2 would you select? b. If we were to substitute the off standard rutile TiO_2 for the material selected at the rate of consumption at each plant in comparison with the total consumption and we can save 4¢/lb. at South San Francisco and 3¢/lb. at Chicago, Fort Madison, Flint and Toledo and 2¢ at the remainder of the plants, how much will the F & F Dept. save annually?

a. W-123 1967 Consumption
b. \$ 55.089.81

22. If we were to substitute KH-1234, Xylene, for H-583 Xylene, what would be the total cost of revising all of the formulas involved if it costs \$4.00 to revised a formula \$ 8,904 (1/68)
23. Name the pigmented products which contain H-505, Creosole
(Jan. 1968) (White Stencil Zinc Chromate Primer, Baking Dulux
Pump Enamel #3 White, Exterior White Paste, Enamel, Dulux

UNIT TWO - Continued

Enamel, New Holland Yellow.

24. Raw Materials for the laboratory may be secured from
a. Weigh _____ and Load _____ Room or by
ordering them from the Store Room _____.
25. Information regarding the supplier(s) of Raw Materials
used in the Dept. is obtained from Specifications _____.
26. Information regarding material not now used by the
F & F Dept. may be secured from Dale Reinecker _____ and
purchased through a Marshall Laboratory order issued by
John Kissel _____. These new Raw Materials are given an
DS _____ code when they are used in the laboratory.

EXERCISES-UNIT 3-PART A

1. The three general types of materials handled by F & F Dept. are 1. Raw Materials 2. Intermediates and 3. Finished Products.
2. Intermediates include manufactured film formers, 1. Varnishes and 2. Resins and pigmented dispersions.
3. A Varnish is made by cooking an oil with a hard gum.
4. Oils generally used in making varnishes are 1. Linseed 2. Tung (CWO), 3. Soya Bean, 4. Dehydrated Castor Oil and 5. Oiticica.
5. Gums used in varnish manufacture are classed as 1. Natural Gums or Modified rosin esters.
6. A 25 gallon oil length varnish is formulated with 25 gallons of oil and 100 lbs. of gum (resin).
7. The higher the volume of oil used in a varnish the more flexible will be the film formed from the varnish.
8. Match the following code prefixes with the type of varnishes to which they refer.

1. VB	a. Miscellaneous Varnishes	(d)
2. VC	b. Gum Solutions	(f)
3. VF	c. Clear Varnish Blends	(e)
4. VG	d. Black Varnishes	(b)
5. VK	e. Flat Varnishes	(c)
6. VM	f. Clear Varnishes	(a)
9. Other "V" coded materials include; 1. VD
2. VH 3. VO 4. VP 5. VS
and 6. VZ.

EXERCISES-UNIT 3-PART A -Cont.

10. The conversion types of synthetic resins used by the F & F are: 1. Alkyds 2. UF 3. M.F.
4. Epoxy 5. Phenolic and 6. Polyurethane.
11. The non converting type resins used by the F & F Dept. are:
1. Nitrocellulose 2. Vinyl
3. Acrylic.
12. Materials used to increase the flexibility of nitrocellulose are called Plasticizers. These are generally ester type products.
13. Emulsion resins used by the F & F Dept. are: 1. (Lecton Acrylic)
2. (Acrylic Latex) and 3. (Teflon) (Styrene Butadiene)
14. Identify the following code prefixes:
1. RC Resin clear
2. RK Resin Blends
3. RL Non drying Oil Resins
4. RF Flat resins
15. Alkyd resins are made from the following general types of compounds: 1. Acid Anhydride or dibasic acids 2. Polyols
and 3. Fatty Acids or oils.
16. The common oils used in alkyd preparation are; 1. Linseed
2. Soya 3. Castor 4. Dehydrated Castor
5. Coconut and 6. Safflower.
17. Oil Acids used in alkyd preparation are: 1. Tall Oil
2. Dehydrated Castor and 3. Soya.
18. Polyols used in alkyd resin preparation are; 1. Glycerol
2. Ethylene Glycol and 3. Pentaerythritol.
19. Di Basic Acids or Anhydrides used in alkyd resin preparation are:
1. Phthalic 2. Maleic and 3. Isophthalic.

EXERCISES-UNIT 3-PART A-Cont.

20. Give the name and Du Pont code for the three common Monoglyceride Catalysts: .

<u>Name</u>	<u>Code</u>
1. <u>Litharge</u>	<u>W-603</u>
2. <u>Lead Tallate</u>	<u>VD-5822</u>
3. <u>Sodium Hydroxide</u>	<u>G-218</u>

21. Match the raw material codes with the following alkyd resin ingredients.

1. H-22	Soya Bean Oil	(4)
2. H-287	Glycerol	10
3. H-19	Dehydrated Castor Oil	6
4. H-59	Pentaerythritol	12
5. H-7	Castor Oil	1
6. H-156	Mineral Spirits	2
7. H-344	Linseed Oil	3
8. H-663	Phthalic Anhydride	14
9. H-255	Isophthalic Acid	15
10. H-2	Cocoanut Oil	7
11. H-514	Tall Oil Fatty Acids	8
12. G-419	Odorless Mineral Spirits	13
13. H-632	Tung Oil	5
14. G-243	Ethylene Glycol	11
15. G-811	Linseed Fatty Acids	9

22. Monomers used in making acrylic polymers are: 1. Ethyl
Acrylate 2. Methyl Methacrylate and 3. Butyl
Acrylate.

23. Peroxides are used as catalysts in preparation of acrylic polymers.

24. Ingredients used in making amine type resins are:

1. Urea 2. Melamine 3. Formaldehyde.

25. Classify the following resins according to their preference classification.

	<u>Classification</u>
1. RC-3140	<u>A</u>
2. RC- 262	<u>A</u>
3. RC- 141	<u>A</u>
4. RC-3083	<u>Obs.</u>

EXERCISES-UNIT 3-PART A-Cont.

5. RC- 483	<u>B</u>
6. RC- 747	<u>B</u>
7. RC- 723	<u>B</u>
8. RC- 921	<u>obs.</u>
9. RC- 945	<u>C</u>
10. RC- 909	<u>A</u>

26. Give the codes for the alkyd resins with the following compositions.

1. A 60% Soya bean oil resin containing 3.6% excess pentaerythritol thinned to 60% solids with H-287. RC-462

2. A 56% dehydrated castor oil resin containing 3.8% excess glycerol thinned to 60% solids with H-287/H-202= 8/5.

RC-506

3. A 37% cocoanut oil resin with 5.6% excess glycerol thinned to 60% solids with H-596. RL-3141

4. A TOFA analog of RC-461. RC-599

27. Give the product line numbers using RC-311.

<u>26</u>	<u>68</u>
<u>28</u>	<u>69</u>
<u>58</u>	<u>81</u>
<u>67</u>	<u>86</u>

28. The alkyd producing plants in 1967 were: 1. Chicago

2. Toledo 3. Flint 4. Ft. Madison

5. Phila. 6. S. San Francisco

29. The nitrogen (amine) resin producing plants are:

1. Perlin 2. Toledo 3. Ft. Madison

EXERCISES-UNIT 3-PART A-Cont.

30. The "Lucite" acrylic resins (RC-900 type) are produced at:

1. Flint
2. Parlin
3. SSF
4. Chicago

31. Parlin Plant is the major producer of RC-6000 type "Acrylic" resins, Chicago Plant is the major producer of "Lecton" Acrylic dispersions and Parlin Plant is the major producer of Furniture flat resins.

EXERCISES-UNIT 3-PART B

1. Functionality refers to the number of reaction sites in a molecule of a monomer.
2. Indicate the functionality of the following:
 1. Glycerol 3
 2. Ethylene Glycol 2
 3. Pentaerythritol 4
 4. Phthalic Anhydride 2
 5. Urea 4
3. The functionality of glycerol may be reduced by the mono glyceride process in which an oil is heated with glycerol. Catalysts such as 1. Litharge or 2. Lead Tallate may be used to promote this ester interchange.
4. Using the following symbols show the following reactions diagrammatically:

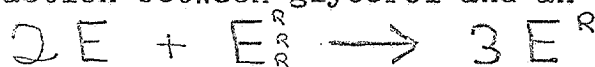
Glycerol - E

Oil - E^R

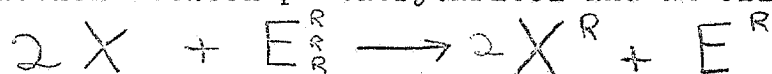
Pentaerythritol - X

Phthalic anhydride - $\square$

- a. Reaction between glycerol and an oil.



- b. Reaction between pentaerythritol and an oil.



- c. Reaction between Phthalic anhydride and glycerol.



- d. Reaction between a Monoglyceride and Phthalic Anhydride.



EXERCISES-UNIT 3-PART B-Cont.

5. These reactions indicate that the alkyd resin reaction is mainly an esterification process in which a hydroxyl group and a carboxyl hydrogen react to liberate water and form a ester.
6. The F & F Dept. makes alkyd resins by the fusion and solution processes.
7. In the solution method the reactions are performed in the presence of a solvent.
8. The fusion process requires an excess of phthalic anhydride to compensate for its loss or sublimation.
9. Calculate an alkyd resin having the following solid and solution composition on a 100 gallon yield basis (a solution process is to be used)

G.P.	- 34.3%
Oil	- 64.0%
Excess Gl.	- 1.7%
Solids	- 83%
Thinner	- H-632
10. Calculate the theoretical acid number at gel of this resin
- 11.5
11. Prepare a formula for the above resin on a green sheet, using RC-311 as a guide.
12. Calculate the theoretical composition of RC-311.

% G.P.	<u>45.40%</u>
% Oil	<u>52.39%</u>
% Excess Gl.	<u>2.21</u>

13. Calculate the cooking solids (%) of RC-311 (Solution Process).
93.9%

EXERCISES-UNIT 3-PART B-Cont.

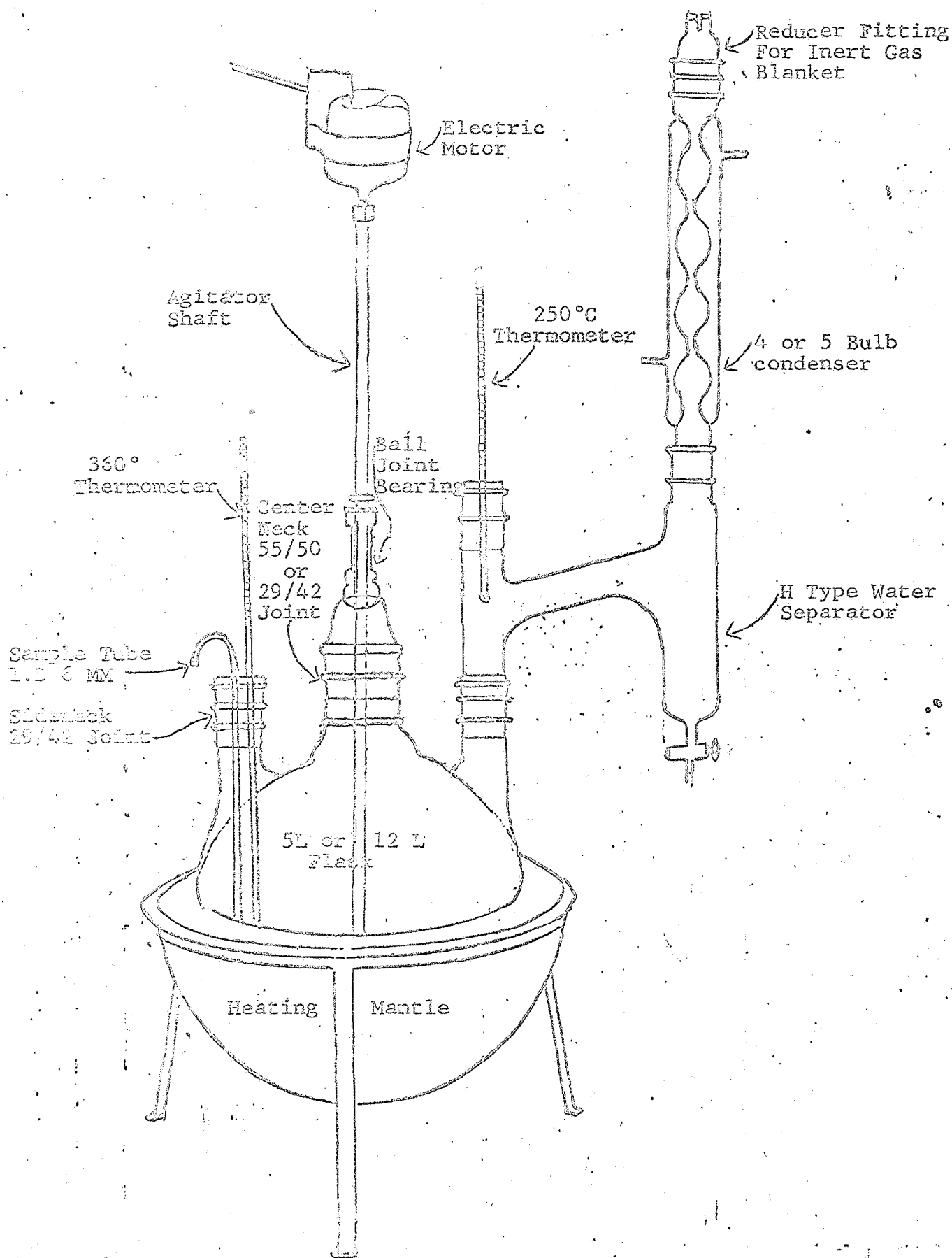
14. LS coded solvents have aniline points falling within + 1°F of the center of specifications.
15. These solvents are used to insure a standard degree of polymerization.
16. PTSP #12 establishes Master resin formulas and operating formulas. It also lists the items to be shown in the Manufacturing directions of the Local operating formula.
17. "Lucite" Acrylic resins are Vinyl type polymerization formed by addition reactions.
18. Polymerization of acrylic resins is initiated by a free radical mechanism. Peroxides are commonly used to supply these free radicals.
19. Final properties of a acrylic resin depends on the concentration of peroxide catalyst used and cooking conditions such as temperature and percent monomer content.
20. These conditions are more important in the control of "Lucite" Acrylic resins than in the control of "Dulux" Alkyd resins.
21. Notebook information should be written in ink.
22. Record the subject of the experiment giving the code and the name of the product involved.
23. The record of the experiment should be sufficiently complete so that someone else can duplicate it at a later date.
24. All materials should be identified according to code and Serial No. The laboratory code prefix for a new raw material is D.S..

EXERCISES-UNIT 3-PART B-Cont.

25. Record all test data and state a conclusion.
26. File out any unused portion of a page and sign and date bottom of page.
27. Make no erasures of data, signatures or dates.
28. Corrections should be made by crossing out the original entry, leaving it legible. Pages are not to be removed.
29. Entries on each page should be witnessed by a person who has knowledge that the experiment was conducted on the date indicated.
30. When should the following personal equipment be worn as safety protection during cooking a resin.
 - a. Safety Glasses at all times
 - b. Face Shield When transferring corrosive materials.
 - c. Gloves When handling toxic, corrosive, hot or cold materials.
 - d. Apron When skin or clothing contact with materials should be avoided.
 - e. Arm Shields When working around hot or cold vessels.
31. All reactions involving hot resinous materials must be performed in a hood.
32. The equipment must be set up so that if the following unexpected situations occur they may be controlled safely:
 - a. Equipment breakdown
 - b. overheating
 - c. spills
 - d. plugging of condenser

EXERCISES-UNIT 3-PART B-Cont.

33. A fire extinguisher should be close by the reaction apparatus.
34. Condenser hoses must be clamped or wired to apparatus.
35. All toxic or corrosive materials must be handled in a hood.
36. A safety shield must always be used.
37. The thinning step must be carried out in a hood.
The material must be stirred continuously during thinning to prevent foaming.
38. In preparing (cooking) a resin, the following should be controlled carefully: 1. agitation 2. temperature
3. distillation rate.
39. In condensation type reactions, the addition of water to the resin cook should be prevented.
40. If the agitation is turned off, the heat must be turned off also. To start up the reaction again, start the agitation slowly, increasing it to full rate, then the heat may be turned on.
41. Describe the method of sampling an alkyd resin during the cook.
The sampling tube must be of sufficient diameter to prevent excessive pressure build up in flask, control pressure by finger over an escape tube. Finger should be released periodically to keep pressure at a level sufficient to blow out sample and no more.
42. Precautions must be taken in handling monomers and peroxides in acrylic resin preparations.



9 This rain is RC-538 if oil is H-59

GP

$$G-243 = .7735 \times 34.3 = 26.53$$

$$H-2 = .324 \times 34.3 = 11.11$$

$$H-2 = 1.70$$

$$H-59 = 64.00$$

	lbs.	Gal.	$\frac{6.93}{100.00}$	100 gallon Formula (Gallons)
H-59 =	64.00	$\div 7.66 = 8.36$	$\times 14.43$	= 57.93
G-243 =	26.53	$\div 12.72 = 2.08$		= 14.41
H-2 =	12.81	$\div 10.45 = 1.22$		= 8.45
Total Solids	103.34	11.66		= 80.80
- Water loss =	3.36	$\div 8.32 = .40$		= - 2.77
H-632 =	20.48	$\div 6.32 = 3.24$		= 22.45
	120.46 (2.83% solids)	14.50		= 100.48
- 0.5% Filtering Loss	.60	$\div 8.31 = .07$		= - .48
	119.86	14.43		= 100.00

Water Loss

$$\frac{26.53 \times 18}{148} = 3.23$$

$$12.81 \times .01 = \frac{.13}{3.36}$$

$$\text{Gallon weight} = \frac{120.46}{14.50} = 8.31 (\text{Gal.})$$

vs.

8.26 for RC-538

100 gallon Formula (Pounds)

$$H-59 = 57.93 \times 7.16 =$$

$$G-243 = 14.41 \times 12.72 =$$

$$H-2 = 8.45 \times 10.45 =$$

$$H-632 = 22.45 \times 6.32 =$$

$$\text{Total} = 857.22$$

$$\text{Water loss} = 2.77 \times 8.32 =$$

$$\text{Yield loss} = .48 \times 8.31 =$$

$$830.19$$

10

Acid no. at gel

$$GP \text{ Defunctionalized by oil} = \frac{64.0 \times 574}{(876)(1.062)} = 39.4$$

$$GP \text{ Prefunctionalized by } H_2O^+ = \frac{1.7 \times 574}{92 \times 1363} = \frac{7.8}{47.2}$$

$$\text{Non-esterified GP is } 34.3 - 47.2 = -12.9$$

$$AN \text{ at gel} = \frac{(-12.9)(89.3)}{100} = -11.5$$

H-59	259.90
H-2	84.06
G-243	<u>174.25</u>
	518.21
	<u>22.03</u>
	496.18
	<u>32.19</u>
	528.37

Water Loss

$$\frac{174.25 \times 18}{148} = 21.19$$

$$84.06 \times .01 = .84$$

$$22.03$$

$$\begin{aligned} \% \text{ H-59} &= \frac{52.38}{52.38\%} \\ \% \text{ GP} &= \frac{225.27}{496.18} = 45.40\% \\ \% \text{ X's H-2} &= \frac{(84.06 - 72.99) \cdot 99^*}{496.18} = \frac{2.21}{99.99\%} \sim 100.0\% \end{aligned}$$

* H-2 contains 1% water

$$\text{GP} = \frac{174.25}{.7735} = 225.27$$

$$\text{H-2} = .324 \times 225.27 = 72.99$$

$$13. \text{ Kettle Solids} = \frac{496.18}{528.37} = 93.9\%$$

UNIT FOUR
General Exercises

1. Dispersion Codes consist of a line number prefix and a Color number suffix.
2. 34, 42 and 44 Line dispersions are general formulating dispersions.
3. Show the number of products containing the following dispersions: (1968):

	<u>No. of Products</u>
a. 32-3010	<u>4</u>
b. 37-621	<u>57</u>
c. 901-750	<u>13</u>
d. 820-50	<u>35</u>
e. 743-818	<u>3</u>

4. Show the preference class for the following:

	<u>Preference</u>
a. 32-5442	<u>A</u>
b. 34-5824	<u>obs.</u>
c. 42-550	<u>B</u>
d. 548-947	<u>C</u>
e. 732-383	<u>NA</u>
f. 901-1655	<u>A</u>
g. 913-1630	<u>C</u>
h. 32-5890	<u>B</u>
i. 32-5707	<u>D</u>
j. MB-3475	<u>NA</u>

5. The general types of ingredients in a solvent type dispersion are 1. Pigment 2. Binder 3. Solvent and 4. additives (Surfactant)

UNIT FOUR - Continued

6. In addition, the following ingredients may be used:
Inhibitors or
1. stabilizers 2. solvents 3. body agents.
7. Surfactants are used either to disperse or
flocculate the pigment.
8. Name the 3 classes of surfactants and an example of each.
- | <u>Class</u> | <u>Example</u> |
|--------------|-------------------------|
| a. anionic | Sodium oleate |
| b. cationic | Lauryl ammonium acetate |
| c. nonionic | Glycerol monolaurate |
9. Describe the differences between a pigment particle, pigment aggregate and a pigment flocculate. A pigment particle may be a single crystal or a fragment of a crystal (Single basic unit)
An aggregate is a group of particles held together by surface forces requiring considerable work to separate them.
A pigment flocculate is a group of particles held together by some liquid medium.
10. The fineness of a dispersion depends on the particle size of the pigment and the degree of dispersion.
11. The fineness of a dispersion may be reduced by the breaking up of pigment particles or aggregates of pigment particles.
12. The types of dispersion equipment or process used in the P & F Dept. are 1. SWM or PIW mill, 2. "47" process, 3. "48"

UNIT FOUR - Continued

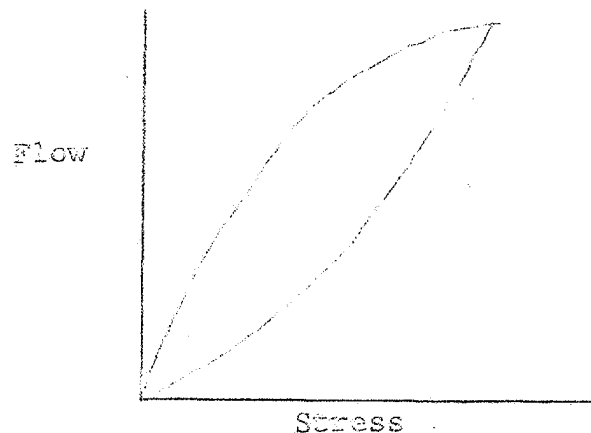
- process, 4. two roll mill and
5. open process.
13. Which of the above will cause pigment cracking? SHW or
PLW.
14. W48 process is the most economical method of dispersion, and is used mainly to produce Trade
Sales products.
15. Two roll mills are used to disperse difficultly
dispersible pigments in thermoplastic resins.
16. W47 Process is now generally called in the
trade "sand grind" process.
17. Since shearing of pigments requires work, a
considerable amount of heat is generated during
the dispersion and cooling by water is required.
18. Dispersed pigments in a finished product settle
slowly. If settling occurs, the settled
cake is hard gummy and of
small volume.
19. Flocculated pigments in a finished product
settle very rapidly. The cake formed is of large
volume and is easily dispersed into the supernatant
vehicle.

UNIT FOUR - Continued

20. To make useable products from the stand point of settling, it is necessary to either 1. grind a dispersion to obtain satisfactory particle size by grinding the pigment in the vehicle or by cracking the pigment particle or 2. produce a flocculated pigmented dispersion.
21. Surfactants in paint are classed as 1. Wetting agents or dispersing agents and flocculating agents.
22. Alkyd resins act as wetting agents.
23. Oil acids are also classed as wetting agents.
24. Soaps are also used to disperse pigments. These may be added as such to the dispersion but zinc soaps may be formed during the dispersion by the reaction of zinc oxide with an High acid resin.
25. The following raw materials are used as flocculating or antisettling agents; show the name for the given raw material code:
- G-12 Soya Lecithin
- G-292 Thixatin
- H-522 Turkey Red Oil
- H-621 "Zelac" UN
- W-1003 "Restone" 34
- G-217 Aluminum Stearate
26. The time of grinding is reduced by reducing the thixotropy of the dispersion.

UNIT FOUR - Continued

27. Increasing the extent of dispersion of a colored pigment in a vehicle increases its tinting strength.
28. The Fineness gauge is used to measure the degree of dispersion obtained by grinding.
29. The types of viscosities possible in paints are 1 Newtonian
2 Plastic 3 Pseudoplastic and 4 dilatant
30. Draw a typical thixotropic Flow curve.



31. Define Thixotropy Thixotropy is the property of a system in which an internal structure is temporarily destroyed by stirring but reforms again on standing.
32. Define yield value of a dispersion Yield Value is the minimum shearing stress which produces flow of a system.
33. The inhibitor content of a dispersion or finished product is based on a certain percentage of binder in the formula.

UNIT FOUR - Continued

34. Anti settling agents are generally added to the dispersion on the basis of the pigment content in the dispersion.
35. The metal content of driers is used to calculate the amount of solution drier to use in a finished product.

UNIT FOUR

BALL AND PEBBLE MILL DISPERSIONS

1. Ball and Pebble Mills are cylindrical in shape and contain either steel balls or porcelain or Flint pebbles or "balls" as the grinding media.
2. Production Mills in the F & F Dept. are generally either 5 or 6 feet in diameter.
3. The conditions for the grinding stage of a "46 Process" Dispersion are
 1. all the pigment
 2. all thinner except to wash mill
 3. 5-10% resin solids
4. Steel Mills contain 40 % of the mill volume as balls and a pebble mill 60 % of the mill volume as pebbles.
5. Pebble Mills are usually lined with Porcelain blocks.
6. Define the following:
 1. Grinding Ratio The ratio of the percent volume of pebbles or balls and voids to the total percent volume of grinding charge of the dispersion and percent volume of pebbles or balls.
 2. Overall Ratio The ratio of the percent volume of pebbles or balls and voids to the percent volume of the total formula and percent volume of pebbles or balls.
 3. Cubic Foot Factor Pounds of overall charge per cubic foot of mill space.
$$\frac{\text{gal/3.78 ft} \times \text{lbs/gal} \times \% \text{ overall charge}}{100\%}$$

UNIT FOUR - Continued

4. Pigment to Binder Ratio is the ratio of pounds of pigment
to 100 lbs of solid binder.
7. Maximum volume of charge and pebbles or steel balls in a
mill at any one time should be 90%
% of total volume of mill.
8. The % volume of solid pebbles in a mill having a pebble charge
of 60% is 24 %.
9. The % volume of charge in a mill containing 40% steel balls
and a total volume of 60% is 80-24 = 56%.
10. Define the following:
1. FWW Pebble Mill, lined and water cooled.
2. SWW Steel Mill, unlined and water cooled.
11. In a "McCabe" dispersion, high solids resin.
is added after the grind stage. Additional grinding is
necessary to deflocculate the pigment, since
removal of thinner from the dispersion
by the resin causes agglomeration of the pigment.
12. 1,000 to 4,000 cycles
is generally sufficient to redispense the
pigment after addition of add and grind resin.

PREPARATION AND PREPARATION OF A SUW DISPERSION

1. Calculate a formula for a steel ball grind having the following composition and requiring the following conditions.

Pigment Data

W-370 - 29.4%

W-1002 - 16.2%

W-12 - 58.4%

Resin Composition

RC-3117/RC-5901

Solid Ratio = 48/52

Maintain ratio in every stage grind

P/B - Grind stage = 1100/100

P/B - Overall stage = 550/100

W-1001 Thinner - 29% of Grind stage

Total solids overall - 62.45%

ALL -

VB-7559 at 6.0% of binder

W-1003 at 4.0% of binder

VA-7790 At 0.6% of pigment

Grinding Cycles - 48,000 cycles

Grind at optimum grind ratio to obtain maximum capacity with satisfactory efficiency of grind.

2. Prepare a green sheet formula for this grind.
3. Make a gallon mill of this formula, basing charge and charge of steel balls on information on page 10-1-2 of F & F Information Manual.

Record the formula based on charge added, show the charge of balls and grinding cycles etc. at end of grind cycle. Determine and record fineness of grind. Specifications - 0.4 Mils Max. Save base-for-next-unit.

UNIT FOUR

"47 PROCESS" DISPERSIONS

1. The types of "47 Process" equipment used at present are
1 top and bottom feed units.
2. The "47 Process" uses sand as the grinding media.
3. Define the following:
 - a. Packing Index is the P/L ratio at which the fully dispersed pigment is dynamically packed.
 - b. Pigment Volume Volume of the pigment in formula.
 - c. Liquid Volume Volume of the liquids in formula
 - d. P/L ratio is the ratio of volume of pigment to volume of liquid.
 - e. Effective diameter is the mean rotational diameter of an average particle in microns.
 - f. Size Ratio is the ratio of effective diameter of the larger particle to the effective diameter of the smaller particle.
4. The Sand/Base Ratio is generally 50/50.
5. For the bottom feed "47 Process" unit, the viscosity of the dispersion should be between 100 and 1,000 centipoises.
6. The range of the normal grinding temperature of a "47 Process" dispersion is 120°F to 140 °F.
7. Dispersion Base P/L should be 25 to 35 % ~~ss~~
8. The maximum particle size for "47 Process" is 30 microns.
9. A 16 gallon unit is to be used to produce a "47 Process" dispersion, based on a 2.5 gal/hr on a 1/2 gal. unit, the

UNIT FOUR - Continued

grinding rate for the 16 gallon unit will be 61.5
gal./hr.

10. Pigments less than 0.3 Micron are generally considered as
finest in "47 Process" calculations.
11. Vehicle solids, in a "47 Process" Dispersion should be
between 20% and 30% by weight.
12. The ratio of dispersion vehicle solids to resin add
(let down) in a finished product should be less than 2
/ 1, to prevent flocculation
of pigment.

UNIT FOUR - PROJECT 2

CALCULATION AND PREPARATION OF A "47 PROCESS" DISPERSION

1. Calculate a "47 Process" dispersion using PP-01-A information and the following composition.

$$\text{P-425/P-4704} = 2/1$$

P-425 at 5% of the total dry pigments

P-425 at 10% of P-425

P-4704 = 0.75% dispersion based on binder

MS-337 = Resin

W-682 = Thinner

2. Develop formula from above information, showing the premix mixing instructions, generally shown for "47 Process".

Don't fill and do data.

3. Grind a 2 qt "47 Process" grind in the grinding room - annex.

4. Prepare a 2 qt laboratory "47 Process" grind or above formula at fineness of 0.5 to 1.0 Mils. Show the plant equivalent grinding rate on your formula, using the scale up factors for the "47 Process" plant units. Record all pertinent data in notebook (Charge of premix, "47 Process" formulating data, note to obtain satisfactory fineness, temperature of mill, sand load and any other information which may be helpful on plant alignment).

"48 Process"

1. The "48 Process" is a mixer, dispersion process.
2. "48 Process" is limited to break down of Low and moderate strength agglomerates.
3. The minimum effective diameter of the pigments used in "48 Process" dispersion is 0.2 microns. The maximum size is dependent on the fineness of the product desired.
4. This process requires a vehicle of low to moderate viscosity, usually below 300 centipoises.
5. Define Hydraulic Shear is the transfer of shear forces from a liquid to a solid body.
Direct Mechanical Action is the transmission of shear forces through particle interlocking.
Coarser Particle Attrition is the shear force exerted by coarser particles on finer particles.
6. A size ratio of 3/1 is required for development of coarser particle attrition.
7. The three classes of pigment systems are 1. Balanced system
2. Excess Fine system 3. Excess Coarse system.
8. "48 Process" Dispersion P/L Values should be in the normal range (between 1.0 and 1.2 Ps).
9. The vehicle solids should be 10 to 30 % by weight and vehicle viscosity should be between 0.05 and 0.5 poises.
10. Let down vehicle solids to Dispersion base vehicle solids ratio should be less than 2 / 1.

"48 Process"

11. The fineness of the "48 Process" grind is dependent on the basic particle _____ size _____ of the pigments or the size of hard _____ which can not be dispersed
12. Packing Index calculations are based on the volume of pigments and liquids in the vehicle.
13. Pigment Packing Index calculations can be made by the computer. Using the form for computer program ML-1049, obtain from the computer center the packing index data from the following pigment combination:

W-10 - 2.5

W-1004 - 36.8

W-165 - 2.8

W-1005 - 36.8

W-123 - 21.1

See attached paper

14. Calculate the liquid grinding portion based on total pigmentation above, using the following liquids:

1. H-632

2. RC-539

3. H-555

4. VH-1833

5. VD-5822

See attached

H-555, VH-1833 and VD-5822 added at the following percent of total pigment by weight.

H-555 - 0.3%

VH-1833 - 0.45%

VD-5822 - 0.93%

"48 PROCESS"

Add H-622 and RC-539 at 15% vehicle polymer solids
by weight.

- 14.2. Prepare formula for grinding purposes with appropriate
grinding and a flow instructions.

"49 PROCESS"

1. The operation of "49 Process" is by mechanical dispersion through the shearing forces developed by mixing with nitrocellulose fibers or vinyl resin particles acting as grinding media.
2. Upon completion of the dispersion active solvents are added to dissolve the nitrocellulose.
3. The two types of first stage "49 Process" Dispersion are "46" Process and "45" Process.
4. The following wetting agents may be used to obtain minimum flocculation in the first stage:
 - a. Blown oils
 - b. Synthetic resins
 - c. Natural gums and resins
 - d. Refined Raw oils
 - e. Special agents (H-185) (G-613) VS-4228
5. Give the procedure for making a "49 Process " dispersion using a "46 Process" type first stage.

W-612 Green Gold Y-562-D
W-622 Molybdate Orange
W-630 Ferrite Yellow Orange
W-679 C. P. Chrome Yellow Lt.
W-697 Shading Yellow

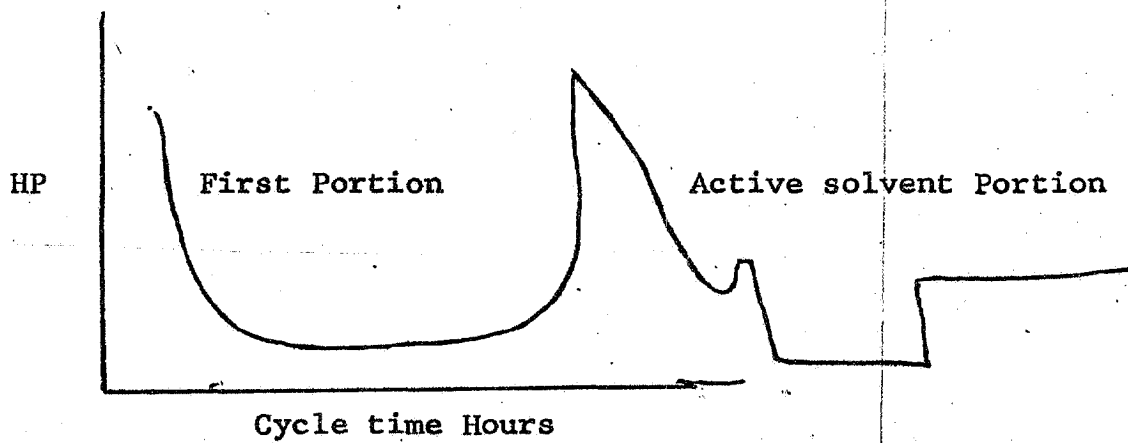
The following laboratory procedure may be employed in the development of laboratory formulations similar to the above:

1. Select the diluent/alcohol system for minimum pigment flocculation for the particular pigment.
2. Charge these into a quart can withholding approximately 25% of the quantity available from the formula.
3. Add all the nitrocotton which agitating.
4. Add the pigment slowly while agitating. Additional quantities of the liquids may be necessary in order to maintain the desired consistency which is similar to "oatmeal" and very thixotropic due to the presence of the nitrocellulose fibers. The heaviest consistency (but still maintaining agitation in all portions of the mixture) is desirable in order to develop the highest shearing force and maintain good contact within the pigment/fiber mass.
5. If the desired consistency is obtain under Step 4, agitate 3 hours at 450 RPM.
6. Stop the mixer and add all the active solvents and remaining alcohols or diluents.
7. Agitate 1 hour at 450 RPM to completely dissolve. (Solution generally occurs in 5 to 10 minutes, however, see section under Plasticizers).
8. Add remaining ingredients such as oils, resins, gums, plasticizers, etc., and mix 1 hour at 450 RPM to complete the batch.

The use of a cover over the can during the first portion is recommended in order to prevent excessive solvent loss with subsequent change in the consistency and rate of shear. The friction effects from the high intensity shear developed will result in a temperature rise which should not be excessive for the above mixing cycles. However, surveillance should be maintained so that a temperature of 50°C is not exceeded.

"49 PROCESS"

6. Draw the power curve for a typical "49 Process" dispersion.



"49 PROCESS"

7. The more aliphatic, hydrocarbon solvent used in vinyl dispersion the more fibers will be available for dispersion in the "kick-out" state.
8. The lower the molecular wt. of the vinyl resin the more aromatic hydrocarbon diluent may be used.
9. To determine the minimum flocculation point required for the first stage of the dispersion, a P/B ladder is made and the viscosity of the individual samples are determined on a Brookfield Viscometer. The viscosity is plotted against the P/B ratio and the lowest point on the curve represents the minimum flocculation point.
10. It may be impossible to restart the mixer if it stopped at the end of the loading operation or early in the dispersion stage. Additions of pigment should be made while mixer is running.

UNIT FIVE - Exercise 1

1. The three general film formers or binders used in Trade Sales Finishes are 1. Oils 2. Alkyd resins and 3. Latexes.
2. "Lucite" Wall Paint is the biggest selling type of trade sales product manufactured by the F & F Dept.
3. Another large volume type of trade sales product is the 310 line outside House Paint. It also uses an Emulsion/latex type film former.
4. Oil based paints are used in exterior paints.
5. Outside trim paints use long oil alkyd resins.
6. The three gloss level finishes used in interiors are 1. Flat 2. Sémi gloss and 3. High gloss. Where is each used in a house? 1. Walls 2. Walls or trim and 3. Woodwork (trim).
7. Give 6 general requirements for a trade Sales Product.
 1. Foolproofness
 2. Stability
 3. Ease of application
 4. Uniform film appearance
 5. Positive dry
 6. Odor
 7. Fire hazard
8. A Trade Sales Paint should after several years storage have satisfactory 1. dry 2. viscosity 3. settling and be free of 4. skinning

UNIT FIVE - Exercise 1 - Cont.

9. Some of the properties required for various types of maintenance paints are 1. speed of dry, 2. chemical resistance and 3. moisture resistance.
10. The two types of finishes used in the Automotive industry are Lacquers and Enamels.
11. The Lacquers used are "Duco" and "Lucite".
12. The Enamels used are 1. "Dulux" 2. "Dulux 100" and 3. thermosetting Acrylics.
13. Two of the most important properties of Automotive finishes are 1. Durability and 2. appearance.
14. In an Automotive finish; the color and gloss retention are two important appearance properties.
15. Metallic colored finishes are more flashy than solid colored finishes.
16. The three kinds of undercoats used in an automotive paint system are 1. Primer 2. Primer surfacer and 3. Surfacer. Describe the function of each in an Automotive Finishes System.

Primer is used to provide an adhering surface to the metal substrate upon which a surfacer or topcoat can be applied. Surfacer is an intermediate coat between primer and top coat to promote adhesion between primer and top coat. Primer surfacers are single coat which act as both primer and surfacer to promote adhesion of top coat to metal substrate.

UNIT FIVE - Exercise 1 - Cont.

17. Automotive primers are generally applied by dipping sheet metal or spraying bodies

Automotive topcoats are applied generally by spraying.

18. Name ten types of film formers used in industrial finishes and the types of end use for each.

<u>Film Former</u>	<u>End Use</u>
1. <u>Nitrocellulose lacquer</u>	<u>Furniture</u>
2. <u>Modified rosin varnish</u>	<u>Can Coatings</u>
3. <u>Alkyd resin</u>	<u>Signs</u>
4. <u>Alkyd/Nitrogen resin</u>	<u>Metal cabinets</u>
5. <u>Thermosetting Acrylic</u>	<u>Refrigerators</u>
6. <u>"Lecton" Acrylic latex</u>	<u>Wire Coating</u>
7. <u>"Teflon"</u>	<u>Fry pans etc.</u>
8. <u>Epoxy</u>	<u>Washing machine</u>
9. <u>Polybutadiene resin (Budium)</u>	<u>Can coatings</u>
10. <u>Styrenated alkyds</u>	<u>Furniture</u>

19. Name ten different kinds of industries using Industrial Finishes (See Industrial Sub-Classification).

1. Insulation
2. Industrial Machinery
3. Electrical Machinery
4. Farm Equipment
5. Can Coatings
6. Coil Coatings
7. Sign Industry
8. Wood Finishes

UNIT FIVE - Exercise 1 - Cont.

9. Appliance Finishes (Vending Machines)
10. Furniture (Metal and Wood)
20. Name ten kinds of substrates used under Industrial topcoat finishes.
 1. Wood
 2. Wire - Copper
 3. Phosphate Coated steel
 4. Alodized aluminum
 5. Bare steel
 6. Paper
 7. Plastics
 8. Prime coated materials
 9. Galvanized steel
 10. Tin plate (Terneplate)
21. Name ten methods of application of finishes.
 1. Spraying
 2. Flow coating
 3. Dipping
 4. Electrostatic Spray
 5. Stencilling (Silk screen)
 6. Rollercoating
 7. Ternespray
 8. Brush
 9. Doctor Blade
 10. Electrodeposition
22. Name five general properties which Industrial finishes must have.
 1. Corrosion Resistance
 2. Moisture Resistance

UNIT FIVE - Exercise 1 - Cont.

3. Initial appearance
4. Retained appearance
5. Flexibility/Chip Resistance (Mar Resistance)

23. Match the type of product with the special property of paint required.

- | | | |
|------------------------------|--------------------------|------|
| 1. Refrigerator | a. Heat Resistance | (3) |
| 2. Washing Machines | b. Non toxicity | (4) |
| 3. Stoves | c. Alkali Resistance | (2) |
| 4. Tin Cans | d. Non-Sticking | (8) |
| 5. Signs | e. Grease Resistance | (1) |
| 6. Aluminum Siding | f. Light Reflectance | (10) |
| 7. Wire | g. Beauty | (9) |
| 8. Frying Pans | h. Formability | (6) |
| 9. Wood Furniture | i. Electrical Resistance | (7) |
| 10. Fluorescent Lamp Fixture | j. Outdoor Durability | (5) |

UNIT FIVE - Exercise 2 - Continued

AUTOMOTIVE AND REFINISH FINISHES

10. 202 Line

N.M. - (M.)

4. "Duco" Lacquers use single pigmented tinting Lacquers in their formulation.

5. Define the three durability groups:

1. Group I shows no appreciable change after 4 mo. and good durability after 8 and 12 mo.

2. Group II shows more change after 4 and 8 mo. exp. than Group I but equal to Group I after 12 mo.

3. Group III shows excessive change after 8 mo. exp. and acceptable durability after 12 mo.

Using 246 Line formulating practice answer the following problems and questions:

6. 246 Line products are formulated at 30 to 40 % solids and at a viscosity of 35 to 45 seconds in a number 15 Cup.

7. 246 Line products use 253 Line single pigment tinting lacquers.

8. A blue "Duco", 246 Line product was color matched in the laboratory and found to have the following pigment composition.

W-50 - 58.3%

W-505 - 14.5%

W-312 - 18.1%

W-222 - 9.1%
100.0%

Since it contains W-50, B-630 was added to adjust for hiding at the rate of 1.75 times amount of 253-050 used. Calculate the 100 gallon formula using 253 Line Tinting Lacquers adding any modifiers required.

UNIT FIVE - Exercise 2

AUTOMOTIVE AND REFINISH FINISHES

1. The general types of Automotive Finishes are 1. "Duco"
Lacquers, 2. Dulux Enamels
3. Lucite Acrylic Lacquers
4. "Dulux" 100 Enamels
and 5. Thermosetting Acrylic Enamels.
2. Show the type of Finish for each of the following lines.

Lines

Type of Finishes

- | | |
|--------------|--|
| 1. 93 Line | <u>"Dulux" Std. Refinish Enamel</u> |
| 2. 246 Line | <u>"Duco" Refinish Lacquer</u> |
| 3. 938 Line | <u>Acrylic thermosetting Enamel</u> |
| 4. 794 Line | <u>"Dulux 100" Automotive Enamel</u> |
| 5. 867 Line | <u>"Lucite" Acrylic Lacquer</u> |
| 6. 780 Line | <u>"Dulux" Automotive Baking Enamels</u> |
| 7. 94 Line | <u>"Dulux" 100" Automotive Enamel</u> |
| 8. 766 Line | <u>"Dulux 100" Automotive Enamel</u> |
| 9. 942 Line | <u>"Lucite" Acrylic Lacquers</u> |
| 10. 253 Line | <u>"Duco" Automotive Lacquer</u> |

3. Indicate which of the following lines are Metallic or Non-Metallic. Circle applicable abbreviation

- | | |
|-------------|--------------------|
| 1. 772 Line | <u>(N.M.)</u> - M. |
| 2. 181 Line | N.M. - <u>(M.)</u> |
| 3. 93 Line | <u>(N.M.)</u> - M. |
| 4. 794 Line | <u>(N.M.)</u> - M. |
| 5. 798 Line | N.M. - <u>(M.)</u> |
| 6. 863 Line | N.M. - <u>(M.)</u> |
| 7. 877 Line | N.M. - <u>(M.)</u> |
| 8. 945 Line | N.M. - <u>(M.)</u> |
| 9. 930 Line | N.M. - <u>(M.)</u> |

UNIT FIVE - Exercise 2 - Cont.

AUTOMOTIVE AND REFINISH FINISHES

9. Give the two basic formulating rules to obtain a specific color.
1. keep the number of tinting lacquers to a minimum
 2. Do not blend complimentary colors.
10. 246 Line is formulated at 1.8 to 2.0 mils dry hiding.
11. The amount of B-630 which can be added should not exceed 4 times the amount of 253-050.
12. A 246 Line product requires the use of W-381, W-382, W-300 and W-222 as 253 Line Tinting Lacquers. Describe procedures necessary to be sure these can be used in a Government Specification product.
1. Check Government Specifications.
 2. Request permission from Flint Development Laboratory to use pigmentation.

UNIT FIVE - Exercise 2 - Cont.

AUTOMOTIVE AND REFINISH FINISHES

13. In order to obtain proper color matching in the plant, the amount of 253-0527 required was 5.8% of the total formula. This percentage is over the limiting amount in the Formulating Practice. Consult the Responsible Plant or Development Laboratory to obtain permission to use this amount of the pigment. John Marshall of the Parlin Plant Laboratory is the Formulating Supervisor responsible for "Duco" problems.
14. 246 Line Dark Greens contain 10 % or less of 253-050.
15. 246 Line Vehicle has the following composition.
- | | |
|----|---------------|
| 1. | <u>PX</u> |
| 2. | <u>RL-233</u> |
| 3. | <u>HE-111</u> |
| 4. | <u>H-116</u> |

UNIT FIVE - EXERCISE 3

"DULUX" FINISHES

1. 93 Line is a line of short oil air dry
"Dulux" Enamels for Refinish trade..
2. 181 Line is the Metallic line similar to 93 Line.
3. What is the durability required for the line? Group II or better
4. Flint is responsible for the line.
5. STP #74 covers testing of 93 Line.
6. 93 Line is applied by spray.
7. W-323, W-800 and W-862 are bleeding pigments.
8. W-622 Molybdate Orange may be used in Olive Greens but flooding must be checked.
9. The vehicle for the 93 Line is RC-3179/RC-3140.
10. H-257 and H-596 are the solvents used in 93 Line.
11. 93 Line is packaged at 50 to 60 secs.
in a Parlin #10 cup.
12. H-172, VD-5822 and H-173 are Cobalt, Lead
and Manganese driers, respectively, used in 93 Line.
13. All 93 Line products are reactive with zinc.
14. A 93 Line product was formulated to a standard using the following amounts of 42 Line bases. Calculate the formula using Formulating Table No. 84, FP-06-86.

42- 655	-	37.2	76.5%
42- 300	-	4.4	4.9
42- 225	-	1.5	0.7
42-5043(H)	-	6.9	17.9
		<u>50.0</u>	<u>100.0%</u>

UNIT FIVE - EXERCISE 3 - Cont.

15. a. Calculate the percent of each pigment in the formula.
b. Calculate Volume Solids, Pigment Volume, Weight Solids and P/B by weight. See separate page.
16. 780 Line quality is a blend of non-drying oil alkyd, drying oil alkyd and nitrogen resins.
17. It is intermediate in quality between 794 Line and conventional "Dulux" Enamels.
18. Name the properties which must be checked when developing a 780 Line product.

- | | |
|----------------------------|-------------------------------|
| 1. <u>Fading</u> | 7. <u>Bleed</u> |
| 2. <u>Chalking</u> | 8. <u>Hiding</u> |
| 3. <u>Checking</u> | 9. <u>Initial gloss</u> |
| 4. <u>Bronzing</u> | 10. <u>Bake discoloration</u> |
| 5. <u>Blistering</u> | 11. <u>Color drift</u> |
| 6. <u>Spot sensitivity</u> | 12. <u>Flooding</u> |

19. Indicate the baking schedules for the following baking band prefixes:

<u>Baking Band Prefix</u>	<u>Baking Schedule (Color)</u>
1. A	<u>40' x 225°F</u>
2. F	<u>20' x 300°F</u>
3. G	<u>20' x 250°F</u>
4. K	<u>30' x 250°F</u>
5. M	<u>30' x 225°F</u>
6. N	<u>60' x 180°F</u>
7. O	<u>30' x 250°F</u>
8. W.	<u>20' x 300°F</u>

20. 780 is generally sprayed at viscosity of 18 to 22 seconds in a #4 Ford cup.

UNIT FIVE - EXERCISE 3 - Cont.

21. In shading, select the tinting pigments which will require the least shading to obtain the desired color.
22. Give four basic formulating rules for color formulation.
1. Keep the number of pigments to a minimum
 2. Do not blend complimentary colors.
 3. Do not blend colors with complimentary undertones
 4. Do not use lightfast pigments to tone fugitive colors
23. The two blacks and two whites used in 780 formulations are:
1. W-123
 2. W-13
 3. W-224
 4. W-225
24. W-13, Lithopone, is used only to tone reds and maroons darker than W-862.
25. W-123 is used at P/B of 20/100 or 35/100.
26. Determine which P/B TiO_2 should be used with the percentage of the following pigment combinations:

W-224	- 0.5%	W-785	15.0%
W-630	- 1.0%	W-519	2.0%
W-312	- 2.0%	W-225	1.0%
W-123	-96.5%	P/B =	<u>35/100</u>
P/B = <u>20/100</u>			

UNIT FIVE - EXERCISE 3 - CONT.

27. W-224 has a brown undertone. W-225 lampblack has a blue undertone.
28. 45 1224 is used when less than 0.5% W-224 is required.
29. 0-780-57625, Green "Dulux" Baking Enamel, uses 42-785, 743-123, 743-612 and 42-225.
- a. Which pigment is used outside formulating practice? 743-612
- b. What properties are affected by the above pigmentation.
Bleeding, low hiding, expensive, improves durability.
30. What is the effect of adding W-582 at a rate exceeding 50% of the pigmentation? Increases mixing time and color drifts.
31. Give good and bad qualities imparted to a finish by the following:
- | | | |
|-----------|--|--------------------------------|
| 1. W- 382 | a. <u>Good</u>
<u>Lightfastness</u> | <u>Bad</u>
<u>Expensive</u> |
| | b. <u>Non bleeder</u> | <u>Humidity color drift</u> |
| 2. W- 300 | a. <u>Brighter color</u> | <u>Color drifts</u> |
| | b. <u>Gloss Retention</u> | <u>Cost</u> |
| 3. W- 819 | a. <u>Lightfastness</u> | <u>Expensive</u> |
| | b. <u>Non bleeding</u> | <u>Hiding</u> |
| 4. W- 862 | a. <u>Durability</u> | <u>Bleeds</u> |
| | b. <u>moderately priced</u> | <u>Alkali spot resistance</u> |

UNIT FIVE - EXERCISE 3 - Cont.

32. Whites must be toned with lightfast pigments such as
W-505 Monastral Blue, W-785 Monastral green or
W-630 Ferrite Yellow.
33. At least two toning pigments are required in all
white enamels.
34. Give the resin combinations for the following qualities:
- | a. <u>O - Bake</u> | b. <u>G - Bake</u> | c. <u>American Motors</u> |
|--------------------|--------------------|---------------------------|
| 1. <u>RC-3113</u> | 1. <u>RL-3141</u> | 1. <u>RC-3113</u> |
| 2. <u>RC-3126</u> | 2. <u>RC-718</u> | 2. <u>RC-305</u> |
| 3. <u>RC-731</u> | 3. <u>RC-731</u> | 3. <u>RC-718</u> |
| | | 4. <u>RC-731</u> |
35. 1 % VH-5379, Silicone must be added to 100
gallon formula.
36. What does VH-5379 do to a 780-line finish? Adds good working props,
such as flow, sag resistance and gloss.
37. What is the purpose of adding H-669, Triethylamine? To improve
gloss and hardness stability.
38. Describe the 5/50 rule as it applies to 780 line. See
next page.
39. STP 59 is used to control 780 line products.
40. a. Write up a 0-780 line formula for Chevrolet Truck, on a green
sheet, with the following pigments:
- | | | | |
|----------|---|---------------|-----------------|
| 743- 123 | - | 65.7% | - P/B of 35/100 |
| 42- 686 | - | 33.3% | |
| 42- 622 | - | 0.7% | |
| 42- 224 | - | 0.3% | |
| | | <u>100.0%</u> | |
- b. Show the items required by FP-08 - Sections 24, 25, 26 and
27-A. See attached page.
41. The plants have complained that a 780-line product is too low
in hiding and W-123 must be added at a P/B of 65/100. Calculate
the values for the resins shown on FP-06-75 for this P/B.
RC-3126 - 41.5; RL-3113 - 47.5; RC-731 - 41.6

UNIT FIVE - EXERCISE 3 - Cont.

42. KW-8925 is a less expensive pigment than W-819 and experiments have indicated that it can be substituted for W-819 in 780 Line products. Who would you ask for permission to use KW-8925.

Permission to use KW-8925 should be obtained from

W. P. Colio and Flint Development Laboratory.

43. A product is developed in 93 line which requires W-686 Chrome Yellow. What approval is necessary to use this pigment?

None

UNIT FIVE - EXERCISE 4

"LUCITE" LACQUERS AND ENAMELS

1. The name of 867 line products is High Gloss Thermo-Flow
"Lucite" Acrylic Lacquer.
2. 867 line contains a high viscosity grade of Cellulose
Acetate Butyrate. It is used to control Mottling.
3. 867 line lacquers should not require polishing for at least
twelve months Florida Exposure.
4. 867 line is tested by STP 43-B.
5. These products are formulated at 33 to 34 % weight
solids with a package viscosity of 40 to 80 secs. in a
#10 Parlin cup.
6. These products are applied by spray. They are reduced
with a "Lucite" thinner to a viscosity of 40 to
45 secs. in a #1 Zahn Cup.
7. They may be buffed or bake sand baked to
obtain optimum gloss.
8. 867 line Metallics are formulated with 868 Line
Single Pigment tinting lacquers and 867 Line
Metallic (Aluminum) Tinting Lacquers.
9. 867 0105 is the recommended Aluminum Paste to be
used.
10. Hiding is adjusted to 2.4 to 2.8 Mils. If the hiding is
at 1.8 Mils., how is the hiding adjusted? with the appropriate
balanced clearly specified on formula card
11. 901 2115 is used to promote wet color stability.

UNIT FIVE - EXERCISE IV - Cont.

"LUCITE" LACQUERS AND ENAMELS

12. G-401, U. V. Screener, is used to improve the resistance to checking.
13. The three classes of Metallic lacquers are 1. Low
2. Medium and 3. High containing 1. 0
to 8 %, 2. 8 to 50 % and 3. 50
to 100 % Aluminum Tinting Lacquer to Total Tinting
Lacquer Content, respectively.
14. Give the general rules for addition of G-401, U. V. Screener.
 1. Add 2% G-401 on binder solids to all colors except
Maroons, Reds, and colors containing hydrous iron oxide
 2. Add 1% G-401 to all colors containing 1-10% hydrous
iron oxide.
 3. Add no G-401 to all colors containing more than 10%
hydrous iron oxide.
15. Following the shading of a low Metallic "Lucite" Lacquer,
using single tinting pigment lacquers, 25 % of RK-3168,
based on the amount of lacquer, is added to the development.
16. Low Metallic 867 Lacquers should have 33 to 34 %
solids. Solids are adjusted with a 2/1 blend of H-30 /
H-79.
17. All 867 line products are doped with 0.13% of VH-5379
18. Low Metallic Lacquers contain no high viscosity CAB.
19. High Metallic Lacquers contain 40 % RK-3158 of total
formula.
20. High Metallic "Lucite" Lacquers use RK-3172 to adjust
hiding.
21. A mill base formula is obtained by using the FC-11
computer program.

UNIT FIVE - EXERCISE IV - Cont.

"LUCITE" LACQUERS AND ENAMELS

22. Give the binder solids of a high Metallic Lacquer.

Acrylic	52.7%	G-401 - 0.0-2.8%
G-515	7-9%	
G-522	11-13%	
H-654	27.3-24.5%	

23. The vehicle of 867 line is composed of the following:

1. Acrylic solids
2. Santicizer 160
3. Cellulose acetate Butyrate

24. Silver formulations contain 5% 901-2115 fortifier to improve check resistance.

25. An 867 line product shows 2.4% 901-253, plant experience has indicated that an additional 2.0% is needed. What must be done to revise formula? Approval of Flint Development Laboratory is required before revision of formula as it is outside of 5/50 rule.

26. Using the nomograph on Page 8 of FP-867 determine the amount of RK-3172 to be added to a factory batch of 867 line lacquer which initially had a hiding of 1.5 mils. 75 pts/100 pts unadjusted lacquer
27. Define 938 line. 938 Line enamels are non metallic baking enamels
28. The 938 line vehicle is composed of Sytrene Acrylic polymer modified with Melamine Formaldehyde.

UNIT FIVE - EXERCISE IV - Cont.

"LUCITE" LACQUERS AND ENAMELS

29. The following are the general properties of products in the 938 line:

1. Color change
2. Alkali spotting of Chromes
3. Bleed
4. Hiding deficiencies
5. Color drift
6. Low - Initial Gloss
7. Reactivity of chrome pigments with catalysts.

30. The minimum bake for 938 line is 30' x 250 °F

31. Minimum hiding of 938 is 2.0 mils.

32. Define Group I and Group II colors.

Group I - No blistering, checking or loss of film integrity after 24 months Florida exposure and no color change or significant chalking after 9 months Florida exposure.

Group II - Same after 24 months Florida exposure but moderate color change after 9 months exposure.

33. The following pigmentation has been shown to give a satisfactory match to a standard. Determine whether it meets the formulating practice for D-938 line for American Motors. If not, in what way is it outside of practice.

909-630	-	52.0	<u>909-630 and/or 909-582</u>
909-582	-	31.1	<u>are not used together.</u>
909-224	-	9.3	<u>Either 909-630 is used</u>
909-785	-	5.9	<u>with W-505 or 909-582 is</u>
909-124	-	<u>1.7</u>	<u>used with W-687</u>
		100.0	

UNIT FIVE - EXERCISE IV - Cont.

"LUCITE" LACQUERS AND ENAMELS

34. What deficiencies will this pigmentation have?

1. Gloss retention
2. Alkali Spot Sensitivity

35. Give the theoretical composition of RC-6025 and RC-6031.

<u>RC-6025</u>		<u>RC-6031</u>	
S	- 30.0	S	- 17%
MMA	- 26.4	MMA	- 26
2-EHA	- 25.0	2-EHA	- 36
HBMA	- 16.0	HBMA	- 18
MMA	- 2.6	MMA	- 3

36. The viscosity of RC-6025 is W to Y and
of RC-6031 is Q to Q.

37. To use a resin blend of RC-6031/RC-731 of 78/22 in 938 what
must be done? Get permission from Flint Development Laboratory
to use this blend.

38. What precautions must go on the formula when - 1. An iron blue
is used and 2. H-41 is used at 3.5% of the formula.

1. Caution Contains Iron Blue

Color Drift: Wait 15 hours or longer after baking before
Comparing to standard for colors.

2. Do not use more than 3.9% of methanol on total batch weight.
39. The maximum W-224 allowed in manufacture of a D-938 line product
is 7.2% when the formula amount is 4.8% W-224 Carbon Black

40. 32 5979 is used to improve the mar resistance of
D-938 line products.

41. Why is H-41 limited to 3.9% of the formula?

It is limited to 3.9% because at 4.0% or above products require
a methanol sticker on containers.

UNIT FIVE - EXERCISE 5

INDUSTRIAL FINISHES

1. 707 line is used for General Industrial Trade.
2. It is intended for Metal furniture use. It bakes at 30 x 300 °F.
3. It is applied by spray over bare metal or baking primers 764-29006 or 828-011.
4. The following pigments are alkali resistant in 707 Line.
 1. W-300 W-550
 2. W-312 W-559
 3. W-355 W-785
 4. W-362 W-608 W-818
 5. W-383 W-612 W-819
 6. W-393
 7. W-630
 8. W-505
 9. W-514
5. The vehicle for 707 line is a mixture of RC-305 and RC-718.
6. Flooding may be reduced by adding up to 0.4 of VH-5379.
7. Up to 0.9 % of 732-912 may be added to provide adequate Mar resistance.
8. Using Table #51, FP-06-53 dated 9/20/67 prepare a formula using the following pigmentation: (Use - Low P/B White)

42-630	-	32.8
42-362	-	28.1
42-224	-	7.1
42-355	-	0.4
732-943	-	31.6

(see next page)

9. Following testing the enamel, it was found that additional mar resistance was required. If the maximum 732-912 is added, what amount should be added to the formula.

7.9 Lbs.

UNIT FIVE - EXERCISE 5 - Cont.

10. Calculate gallon weight, weight solids, volume solids, P/B and pigment volume of your 707 formula. See attached page
11. 752 line is a High bake line for 700 Industrial Enamels.
12. Indicate whether the following resins are Alkyds, Nitrogen resins or Epoxy resins:
- | | |
|-------------|-----------------|
| 1. RC- 483 | <u>Alkyd</u> |
| 2. RC- 305 | <u>Alkyd</u> |
| 3. RC- 731 | <u>Nitrogen</u> |
| 4. VG-5924 | <u>Epoxy</u> |
| 5. RC-3108 | <u>Alkyd</u> |
| 6. RC- 718 | <u>Nitrogen</u> |
| 7. RL- 670 | <u>Alkyd</u> |
| 8. CP- 110 | <u>Nitrogen</u> |
| 9. RL- 495 | <u>Alkyd</u> |
| 10. RC- 262 | <u>Alkyd</u> |
13. Match the following intermediates with the property they produce in 752 line products.
- | | | |
|------------------------------|------------------|-------|
| 1. Improved Hardness | a. RL-495/RC-731 | (4) |
| 2. Retained adhesion to zinc | b. 732-912 | (6) |
| 3. Maximum Heat Stability | c. VG-5924 | (2) |
| 4. Maximum Durability | d. RL-495 | (3) |
| 5. Reduced Gloss | e. 32-17980 | (7) |
| 6. Mar Resistance | f. CP-110 | (1) |
| 7. Abrasion Resistance | g. 32-5297 | (5) |

UNIT FIVE - EXERCISE 5 - Cont.

14. FP 780 should be used as a guide for pigment selection in formulating 752 line exterior enamels.
15. 732-943 is used as the white dispersion for interior use.
16. Give the two white dispersions for exterior use. Indicate which should be used to give maximum gloss by using the figure (1) and which for resistance to pigment settling by using the figure (2).

732-10163 (1)

42-185 (2)

17. Indicate for what purpose each of the following Modifiers are used.

- | | | |
|------------|-------|------------------------------------|
| 1. VH-5379 | (b) | a. Flooding and silking resistance |
| 2. T- 8805 | (e) | b. Sag resistance |
| 3. VH-5324 | (c) | c. Frosting resistance |
| 4. VH-1260 | (a) | d. Aeration stability |
| 5. VH-7552 | (d) | e. Reduction thinner |

18. The minimum ratio of H-12 to nitrogen resin is 85 pts to 100 pts.
19. In formulating a 752 line product, 300 grams of RC-262 was used, to promote maximum viscosity H-669, triethylamine was added. How many grams of H-669 should be added to the formula? (14.1)
20. Refer to FP-05, state the rules for mixing 700 line products.

UNIT FIVE - EXERCISE 5 - Cont.

21. Using the attached formula for 724-64730 determine the following:

1. Pigments used in formula. W-384 96.04%, W-818 0.39%,
W-259 0.03%, W-1021 3.54%

2. Percentage of each pigment based on total pigment. See
above.

3. Pigment Volume 9.16%

4. Total Solids (weight and volume) 54.0% 40.77%

5. P/B 37/100

6. Vehicle composition (solids basis) RC-6028/RC-731 = 60/40

22. RC-6028 uses monomers, Styrene and Cardura E Ester
Acrylic Acid.

23. Mar resistance is improved by use of 32-5979, Polymekon Wax
dispersion .

B. Order-Of-Addition and Mixing Procedures - Non-Blended Non-Aqueous Pigmented Finished Products

The order-of-addition and mixing cycles for non-blended pigmented finished products should follow the format below:

Ingredient: (Note:1)

Manufacturing Directions

- (1) Resins
- (2) Aluminum Dispersions or Pigments
- (3) Pigmented Dispersions above 2.0#/100 Gal.
- (4) Thinners, Inhibitors, Additives

-----Add in order (Note:3) Mix
30 minutes.

- (5) Pigmented Dispersions less than 2.0#/100 Gal.
- (6) Solvents (Note:2)

-----Shade to standard and thin
to viscosity.

NOTES:

1. The ingredients listed in each ingredient category in any single stage are added in order of decreasing amounts except for the "Solvent" stage. The order-of-addition within the "Solvent" stage should be dictated by the individual requirements of the product.
2. If there are one or more thinners added for other reasons than for viscosity adjustment, these should be separated from the thinner or thinners added for viscosity adjustment by a line. The manufacturing directions should be "Add and mix". Solvents added for viscosity adjustment should be added as the last ingredient (s) with manufacturing directions of "Shade to standard and thin to viscosity".
3. While addition of ingredients with mixing may sometimes be an advantage, the phrase "add in order with mixing" should be used only when necessary for quality reasons, etc.

C. Order-Of-Addition and Mixing Procedures - 700-Line Pigmented Finished Products

Special orders-of-addition for 700-Line gloss Pigmented Products are required to obtain maximum properties.

There are two different orders-of-addition for 700-Line systems, classified as "alkyd portion first" or "nitrogen portion first". To determine which order-of-addition sequence to use for a particular product, separately total the weights of (1) all dispersions containing alkyd resins and all 330 Line dispersions, and (2) all dispersions containing nitrogen resins. If the total weight of the alkyd containing dispersions and/or 330 Line dispersions is larger use

the "alkyd portion first" order-of-addition. If the total weight of the nitrogen containing dispersions is larger use the "nitrogen portion first" order-of-addition.

The order of addition and mixing cycles for all 700-Line gloss products should conform to the following procedure:

(1) Alkyd Portion First

Ingredient (Note:1)

Manufacturing Directions

1. Alkyd resins
2. VH-7552 and VM-7790
3. Alkyd containing aluminum dispersions or pigments.
4. 330 Line and alkyd containing pigmented dispersions greater than 2.0#/100 Gal.

-----Add in order (Note:3) Mix 15 minutes.

5. Nitrogen Resins.
6. Alcohols or other oxygenated solvents.
7. Nitrogen containing pigmented dispersions greater than 2.0#/100 Gal.
8. Additives & miscellaneous minor ingredients.

-----Add in order with mixing. Mix 15 minutes.

9. All dispersions less than 2.0#/100 Gal.
10. Solvents (Note:2)

-----Shade to standard and thin to viscosity.

(2) Nitrogen Portion First

Ingredient (Note:1)

Manufacturing Directions

1. Nitrogen Resins
2. Alcohols or other oxygenated solvents
3. Nitrogen containing aluminum dispersions or pigments.

Ingredient (Note:1)

Manufacturing Directions

4. Nitrogen containing dispersions greater than 2.0#/100 Gal.

-----Add in order (Note:3) Mix
15 minutes.

5. Alkyd Resins.

6. VH-7552 and VM-7790

7. 330 Line and alkyd containing dispersions greater than 2.0#/100 Gal.

8. Additives and miscellaneous minor ingredients.

-----Add in order (Note:3) Mix
15 minutes.

9. All dispersions less than 2.0#/100 Gal.

10. Solvents (Note:2)

-----Shade to standard and thin
to viscosity.

NOTES:

1. The ingredients listed in each ingredient category in any single stage are added in order of decreasing amounts, except for the "Solvent" stage. Order-of-addition within the "Solvent" stage should be dictated by the individual requirements of the product.
2. If there are one or more thinners added for other reasons than for viscosity adjustment, these should be separated from the thinner or thinners added for viscosity adjustment by a line. The manufacturing directions should be "Add and mix". Solvents added for viscosity adjustment should be added as the last ingredient (s) with manufacturing directions of "Shade to standard and thin to viscosity".
3. While addition of ingredients with mixing may sometimes be an advantage, the phrase "Add in order with mixing" should be used only when necessary for quality reasons, etc.

UNIT FIVE - EXERCISE 6

AUTOMOTIVE AND INDUSTRIAL PRIMERS

1. Using the formulas 820-938 and 828-025 calculate the following for the product 828-025.

1. Weight Solids 58.4%
2. Volume Solids 36.6%
3. Vehicle composition (solids) G-511 = 79.1 / RC-718 = 20.9
4. Pigment composition based on total pigment.

- a. W-12 56.1%
b. W-1008 11.4
c. W-636 0.9
d. W-93 31.6
e. W-205 T
f. _____

5. Ratio of prime pigment to extender pigment. 32.5/67.5
6. Pigment Volume 32.8
7. Compare the pigment volumes and pigment to binder ratios of 828-025 - Primer and 724-64730 - Enamel.

	<u>P/B</u>	<u>Pig.Vol.</u>
828- 025	168/100	32.8
724-64730	37/100	9.16

8. VH-7552 is used to prevent skinning.
9. H-522 and VM-7790 are used to prevent hard settling.
10. H-39 is Diacetone alcohol.

UNIT FIVE - EXERCISE 6-Cont.

2. Using the Marshall Laboratory Computer Center form, (attached), request that the 828-1992 formula, (attached) be broken down into its basic raw materials. Upon receipt of the breakdown determine the following:

1. Weight solids 60.5%

2. Volume solids 32.7%

3. Pigment volume 55.8%

4. P/B 450.7/100

5. Vehicle composition - a. RC-5901/G-507 - 50%

b. RC-3117 - 40%

c. RC-718 - 10%

6. Pigment composition -

a. W-833 / W-870 22.67%

b. W-1002 17.66%

c. W-12 59.67%

d. _____

7. Solvent composition -

a. H-12 - 4.4

b. H-601 - 69.0

c. H-583 - 26.5

d. H-287 - .1

3. W-1003 is used to reduce hard settling.

4. W-1002 and W-12 are extenders used to

1. reduce cost, 2. reduce gloss and 3. promote adhesion

5. 32-1992 is a SUW dispersion. It contains W-12, a fine particle size barytes W-34 is a larger sized barytes and therefore cheaper than W-12. How would you go about determining whether

W-34 could be substituted for W-12 in this product? Explain

1. Compare W-34 VS W-12 in the laboratory in 828-1992.

2. If OK advise Flint and request formula revision.

UNIT FIVE - EXERCISE 6-Cont.

6. Compare 828-025 and 828-1992 for P/B and pigment volume.

<u>Code</u>	<u>P/B</u>	<u>Pig.Vol.</u>
828-025	168/100	32.8%
828-1992	450.7/100	55.8%

UNIT FIVE - EXERCISE NO. 7

TRADE SALES PRODUCTS

(603-904 as an example)

1. Exterior house paints or trim paints use a Long oil solids alkyd resin using linseed oil or Soya bean oil.
2. The Solvent used is a high Solvency hydrocarbon (H-601) which has slow evaporation rate.
3. The latter property is to provide sufficient lap time.
4. The driers used are 1. H-173, 2. VD-5822 and 3. .
5. H-545, Tertrary Butyl Perbenzoate, is a mildew inhibitor used in colors only.
6. VH-5379, antiflooding agent is a Silicone solution used mainly with blue pigments.
7. VM-7790, Soya Lecithin and 348-18323 are anti sag agents.
8. The pigments used must have the following properties: gloss retention, color retention and chalk resistance.
9. The products are formulated at a volume solids of 45-50%, and at a pigment binder that will give hiding at reasonable film thickeners.
10. Composite dispersions are used to prevent flooding and for sag resistance. 34 Line dispersions are used to tint exterior paints.

UNIT FIVE - EXERCISE NO. 7 - Cont.

(Use 60-360 as an example)

11. The vehicles for interiors are generally RC-537 and RC-539 which are long oil alkyd resins. The blend of low and high body resins is necessary for viscosity and hold out.
12. The solvent for interior oil paints is Low odor mineral spirits, H-632 or equivalent.
13. Interior paints do not contain lead driers because of their toxicity.
14. Interior paints use the following driers:
1. Calcium Naphthenate
 2. Cobalt Naphthenate
 3. Zirionium Silicate
15. H-580 Butraldehyde Oxime is used as an antiskinning agent.
16. Sag control is obtained by two groups of agents which must be used together. Match them up by drawing lines between each group of two.
- Zinc Oxide

Gelomer

Caprylic Acid

Calcium Naphthenate
17. W-10 and W-154 are zinc oxides; they are Nodular in shape and have low particle size.

UNIT FIVE - EXERCISE NO. 7 - Cont.

18. The following pigments are used in most interior paints:

Indicate the reason for each.

- | | |
|--------------------------|------------------|
| (c) 1. Rutile TiO_2 | a. Reduces cost |
| (a) 2. Calcium Carbonate | b. Sag control |
| (d) 3. Celite | c. Hiding |
| (b) 4. Zinc Oxide | d. Gloss control |

19. Zinc Oxide is added at the rate of 4-5 % on Pigment.

20. Like exterior paints, interior paints are formulated on the basis of volume solids and pigment volume. Determine the volume solids and pigment volume of 60-360.

1. Volume Solids 41.37

2. Pigment Volume 39.49

21. Bases are ground "48" Process.

22. There are three TiO_2 bases used, show the code for each.

a. Base for Whites and Light Tints 32-6157

b. Base for medium tints 32-6158

c. Base for deep tints 32-6159

23. Interior paints must have alkali resistant pigmentation because of the contact of Plaster and soap or detergents with the paint.

UNIT FIVE - Exercise 7 - Cont.

24. Tinting pigments must be non bleeding for air
dry topcoats.

(Use 392-092 as an example)

Reference PTSP #25

25. G-743 Rhoplex A C 33, Styrene Butadiene
Latex, G. 728, and G-1117 Resin Emulsion are
used as the vehicle in "Lucite" Wall Paint.
26. The two phases of "Lucite" Wall Paint are 1. external or continuous,
and 2. dispersed phases.
27. Match the ingredients in the first phase (above) with property's
they impart to the paint.
- | | |
|---------------------------------|--|
| (4) Ethylene Glycol | 1. Mechanical Stability |
| (5) Polypropylene Glycol | 2. Dispersion |
| (2) Non-ionic Surfactant | 3. Pigment Wetting |
| (8) Cobalt Naphthenate | 4. Freeze thaw stability |
| (9) Methocell | 5. Anti foaming |
| (9) Sodium Polycarboxylate Sol. | 6. Wetting |
| (7) Triton X-100 | 7. Dispersion |
| (2) Soya Lecithin | 8. To speed dry of Styrene Butadiene Resin |
| (10) Phenol Mercury Oleate | 9. Thickner |
| (1) Ammonia | 10. Prevent putrefaction |
28. Odor less Mineral Spirits, H- 632 is added as a
Anti bubbling agent when paint is applied by roller.
29. The dispersed phase includes Latexes and pigments.
30. Water based dispersions are made by "48" Process.
31. Show the use of the following ingredients in a "Lucite" Wall
Paint.
- | | |
|---------------------|--------------------|
| 1. V-Gum | (3) a Reduces Cost |
| 2. Titanium Dioxide | (5) b Lowers Gloss |

UNIT FIVE - Exercise 7 - Cont.

3. Calcium Carbonate (6) c Adds Color
 4. Calcined Clay (2) d Produces Hiding
 5. "Celite" (7) e Hydrates V-Gum
 6. 547 Line Dispersions (1) f Produces Thixotropy
32. _____ pigments are used to provide _____ stability.
33. The maximum fineness allowed is 2.5-4 Mils.
34. Color pigments added as 547 Line "47" Process dispersions or purchased dispersions.
35. V-Gum and water are added together in the first part of the "48 Process" grind.
36. Colored tintings should be mixed a minimum of 1 hours to affect satisfactory dispersion, as tested by the brush Sensitivity Test.
37. Care must be exercised in mixing to prevent foaming.
38. Trade Sales products containing over 0.65 % lead must carry a lead warning notice.
39. A 37-5032 Green Dispersion is to be ground in the plant. The following type of Mills are available.
1. 227 Cu ft. Mill - 6' x 6'
 2. 78 Cu ft. Mill - 5' x 4'
 3. 26 Cu ft. Mill - 5' x 1'
- What Mill or Mills are required to grind sufficient 37 Line dispersion to produce 1500 gals of 603-904 - two 544 Mils
40. Calculate the most economical batch size to make of 603-904. 1700 gal.
41. Give the name for the following intermediates
- a. VD-5822 Lead Tallate

UNIT FIVE - Exercise 7 - Cont.

- b. 348-18323 Ammonium Stearate solution
- c. VH-7552 10% Inhibitor Solution
- d. T-8629 #200 Thinner
42. RC-427 is added to the final stages of a steel Mill grind with spins between each addition to prevent colloidal shock.
43. In 32-6117, a 48 Process Grind, the final adds of resin and thinner should be added so that maximum amperage drop is 1 amp. every 2 mins.
44. What two precautions must be observed in scheduling a batch of 60-360 in the plant?
1. No high acid resin in previous mill dispersion
 2. No lead in previous mill dispersion
45. Give ratios of ingredients to;
- a Reduce gloss 32-6097/34-123 = 65/30
- b. Increase gloss RC-539/34-123 = 95/30
- of 60-360.
46. Give the chemical reaction between W-10 and H-555
 $ZnO + 2CH_3(CH_2)_6COOH \rightarrow Zn(COOCH_2)_6CH_3 + H_2O$
47. In 392-013, the Latex & Thinner are added first.
48. Give the function of the following codes in 392-013.

<u>Code</u>	<u>Function</u>
a. H-506	1. <u>Reduce Viscosity</u>
b. H-454	2. <u>Fungicide</u>
c. H-701	3. <u>Odorant</u>
d. H-632	4. <u>defoamer - coalescent agent</u>
e. H-542	5. <u>drier</u>
f. H-284	6. <u>pH control</u>
g. H-658	7. <u>Defoamer</u>

UNIT FIVE - Exercise 7 - Cont.

- ### 49. How does the adjusting for viscosity of a water based paint differ from an alkyd type paint?
- In water based paint you add all H₂O and increase viscosity with VM-5751, Methyl Cellulose.
- In alkyd type paint you add thinner to reduce viscosity.
- ### 50. Streaking of 392 Line dispersions are caused by lump of colored pigment.
- ### 51. Water in "48 Process" grinds should be added at 70 to 90 °F.
- ### 52. Why must W-1012 be added slowly (sifted) in a water dispersion?
- For proper hydration
- ### 53. Name the S-4 and S-5 materials used in a batch of a 392 Line product. Ammonia and Potassium Pentachlorophenol
- ### 54. Hydration of V-Gum occurs faster in hot water than in cold water.
- ### 55. Thixotropy is produced by the hydration of V-gum.
- ### 56. Doping water based products is limited to 2 % on total batch or 20 % on ingredient whichever is smaller.
- ### 57. Occasional/Steam cleaning of equipment used for water based products should be done to sterilize the equipment.

UNIT SIX - EXERCISE I - Cont.

9. What properties are covered under the test for Film Properties.
 - Color gloss
 - Hardness
 - Appearance
 - Adhesion

10. Match the gloss angle with the type of product controlled by that angle.
 - a. 20° (4) 1. "Lucite" Wall Paint
 - b. 60° (3) 2. Textured Auto. Lacquer
 - c. 75° (2) 3. Semi-Gloss Interiors
 - d. 85° (1) 4. Refrigerator Whites

11. Give the TM's used in Color Matching Instrumentally.
 - 1. TM-142-A TM-142-O
 - 2. TM-143-A TM-142-M
 - 3. TM-143-B

12. Name the stages of dry. (TM-219-A).
 - 1. Dust free
 - 2. Tack free
 - 3. Hard dry
 - 4. Set to touch

13. 95 % Confidence Limits of the test is measure of the reliability of the test.

14. To determine brushing time as a function of dry time; TD- 508-R Brush Dry and Wet Edge time is used. This test should not be used as a control test.

UNIT SIX - EXERCISE I

1. The three types of test methods are:
 - a. TD's
 - b. TT's
 - c. TM's
2. Only T M 's are specified on formulas for control of products.
3. The test methods describe a test procedure.
4. A Standard Testing Practice describes the way a line of products is tested.
5. If a product is controlled by an STP, no tests are generally shown on a formula.
6. Most products are tested for: (show the TM number)
 - a. Dry TM-219-A
 - b. Film properties TM-340-A
 - c. Color TM-350-A
 - d. Gal. wt. TM-13-
7. Other generally applicable test methods are: (show TM number)
 - a. Viscosity TM-9
 - b. Bake TM -341-A
 - c. Gloss TM -204-F
 - d. Solids TM -221
8. Name seven methods of application used in testing of products.
 - a. Brush
 - b. Spray
 - c. Doctor blade
 - d. Wire wound rod
 - e. Silk Screen
 - f. Flow
 - g. Roller coating

UNIT SIX - EXERCISE I - Cont.

15. You desire to control a product by TD-508-J. What must be done to get it issued for control purposes? Submit it to H. A. Wray with request that it be issued as a TM.
16. What is the purpose of a STP? To list all tests generally applicable to a line in one place. This eliminates necessity for showing all tests on formulas and it tends to maintain the uniqueness character of a uniqueness line.
17. Color Standards are either wet standards or dry plate standards.
18. Permanent Standards are given a 6 Digit Code.
19. The code indicates the general Color of the standard and the plant developing the color.
20. Instrumental Color Standards have an "X" in the code and Sparger Standards an "S".

UNIT SIX - COLOR PROBLEMS

1. Determine the L, A and B values for the following G, R and B Values using TM-143-A.

a.	G = 53.28	R = 56.94	B = 48.820
	L = 76.60	a = 5.11	b = 4.65
b.	G = 3.040	R = 3.823	B = .611
	L = 19.66	a = 2.32	b = 24.11

2. The G, R, and B Values of a standard are: $G = 22.64$, $R = 26.540$, $B = 14.550$, the batch has values of $G = 23.240$, $R = 27.360$ and $B = 15.050$. Is this batch a satisfactory batch, using zone G as the limits of acceptability? Plot results on Zone G Chart. No. $\Delta L = 0.61$ $\Delta a = .55$ $\Delta b = -0.10$
3. A pilot of a blue 42 line base, batch #5295672, was found to have a G value of 49.90. The G value of the standard is 51.25. The tinting strength of the batch is 18.225 % when the tinting strength factor is 13.5. Calculate the pounds of adjustment resin to be added if the batch size is 1,500 lbs.
173.38 lbs.

UNIT SEVEN Exercise 1

LABORATORY - COMPANY PRACTICES

1. The official title of the Dupont Co. is E. I. du Pont
de Nemours and Co., Inc.

2. When full name is used, de and du are always in _____
lower case except when all letters are in capitals.

3. The "d" of du is capitalized when Du Pont
is used alone.

4. How is the word Incorporated or its abbreviation used?
Used in smaller print than the company name, under the name
if possible, if not put in parenthesis.

5. Show how you would address a letter to S. N. Kelly in
Toledo. J. W. Gkonos
Toledo Paint
Attn: S. N. Kelly

6. Show how you would sign this letter. Plants
Chemical Group and your name.

7. Show how you head a letter if the following is the
subject of your letter.

The Divisional plants have had trouble with viscosity
stability of 60-215 Black Semi Gloss "Dulux" Wall Paint and
you have corrected this and you are now reporting on your
solution. 60-215 Black Semi Gloss "Dulux" Wall Paint

Viscosity Stability

Divisional

UNIT SEVEN - Cont.

8. Generally one copy of a letter to Wilmington Production office is sufficient.

9. Your supervisor should visa all letters going outside of the Plant.

UNIT SEVEN

Exercise 1

10. Copies of letters concerning production technical subjects should be sent to E. T. Breuer of Wilmington Production office.
11. Copies of all correspondence concerning Release Letters should be sent to L. S. Baker; concerning all Finishes Release Letters to H. C. Anderson, concerning Automotive Product Releases to E. P. Gwynne and Household Specialties Releases to H. J. Jenemann of Wilmington Production office.
12. As a chemist I have responsibility to:
 1. to the public
 2. to my science
 3. to my profession
 4. to my employer
 5. to myself
 6. to my associates
13. We should recognize that information is valuable and we should be discrete in its use.
14. Technical and trade secrets and confidential information are an important asset of the Du Pont Company.
15. All information relative to Du Pont Company should be considered as confidential by the employees.
16. These types of information should be safe guarded:
 1. Research information
 2. Technical information and "know how" on processes etc.
 3. Fields of endeavor of Du Pont
 4. Information on equipment used or not used by Du Pont.
 5. Patents that Du Pont uses or does not use.

UNIT SEVEN

Exercise 1

6. Information on costs, sales forecasts etc.
7. Marketing strategies and advertising campaign
8. Product quality and diversification programs
9. Changes under consideration in wages, salaries, benefits
17. The two questions which should be asked when decisions regarding safeguarding information are required are:
 1. Does the person have the right to know the information
 2. Does the person need to know the information
18. Precautions should be taken when:
 1. Discussing confidential matters in public places, etc.
 2. Using phone where an employee may be overheard.
 3. Leaving confidential papers where they may be seen by others.
 4. Improper disposal of confidential information
 5. Using telegrams and teletypes where persons other than addressee may see them.
19. What are the three items you agreed to when you signed the Employment agreement.
 1. Not to disclose any secrets on information to which you may become informed.
 2. Shall promptly inform employer of any inventions or discoveries and to assign all his interests in same to the employer.
 3. To promptly turn over to employer all secret documents in your possession.
20. What are three things to be done if you should be given an unsolicited suggestion by some one outside of the Company?
 1. Never discuss an idea or suggestion
 2. Suggest he write the Manager Patent Section F & F Dept.
 3. If unsolicited idea received forward to above manager

UNIT SEVEN

Exercise 1

21. What are the most important disadvantages in discussing in a publication or talk a patentable idea for which a patent application has been made?

1. In advent a patent does not issue, information has been disclosed which we may want to keep secret.
2. If a patent issues and is litigated competition may be given ammunition for its attack on the patent.
3. Publication may stimulate undesired competitive activity in the same area and may lead to interference procedures.

22. Confidential Documents include:

1. Written or printed matter
2. Drawings
3. Photographs
4. Punch Cards
5. Magnetic tape
6. Any other physical object embodying Company information

23. I am responsible for safe guarding documents I originate.

24. What are the two types of markings that are used for indicating the confidential nature of the document?

1. For company use only
2. Limited Distribution

UNIT SEVEN - Exercise 1

25. Circle the letter T or F designating whether the following statements are true or false.

1. There are some documents relative to the company which are not confidential. (T) F
2. Photographs are never confidential. T (F)
3. Most of the Company's confidential documents require only the marking "For Company Use Only." T (F)
4. "Limited Distribution" should be used sparingly. (T) F
5. The basic consideration for the type of distribution to be given a document is the desire of the recipient. T (F)
6. "Limited Distribution" should never be shown on the outside of an envelope. (T) F
7. "Confidential" should never be shown on any F & F correspondence. T (F)
8. "To be opened by addressee only" may be used on envelopes not containing any data marked with classified markings. (T) F
9. Confidential documents not needed by an employee should be sent to file or sender or otherwise properly disposed of. (T) F
10. Employees having need for confidential documents should have suitable storage facilities to properly safeguard them. (T) F

26. "Du Pont Confidential Technical Information" is used on all information transmitted to foreign affiliates.
27. Mailing envelopes to foreign affiliates should not show any Confidential information markings.
28. Define the term Trade Mark The term trade mark includes any word name, symbol or device adapted and used by a Manufacturer to identify his goods and distinguish them from those made by others.
29. Trade Marks are of definite and rangible value.
30. a. Define "Generic Usage" is defined as the use of a valid trademark as a descriptive item for a general class of goods.

UNIT SEVEN - Exercise 1

b. Name three trade marks which have become generic by use.

Nylon

Aspirin

Cellophane

Dynamite

31. Give the proper generic term to be used with the following trade marks, indicating by proper symbol their registration status.

1. "Duco" Lacquer

2. "Dulux" Enamel

3. "7" Chemical specialties

4. * "40" Outside White

5. "Dulite" Enamel

6. * "Dux" Enamel

7. * "Old English" Paint Oil

8. "Lecton" Acrylic Resin

9. "Lucite" Wall Paint

10. "Ovalite" Undercoater

11. "Teflon" TFE - fluorocarbon Resin Finish

12. "Preparakote" Primer Surfacer

32. Show by circling the T or F if the following statements are true or False.

a. All correspondence having the trademark mentioned should carry a footnote Registered Du Pont Trademark, T ☒ F

b. Teflon enamel is the correct way to designate the trade mark for TFE paint products in a letter. T ☒ F

c. All Trade Marks should have the first letter capitalized. T ☒ F

d. The following markings in a letter indicates that it is a non registered trade mark: "Tufcote"* T ☒ F

UNIT SEVEN - Exercise 1

- e. When ever the first letters of other words in a sentence are capitalized it is advisable to capitalize the whole Trade Mark. (T) F
- f. The generic name need appear only once with the trade mark in any single document. T (F)
- g. The generic name should follow immediately after the trade mark with no punctuation or article between the trade mark and generic name. (T) F
- h. If the trade mark is registered then there should be a footnote on the page where the trade mark first appears stating *Registered Du Pont Trade Mark. (T) F
- i. Unregistered trade marks need not refer to a footnote indicating the status of the trade mark. T (F)
- j. TM placed to the upper right of the trade mark indicates that it is a registered trade mark. T (F)
- k. We should apply our rules regarding Trade Marks to those of other companies. (T) F
- l. The Du Pont oval with the single word Du Pont therein is the official trade mark of the Du Pont company. (T) F
- m. Trade Marks and Trade Names are synonymous. T (F)

UNIT SEVEN - Exercise 2

1. Absences should be reported to your Supervisor by 9 A.M. of the first day of absence.
2. Give the seven items you should give when reporting an illness.
 - a. Name in full
 - b. Payroll number or salary
 - c. Home address
 - d. Name of hospital if hospitalized
 - e. If sick or injured, name of attending physician
 - f. Nature of Illness or injury
 - g. Date expected to return to work
3. What should you do when reporting back to work after an illness.
 - a. Report to Medical
 - b. Then to Personnel
 - c. and finally your supervisor
4. An identification pass with your photograph on it must be shown when asked for to gain entrance to the plant.
5. An employee not having his pass when he is asked to show it will be required to wait at the gate for his supervisor to identify him.
6. All cars must have a yellow bumper sticker on the car before they can be brought into the plant.
7. Pedestrian employees must enter at all times through the Main gate.
8. Automobiles being driven into the plant at 7:45 A.M. must enter through the West gate. At 12:00 Noon they must leave through the Main gate.
9. No material may be removed from the plant without an written materials pass obtained from the supervisor responsible for the material. All personal property brought into the plant should

UNIT SEVEN - Exercise 2

- be checked in by the guards.
10. Requests for Cash Sales of regular Trade Sales products or O and D materials must be made on Tuesday, Wednesday, Thursday between the hours of 8 A.M. and 10 A.M. at second floor No. 3 Bldg..
11. Employee will receive a Carbon copy of the Sales ticket for sale from the rework man.
12. He picks up his paint from the guard house and presents his sales slip to the guard as he leaves the plant.
13. Circle the T or F to indicate whether the following statements are true or false.
- a. Common glass ware can be secured from the Store Room. Room 102 ☒ T ☐ F
 - b. Orders for common vehicles and pigments must be made on Store Room order (Pink sheet). ☐ T ☒ F
 - c. Orders for materials made at another plant should be placed with the Laboratory Purchasing section (John Kissel). ☐ T ☒ F
 - d. Resins, Dispersions and thinners will always be supplied within specifications. ☐ T ☒ F
 - e. A chemist may order materials or equipment up to \$25.00. ☐ T ☒ F
 - f. D. S. Samples are samples of substandard finished products made by an F & F Plant. ☐ T ☒ F
 - g. A chemist can sign maintenance, repair or installation of laboratory equipment shop orders up to \$50.00 beyond that the orders must be signed by supervisor. ☐ T ☒ F
 - h. Orders for new raw materials should be routed through the Technical Investigator (Harry Stauffer). ☐ T ☒ F
 - i. Information on standard codes can be obtained from Dale Reinecker. ☐ T ☒ F

UNIT SEVEN - Exercise 2

- j. "K" coded materials are special high cost raw materials. T (F)
14. Permanent codes are assigned at Philadelphia and _____
Plants.
15. Indicate where the particular type of Finish is exposed.
- | <u>Exterior House Paint</u> | <u>Industrial Finishes</u> | <u>Clears</u> |
|-----------------------------|----------------------------|---------------|
| 1. Delaware | 1. Florida | 1. Florida |
| 2. Florida | | 2. Delaware |
| 3. Texas | | |
- Metal Protective Paints
1. Florida
2. Delaware
16. In the dark _____ and in the light exposures are used to determine color retention of finishes.
17. A finished product (60-170) has been made in the plant but for some reason satisfactory hardness and dry cannot be obtained even with doping. It is suspected that the wrong resin was used in preparation of the product. RC-539 is the resin required by the formula. Prepare an analytical request form to obtain information about the resin indicating the supplying of the pigmented finished product (60-170) to analytical section.

RESULTS:

UNIT SEVEN - Exercise 2

18. A problem exists regarding hardness of 942-97540 Red Lacquer. In your study of this problem you have made panels of a standard and 5 experimental products. Tukon Hardness readings are needed. Prepare a physical Testing Form requesting Tukon Hardness of these 6 panels.
19. Explain procedure for filing retain samples, indicating form to be filled in, sample sizes required, boxes to be used and records to be kept.

Duplicate R S record storage cards are filled in, stored in cans no larger than 1 qt. and these to be filled into quart containing cartons. Retains are stored for 2 yrs. and records should be kept by the chemist of what is in each box. Box should be labeled with formulators name and disposal date.

- 19-A. Retains should be kept on all samples of products made by you.

20. FP-08 is called Formula Writing Guide.
21. Write the name of the plant after its letter designation.

B Brazil

L Tucker

C Chicago

M Fort Madison

E Everett

O Canada - Ajax

F Flint

P Philadelphia

J Parlin

S South San Francisco

22. Formulas developed by Marshall Development Laboratory show the responsibility for the formula as Phila. DL.
23. What approvals are required before a formula is issued?

Supervisor

Simplification (W. P. Colio if necessary)

Formula Specialists

UNIT SEVEN - Exercise 2

24. Gloss of a product is now expressed as follows 60/45-55.
25. Define
1. Volume Solids Percent of solids by volume in finished product.
 2. Pigment Volume Percent of pigment by volume in a finished product.
 3. Weight Solids Percent solids by weight in a finished product.
 4. Pigment/Binder Ratio Ratio of the pigment to 100 lbs. of binder in a finished product.
 5. Binder Solids Percent of binder (resin solids) by weight in finished product.
 6. Square foot Coverage The number of square foot a gallon of paint will cover at 1 mil of solid film.
 7. Volume Weight Solids The volume of solids in an intermediate per 100 lbs. of intermediate
 8. Prime Pigment is a hiding pigment.
26. What vehicles are Reactive with Zinc? Vehicles which have an acid number specifications of 10 or more.
27. C.O.S. is now shown on the formula in space listed for Patent Markings.
28. Give the specifications of a Ball Mill Dispersions which are shown in "Initial Directions". 1. Cu ft factor, 2. Overall cycles & overall ratio
29. Define Terminal Directions in a formula. Directions to fill and label the product. Also to show special accounting procedures.
30. The formula charge for finished Products is based on pounds per 100 gallons.
31. Thinner ingredient amounts are shown in pounds and gallons

UNIT SEVEN - Exercise 2

32. Yield of resins is shown as the weight per 100 gallons.
Losses include filter pressing and polymerization
reactions losses.
33. What is the purpose of a Stop Notice? To stop production and/or
shipment of a finished product when necessary.
34. 60-160 Satin Sheen White formula appears to give off standard
material and you have decided that the formula should be stopped.
What steps must be taken to stop this formula. Write necessary
stop notice form.
35. Give the nine reasons for obsoletions of a formula.
1. No manufacture for 1 year (Perm) 6 mo. (exp.)
 2. No business anticipated by Sales
 3. Production unsatisfactory
 4. Fail to conform to best formulating practice
 5. Replaced by another formula
 6. No longer required as an intermediate
 7. Materials no longer available for product
 8. Issued in error
 9. Sales withdrawn
36. What is the function of an Experimental Request? To request
experimental production of a finished product or intermediate.
37. 100-X-12345 is to be made on an experimental request to get
factory experience; a 100 gal batch is to be made. 40-X-23456 is
used in 100-X-12345 and is also to be made. Prepare an experimental
request form and below trace the forms through the plant to
manufacture of product.
38. Indicate the cost code for the following work done by you.
1. Plant Service work for Ft. Madison. 2280-M
 2. "47 Process" formula for a SUW formula. 2600-G

UNIT SEVEN - Exercise 2

3. Preparation of an improved test method. 2600-I
4. Training 2600-D
5. Annual inventory 2181
6. Service to Mexico Plant 2600-K
39. Name and define the function of each of the testing procedures used by the F & F Department.
 1. TM - Control Tests
 2. STP - Standard Testing Practices to specify test for a line
 3. TM-400 series, Development or Sales Service tests.
40. Name the classifications of dangerous items by Interstate Commerce Commission.
 - a. Explosives
 - b. Flammable liquids - 80
 - c. Flammable solids
 - d. Oxidizing materials
 - e. Corrosive liquids
 - f. Compressed gases
 - g. Poisonous substances
 - h. Combustible liquids + 80
 - i. Hazardous articles
41. A raw material is a poison but it flashes at +80°; What ICC designation is shown on the formula. Pois.
42. Match designation of a code prefix with the product type code.

1. H	a. Lacquers and adhesives	(7)
2. VF	b. Semi Alkyd	(9)
3. RC	c. Varnish Flat	(2)
4. HE	d. Nitrocellulose Base	(5)
5. B	e. Duco Pigmented Lacquers	(8)

UNIT SEVEN - Exercise 2

- | | | |
|--------------|--|-----|
| 6. MG | f. Plasticizers | (4) |
| 7. No prefix | g. Resins | (3) |
| 8. 200-Line | h. 49 Process Dispersions | (6) |
| 9. 600-Line | i. Synthetic Resin Pigmented Products (10) | |
| 10. 800-Line | j. Liquids | (1) |
43. Color number assignments are made to each Plant.
44. The new color number system uses two letters and three digits.
45. The prefix to a line number indicates a baking band.
46. The number zero (0) preceding digits in a color number indicates a single pigmented lacquer or dispersion.
47. In formulating a new product, it was found that a solvent modification of RC-539 was the resin required. In this solvent modification H-47 was substituted for H-632 on a pound for pound basis.
What is the flash range for this new resin solution? -80°L.
48. Give the 3 classes of pigments according to their bleeding characteristics.
1. Non-bleeder
 2. Bleeder
 3. Slight bleeder
49. What Bleeding notations are shown on formulas containing a slight Bleeding Pigments? Why?
- Initial Directions - "Slight bleeder. Use clean non-bleeding equipment."
- Terminal Directions "Clean equipment before loading a non-bleeder"
- To prevent subsequent contamination in non-bleeding equipment.

UNIT SEVEN - Exercise 3

1. Give the five purposes of the Release Letter System.
 - a. Propose new or significantly changed items for test or sale.
 - b. Propose important changes in Manufacturing processes
 - c. Present information on previously released production affecting Marketing.
 - d. Withdraw or otherwise modify another release.
 - e. Transfer responsibility from one organization to another.
2. When should a Release Letter be written?
 - a. Important new products or processes.
 - b. Revision or modification of existing products
 - c. Finished products for resale
 - d. Products or processes which may create manufacturing problems.
 - e. Products that may involve new or unusual toxicity hazards.
 - f. Developments that present air pollution problems.
3. List items to be included in Release Letters.
 - a. Proposal and extent of Release
 - b. Management decision requested
 - c. Technical opinion
 - d. Description of product or process.
 - e. Reproducibility
 - f. Continuing laboratory work
 - g. Cost information
 - h. Manufacturing problems
 - i. Toxicity or other hazards
 - j. Label information
 - k. Simplification
 - l. Patent information
 - m. Conformance to APC Directive
 - n.

UNIT SEVEN - Exercise 3

- n. Confidential information
 - o. Formula Cards
 - p. Approvals
4. What items should be included under Manufacturing problems?
- a. New raw materials
 - b. Effect on consumption of raw materials
 - c. Effect on production capacity
 - d. Need for new or special equipment
 - e. Special precautions necessary
 - f. Unusual control tests
 - g. Special containers required
 - h. New intermediates required.
5. Release Letter comment Letters issued by Plants Chemical Group shall be addressed to L. S. Baker with copies to:
- a. H. J. Jenemann or E. P. Gwynne
 - b. Writer of Release
 - c. Your supervisor
6. List the items to be covered in a Laboratory Report.
- a. Introduction
 - b. Objectives
 - c. Summary and conclusions
 - d. Action taken or proposed
 - e. Patent Situation
 - f. Publication Status
 - g. Acknowledgements
 - h. Discussion
 - i. Experimental Details

UNIT SEVEN - Exercise 3

- j. Bibliography
 - k. Charts and graphs
 - l. Appendix
 - m. Glossary
 - n. Abstract
 - o. Table of Contents
 - p. Distribution
 - q. Standard form of title page
7. Define the following
- a. Master Standards are Du Pont stds. which are reference stds for working stds.
 - b. Operating Standard a standard used to control production
 - c. Official Standard Customer stds used as basis for color matching by Du Pont.
 - d. Temporary Color Standard A wet std or DPS coded with code of prod.
 - e. Permanent Dry Plate Standard A dry plate standard used to control one or more products coded with a 6 digit code
 - f. Porcelain Standard A standard made of porcelain
 - g. S. R. Standard A standard supplied by customer
 - h. Quality Standard A wet standard to check quality of production
 - i. All property Standard A wet standard used to check film properties and color
8. What is Metamerism? How can it be prevented? A colored product which can be matched to a standard under one light source but not under another. It can be prevented by using same pigmentations as in standard.

UNIT SEVEN - Exercise 3

9. Match the following standard codes with the name for their type.
 1. W-752-67852-P a. Sparger Standard (3)
 2. 4-0123-6 b. Wet Standard (1)
 3. 4-S135-6 c. Permanent Color Std. (2)
 4. DPS-860-78523 d. Tinting Strength Std. (5)
 5. 4-X012-3 e. Temporary Color Std. (4)
10. Flint Plant Laboratory prepares the majority of Dry Plate Standards.
11. Give the source for Fed. Standard No. 595 General Services Adm. Business Service Center, Region 3.
12. What is meant by the term "Offset Standard Values"? The standard Colorimeter values of a product when a Colorimeter is calibrated to a porcelain standard. These values are then used to control future production.
13. Form FF-4745 Rev. is used to request standards.
14. Form FF-7182 is used to request Flint to prepare a permanent std.
15. Indicate by the plant designation (1) Plant originating standard and (2) the color of the standard.

<u>Code</u>	<u>Plant</u>	<u>Color</u>
a. 2-1234-6	Flint	Black
b. 3-X125-3	Toledo	Red
c. 1-2516-4	Ft. Madison	White
d. 7-2015-1	Parlin	Green
e. 5-S025-7	Philadelphia	Blue
16. S R Coded Standards are not to be shown on formulas.
17. Define Color Tie-in Certain lines are in "color tie-in lines" in which the same color number is used in each line for the same color
18. In the following group of codes indicate with a "Y" or "N" whether they are proper tie in codes.
 - a. 93-123 and 246-123 (N)

UNIT SEVEN - Exercise 3

- b. 84 - 5869 and 85 - 5869 (Y)
c. 726 - 78562 and 797 - 78562 (Y)
d. 884 - 97652 and 885 - 97652 (N)
e. 707 - 5896 and 246 - 5896 (N)
19. Explain the purpose of the "Color Classification System". to
find an active product and color for product desired by customer.
20. Give the codes of all the products controlled by color standard No.
2-2001-7 84-24675, 93 - 8904
246 - 890-67114
701 -
890 -
21. You have a request for an 895-Line product having similar color
to 93-95896, determine the standard code controlling 93-95896 and
then whether there is an active product of this color in 895-Line.
Standard Code 3-0080-6 . 895- None .

UNIT SEVEN - Exercise 3

22. S R-12345 was received from Sales with a request to develop a 780-Line product having the color of the S R. Determine if we have a product with the color of the S R.
1. Select segment plate nearest color of S.R.
 2. Check color chips filed under segment plate color for color match.
 3. If a color match is available check standard index for products available for a 780 Line product.
23. Describe what you should do, if you revise a Automotive product with an increase of \$0.05 per gallon.

Send a notice of this to the Sales Department on form FF-7694

FF-7784

24. You have formulated a revised "47 Process" Mill base for 93-97625 (32-97626). You desire to make a semi works batch of the finished product to test plant production. Prepare the necessary papers to produce a 100 gal. batch in the plant.

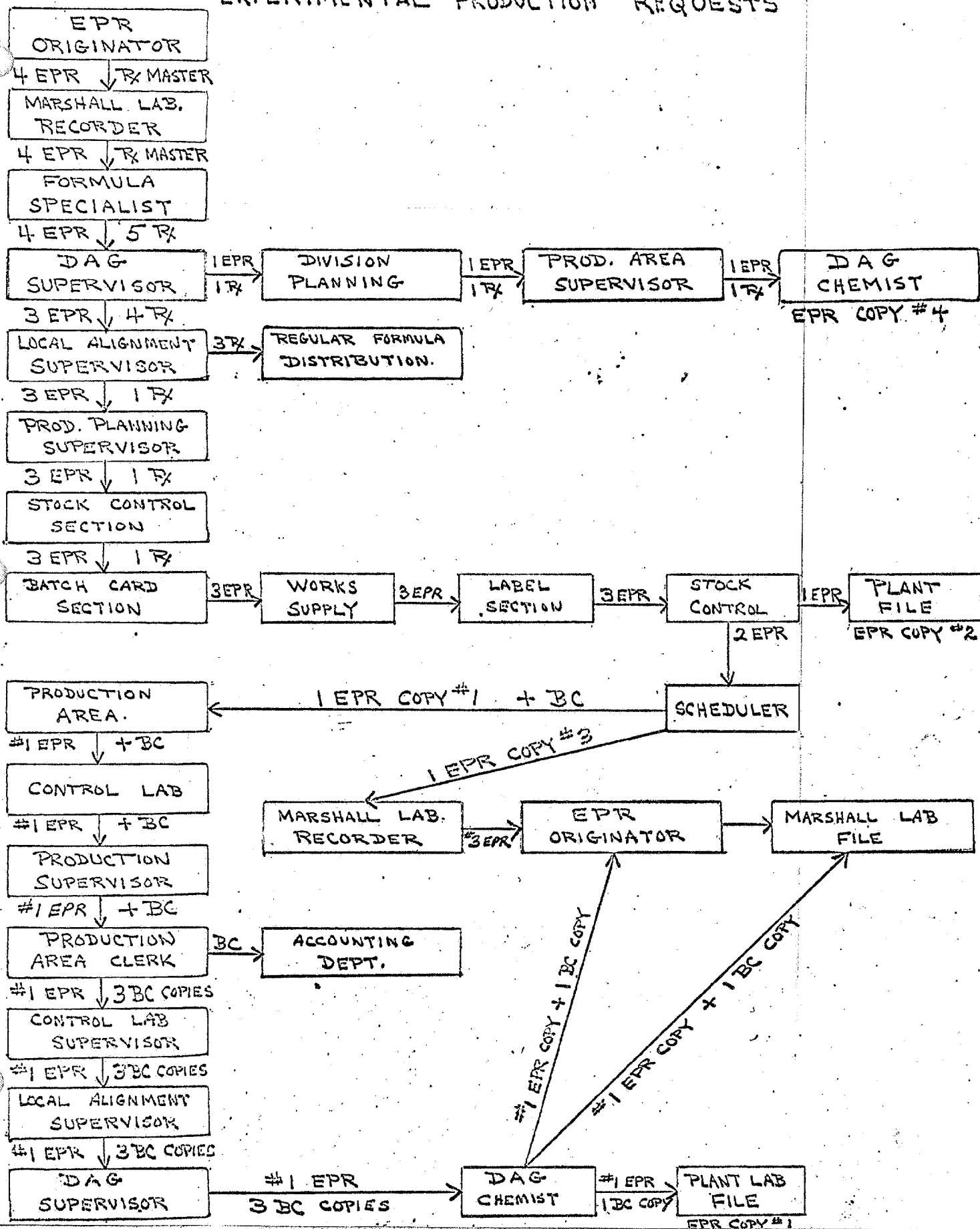
EPR

UNIT SEVEN - Exercise 3

25. Prepare a flow chart for the handling of these papers.

EXHIBIT II

CIRCULATION FOR APPROVING AND PROCESSING EXPERIMENTAL PRODUCTION REQUESTS



UNIT SEVEN - Exercise 3

26. The Divisional Alignment Group serves as the central clearing point for special alignments involving more than one plant and for coordinating all special alignments.
27. The Plant Alignment chemist is responsible for handling routine alignments.
28. List 5 types of situation which would require "Special" Alignment.
1. Initial manufacture of new quality lines
 2. All new dispersions or significant modifications
 3. All new resins or significant modifications
 4. All formulas involving new processes or process modifications.
 5. All formulas where manufacture at more than one plant is anticipated
29. The responsibility for testing stability samples lies with the Development chemist.
30. An Alignment program may consist of the following.
1. Anticipated time table for alignment
 2. Establishment of preferred location for alignment
 3. Periodic review meetings with sales, development and production
 4. Participation of alignment chemist in experimental prod. batches
 5. Pre-alignment of formulas in semi-works
 6. Review of formulas during development with DAG
 7. Participation of P. E. Group
 8. Review of simplification aspects
 9. Coordination with other Plants Technical Activities
 10. Arrangement for adequate stability studies of alignment batches.

UNIT SEVEN - Exercise 3 (Cont.)

31. The Divisional Alignment Group will maintain a Special Alignment History File.
32. It is the responsibility of the Divisional Alignment Group to determine at which point Development and Production are satisfied with performance of a formula.
33. The following persons should be advised of satisfactory completion of alignment of a formula.
 1. Sales Product Manager
 2. Development Supervisor
 3. Technical Supervisors
 4. Production Planning Manager
 5. Release Letter Coordination

UNIT SEVEN - Exercise 4
RULES - GENERAL PLANT AND SAFETY

REFERENCES

- a. Employees Handbook
 - b. Safety in Laboratory
 - c. PTSP #28 Identification of Fire Hazards of Materials
1. Notify your supervisor of any change in your home address or phone number.
 2. Employees found smoking in other than designated areas are subject to dismissal.
 3. Gambling in any form is strickly forbidden.
 4. Any injury no matter how small should be reported to Medical and must be treated at plant dispensary as soon as possible.
 5. Circle the "T" or "F" indicate whether the following statements are true or false:
 - a. All unsafe practices should be reported to your supervisor. (T) F
 - b. Horseplay and practical jokes help maintain morale of the employees. T (F)
 - c. Materials should be stored more than 12' below a sprinkler head. T (F)
 - d. You should lift with your legs and not your back. (T) F
 - e. Safety glasses are required in all operating areas of the plant with certain exceptions such as smoke houses and cafeteria. (T) F
 - f. Head protection is required in all operating areas. T (F)
 - g. Safety shoes must be worn by all employees. T (F)
 - h. No person shall enter a roped area without approval of supervision. (T) F
 - i. Occasionally it is permissable to use a tool for which it is not intended. T (F)

UNIT SEVEN - Exercise 4
RULES - GENERAL PLANT AND SAFETY

- j. No one is to operate elevators unless properly instructed and authorized. (T) F
6. Circle "T" or "F" to indicate whether the following statements are true or false:
- a. Stand in front of a disconnect switch when operating it. T (F)
 - b. No one is to work on any electrical equipment except an employee authorized to do so. (T) F
 - c. Use only machines you are authorized and know how to operate. (T) F
 - d. No equipment is to be operated with guards removed. (T) F
 - e. Get janitor to clean up all spills. T (F)
 - f. Fire alarm boxes are painted Green. T (F)
 - g. Safety is a personal responsibility. (T) F
 - h. Asbestos gloves are worn to protect you against corrosive chemicals. T (F)
 - i. In a laboratory try to keep a fire under control with available fire fighting equipment. (T) F
 - j. Ground wires must be attached when transferring solvent from one container to another. (T) F
7. Marshall laboratory must be evacuated when signals 12 and 13 are sounded.
8. Name the type of fire referred to by the following class codes.
- Class A Wood, paper textiles and rags
- Class B Flammable liquids
- Class C Electrical Fires
- Class D Metallic powder Fires
9. Indicate the Class of fires upon which the following fire extinguisher may be used.

UNIT SEVEN - Exercise 4
RULES - GENERAL PLANT AND SAFETY

- a. Water Class A
 - b. Foamite Class A & B
 - c. Carbon Dioxide Class B & C
 - d. Dry Chemical Class A, B & C
 - e. Met-L-X Class D
10. Indicate where the nearest safety equipment is located.
- a. Fire alarm 3rd floor west corridor
 - b. Class A Fire Extinguisher _____
 - c. CO₂ - Fire Extinguisher _____
 - d. Shower _____
11. What are the three things you should do in an emergency?
- a. Keep calm Get to safety
 - b. Send out alarms
 - c. Bring situation under control
12. How should you sound the alarm in the laboratory?
- a. Phone guards 222 or pull alarm box
13. What are the three precautions to be observed in preventing fires?
- a. Control flames or sparks
 - b. Safe handling and storage of flammables
 - c. Good Housekeeping
14. Give five rules for proper and safe operation of electrical equipment.
- a. Do not operate any electrical equipment of questionable condition.
 - b. Do not use any equipment not equipped with proper ground cord attached.

UNIT SEVEN - Exercise 4

RULES - GENERAL PLANT AND SAFETY

- c. Do not make connections between non mating plugs.
- d. Use only explosion proof equipment in hazardous areas
- e. Do not use equipment which gives a noticeable shock.

15. What are the safety rules for operating "47/48" Process Equipment, SUW and PLW Mill and Rejuvenators.

47/48 Process Equipment

- a. Make sure glass disks are tight and in good conditions
- b. Make sure all fastenings and adjustments are tight before starting unit.
- c. Keep hands away from chuck
- d. Low boiling or toxic solvents should be avoided.

SUW And PLW Mills

- a. Proper gaskets must be used and tightly secured.
- b. Damaged lids not to be used
- c. Lift mills close to body and lift using knees for leverage
- d. Lock out switch before adding or removing mills to rack
- e. Put mills on head to foot.

Rejuvenators

- a. Cans should be properly closed.
- b. Use adapters where necessary for small cans
- c. Lock out switch before opening gate
- d. Check for leaks before leaving rejuvenator

16. Name the types of oxidizing agents which are used in the Laboratory.
Give one example of each.

- | | |
|------------------------------|------------------------------|
| a. <u>Peroxides</u> | 1. <u>Benzoyl peroxide</u> |
| b. <u>Metallic peroxides</u> | 1. <u>Sodium peroxide</u> |
| c. <u>solid oxidants</u> | 1. <u>Potassium chlorate</u> |
| d. <u>Liquid oxidants</u> | 1. <u>Perchloric acid</u> |
| e. <u>Volatile oxidants</u> | 1. <u>Chromic oxide</u> |

UNIT SEVEN - Exercise 4

RULES - GENERAL PLANT AND SAFETY

17. What precautions must be used in handling organic peroxides?

1. Store at low temperatures
2. Store limited quantities
3. Use protective equipment, especially eye protection
4. Work back of a shield
5. Keep away from organic material
6. Clean up spills immediately

18. Describe the hazards involved in Chlorinated hydrocarbons.

Symptoms of excessive exposure are

1. Headache
2. undue fatigue, excitement and nausea

CCL₄ produces cumulative effects on the liver. Keep from breathing vapors or skin absorption.

19. Describe the procedure for disposing broken glass.

Glass must be disposed in special containers provided for purpose.

20. Describe the procedure for disposing toxic or explosive waste material.

These must be packed in separate metal containers, tagged with a red tag (name of chemist and contents). The tag must also give specific disposal directions and delivered to store room for transfer to experimental station.

UNIT SEVEN - Exercise 4

RULES - GENERAL PLANT AND SAFETY

-
-
-
21. Colored diamond shaped diagrams on tanks indicate that they contain materials which are hazardous.
22. These are classed as.
1. Health
 2. Flammability
 3. Reactivity
 4. Special hazards.
23. The higher the number the more hazardous is the material.