

AE 469/569 - Exam 2

Multiple Choice: 2 pts each
One 8.5 x 11 sheet of notes allowed

Name KEY

- 1) When a load of corn is taken to an elevator a calculation of the number of bushels on the load is made. In this instance, a bushel is defined as
 - a) 56 lbs of corn.
 - b) a quantity of corn which will weigh 56 lbs at 15.5% MC.
 - c) the test weight (lbs/bu) as determined from a sample.
 - d) 1.25 cubic feet of corn.

- 2) The most common type of continuous-flow column dryer is
 - a) a counterflow dryer.
 - b) a concurrent flow dryer.
 - c) a crossflow dryer.
 - d) any of the above.
 - e) none of the above.

- 3) Which continuous-flow dryer type most often represents continuous-flow dryers in cylindrical bins?
 - a) counterflow
 - b) concurrent flow
 - c) crossflow
 - d) all three types are often found as bin dryers.

- 4) In a continuous cross flow dryer, heat required per pound of water evaporated
 - a) goes up as air temperature is increased
 - b) goes down as air temperature is increased
 - c) is independent of air temperature
 - d) at low airflows goes down as air temp is increased
 - e) at high airflows goes down as air temp is increased

- 5) Which of the continuous dryer types discharges grain with large temperature variations?
 - a) all
 - b) concurrent
 - c) counterflow
 - d) crossflow
 - e) none

- 6) Soybean hulls are removed before oil extraction because
- a) they're more valuable for use as a dietary supplement
 - b) they loosen and clog the system
 - c) they don't have enough oil to merit processing
 - d) it is a tradition in the industry
- 7) The solvent extraction process for soybean processing is generally
- a) counterflow.
 - b) concurrent flow.
 - c) counterflow followed by concurrent flow.
 - d) concurrent flow followed by counterflow.
- 8) The fineness modulus provides an estimate of
- a) average particle size
 - b) variability in particle size
 - c) energy required to reduce particle size
 - d) all of the above.
- 9) Which type of hammermill will exhibit the most uniform output?
- a) quarter screen
 - b) half screen
 - c) full screen
 - d) full screen + end screen
 - e) no screen
- 10) For a certain grain ground in a hammer mill, as hammer length increases,
- a) product uniformity should improve
 - b) product uniformity should worsen
 - c) there should be no effect on product uniformity
- 11) In the standard Tyler sieve series, the next larger sieve size
- a) has double the open area of the previous size.
 - b) has 1.414 times the open area of the previous size.
 - c) has wire diameters which are twice as large as the previous size.
 - d) has a larger open area, but the increase is in no fixed ratio to area of
 - e) previous size
- 12) In order of increasing density:
- a) gluten, starch, water
 - b) starch, gluten, water
 - c) water, gluten, starch
 - d) water, starch, gluten

13) Soybean oil is separated from hexane by a process which takes advantage of differences in this property:

- a) boiling point
- b) viscosity
- c) density
- d) conductivity

14) A spark within the rotocelextractor is not likely to cause an explosion because

- a) all the hexane here is liquid
- b) the hexane concentration in the air is too high
- c) the hexane concentration in the air is too low
- d) fire control equipment within the rotocelextractor would extinguish the spark before an explosion could occur.

15) Soybeans are cracked prior to flaking by use of a

- a) hammer mill
- b) burr mill
- c) roller mill
- d) aspirator

- (10) 16. Explain why hydrogenated vegetable oil often appears on the contents listing of foods now that all foods must list their grams of trans fats.

Hydrogenated vegetable oil has no trans fats, but it has some of the good properties of partially hydrogenated oils. Therefore, its use can result in a product with the properties of partially hydrogenated oils, without the trans fats.

(15) 17. A grain bin contains 5000 bu of corn at 24% moisture (1 bu = 56 lb at 15.5% moisture).

a) What is the total weight of this corn?

$$5000 \times 47.32 = 236,600$$

$$.24 = \frac{W}{236,600 + W}$$

$$.76W = .24(236,600) \quad 74,715$$

$$W =$$

$$\begin{array}{r} 236,600 \\ 74,715 \\ \hline 311,315 \text{ lb} \end{array}$$

b) How many lb of water must be removed to dry this bin of corn to 14% moisture?

$$.14 = \frac{W}{236,600 + W}$$

$$.86W = .14(236,600) \quad 74,715$$

$$W = 38,516$$

$$\begin{array}{r} 74,715 \\ - 38,516 \\ \hline 36,189 \end{array}$$

c) How many bushels of corn remain in the bin after drying to 14% moisture?

5000

$$\begin{array}{r} 236600 \\ 38516 \\ \hline 275,116 \end{array}$$

$$\frac{(275,116) \cdot .86}{47.32} = 4999.99 \text{ BU}$$

- (23) 18. A 20-degree troughed belt conveyor is needed to convey soybeans up a 6-degree slope for a distance (at slope) of 300 ft at a rate of 6000 bu/h. The conveyor is to be designed for a minimum investment. There are two speed reducers. Soybeans: 48 lb/ft³, 21 to 28 degree angle of repose.

a) What belt width and speed should be used?

$$6000 \frac{\text{BU}}{\text{h}} \cdot \frac{1.245 \text{ FT}^3}{\text{BU}} = 7470 \frac{\text{FT}^3}{\text{h}}$$

TRY 18" $(.128 \text{ FT}^2) (500) \left(\frac{60 \text{ MIN}}{\text{h}} \right) = 3840$
TOO SMALL

10 $\boxed{24"}$ $(.246) (700) (60) = 10,332$

$$\frac{10332}{700} = \frac{7470}{X}$$

$$W_M = \frac{(6000)(48)(1.245) \text{ LB MIN}^{-1}}{506 \text{ FT} \times 60 \text{ MIN}} = 11.8$$

$$X = \boxed{506 \frac{\text{FT}}{\text{MIN}}}$$

b) What hp is needed at the head pulley?

9 $T_e = (300) \left(.00068(11.8) + .05(4.5) + .58 \right) + 11.8 \left(.035(300) + 31.4 \right) + 225$
243.9 + 494.9 + 225 = 963.2

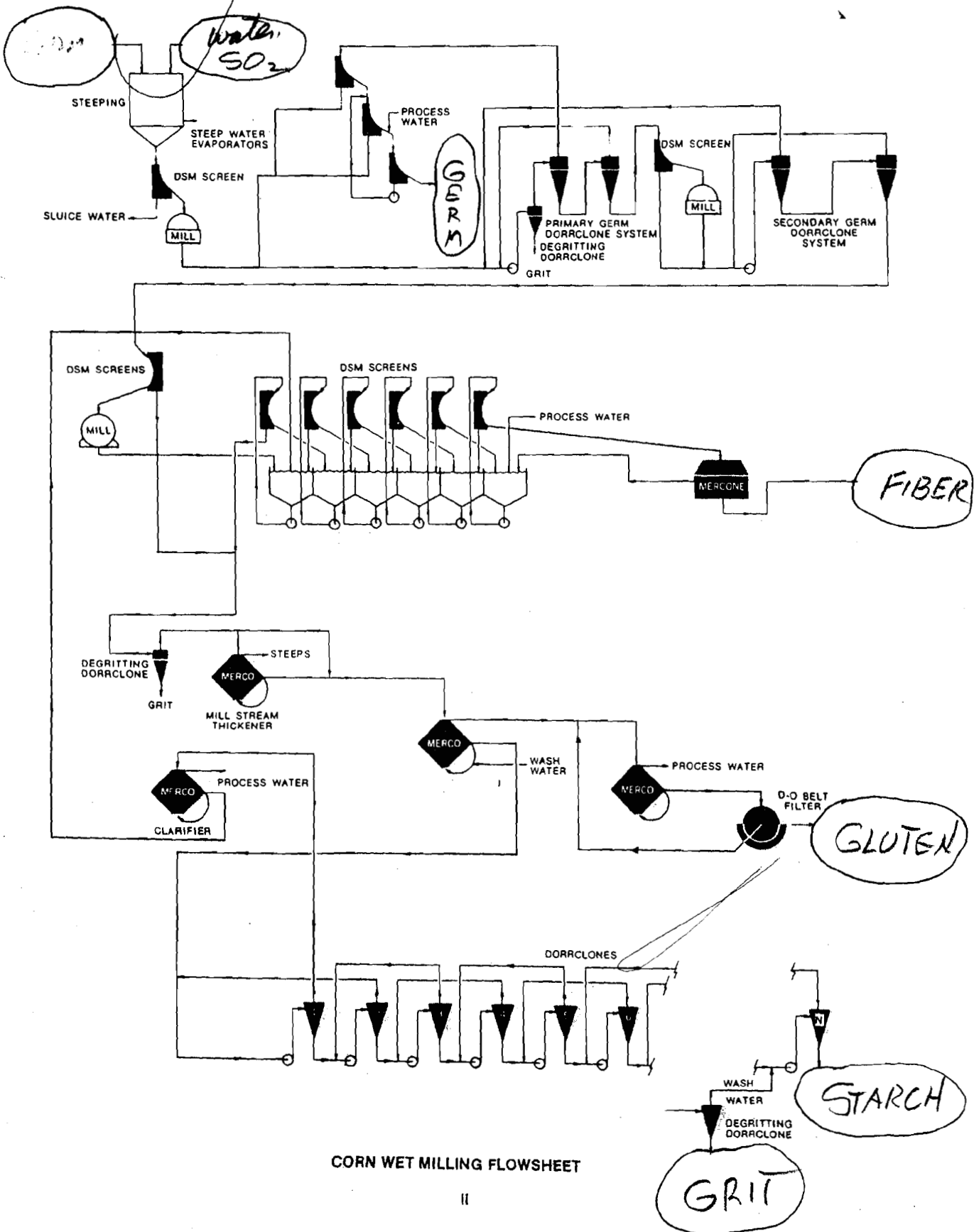
$$300 \sin 6 = 31.4 \text{ FT}$$

$$\text{hp} = \frac{(963.2)(506)}{33000} = \boxed{14.77 \text{ hp}}$$

c) What hp is needed from the motor?

$$\text{hp}_M = \frac{14.77}{(.93)(.93)} = \boxed{17.1 \text{ hp AT MOTOR}}$$

(12) 19. Write the name of the material in each oval.



CORN WET MILLING FLOWSHEET

(10) 20. What are the advantage and disadvantages of the dry grind process versus the wet milling process for production of ethanol?

A

Lower investment cost
Possible higher ethanol yield
Faster to build plant.

D

oil & protein sold
with DDG & at low costs
- Cannot use starch for
anything except
ethanol.

Table 12-4. Flowability - Angle of surcharge - Angle of Repose (CEMA) 1979.

<i>Very free flowing 1*</i>	<i>Free flowing 2*</i>	<i>Average flowing 3*</i>		<i>Sluggish 4*</i>
<i>5° Angle of surcharge</i>	<i>10° Angle of surcharge</i>	<i>20° Angle of surcharge</i>	<i>25° Angle of surcharge</i>	<i>30° Angle of surcharge</i>
<i>0°-19° Angle of repose</i>	<i>20°-29° Angle of repose</i>	<i>30°-34° Angle of repose</i>	<i>35°-39° Angle of repose</i>	<i>40°-up Angle of repose</i>
<i>Material characteristics</i>				
<i>Uniform size, very small rounded particle, either very wet or very dry, such as dry silica sand, cement, wet concrete, etc.</i>	<i>Rounded, dry polished particles, of medium weight, such as whole grain and beans.</i>	<i>Irregular, granular or lumpy materials of medium weight, such as anthracite coal, cottonseed meal, clay, etc.</i>	<i>Typical common materials such as bituminous coal, stone, most ores, etc.</i>	<i>Irregular, stringy, fibrous, interlocking material, such as wood chips, bagasse, tempered foundry sand, etc.</i>

*Code designations conform to bulk material characteristics chart, Table 3-2.

Recommended maximum belt speeds and belt weight for grain and other free-flowing, nonabrasive material (CEMA, 1979)

Belt width, in.	Max. belt speed, ft/min.	Approx. belt weight lb/ft #
18	500	3.5
24	700	4.5
30	700	6
36	800	9
42	800	11
48	1000	14
54	1000	16
60	1000	18
72	1000	21
84	1000	25
96	1000	30

Table 12-5. Load cross section and capacity for 20-degree troughed belt, three equal rolls (CEMA, 1979).

Belt Width (Inches)	A _r - Cross Section of Load (ft ²)							Capacity at 100 ft/min (ft ³ /h)						
	Surcharge Angle							Surcharge Angle						
	0°	5°	10°	15°	20°	25°	30°	0°	5°	10°	15°	20°	25°	30°
18	.089	.108	.128	.147	.167	.188	.209	537	653	769	886	1005	1128	1254
24	.173	.209	.246	.283	.320	.359	.399	1041	1258	1477	1698	1924	2155	2394
30	.284	.343	.402	.462	.522	.585	.649	1708	2060	2414	2772	3137	3511	3897
36	.423	.509	.596	.684	.774	.866	.960	2538	3057	3579	4107	4645	5196	5765
42	.588	.708	.828	.950	1.074	1.201	1.332	3533	4250	4972	5703	6447	7210	7997
48	.781	.940	1.099	1.260	1.424	1.592	1.765	4691	5640	6594	7560	8544	9552	10592
54	1.002	1.204	1.407	1.613	1.822	2.037	2.258	6013	7225	8444	9678	10935	12223	13552
60	1.249	1.501	1.753	2.009	2.270	2.537	2.812	7498	9006	10552	12057	13621	15223	16876
72	1.826	2.192	2.560	2.933	3.312	3.701	4.102	10961	13155	15364	17599	19876	22210	24617
84	2.513	3.014	3.519	4.030	4.551	5.085	5.635	15079	18089	21119	24186	27309	30511	33813
96	3.308	3.967	4.631	5.302	5.986	6.687	7.411	19850	23806	27787	31816	35921	40128	44466

Power requirement