

Practice Examination #2: Morning Session

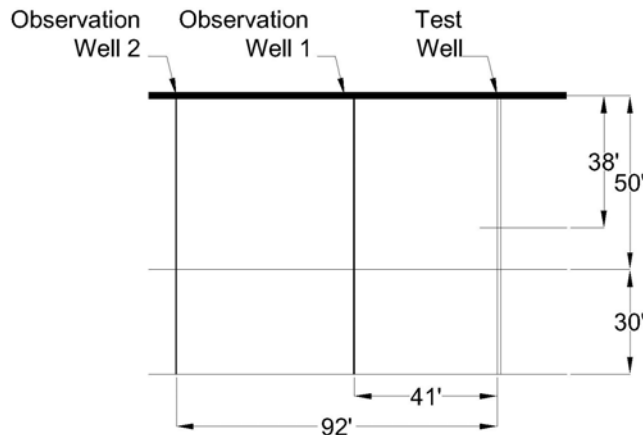
Soil and Water

101. A common rectangular weir with end contractions is used to measure the final effluent from a chlorine contact chamber for a beef processing plant in Nebraska. The weir is 0.8 meters wide and the average flow depth is 0.265 meters. The daily capacity in cubic meters of the weir is most nearly.
- a) 87,751
 - b) 17,520
 - c) 17,335
 - d) 16,180

102. A 1 ft diameter well is constructed into the confined aquifer shown below in the figure. The aquifer has a uniform thickness at 30 feet overlaid by an impermeable layer 50 feet deep. The initial piezometric surface is 38 feet below the ground surface datum of the test well and observation wells. After water was pumped for several days at $0.3 \text{ ft}^3/\text{s}$, the water levels stabilized at the following drawdowns:

Test Well	24 ft
Observation Well 1	16.1 ft
Observation Well 2	9.2 ft

The permeability (ft/s) of the aquifer is most nearly:



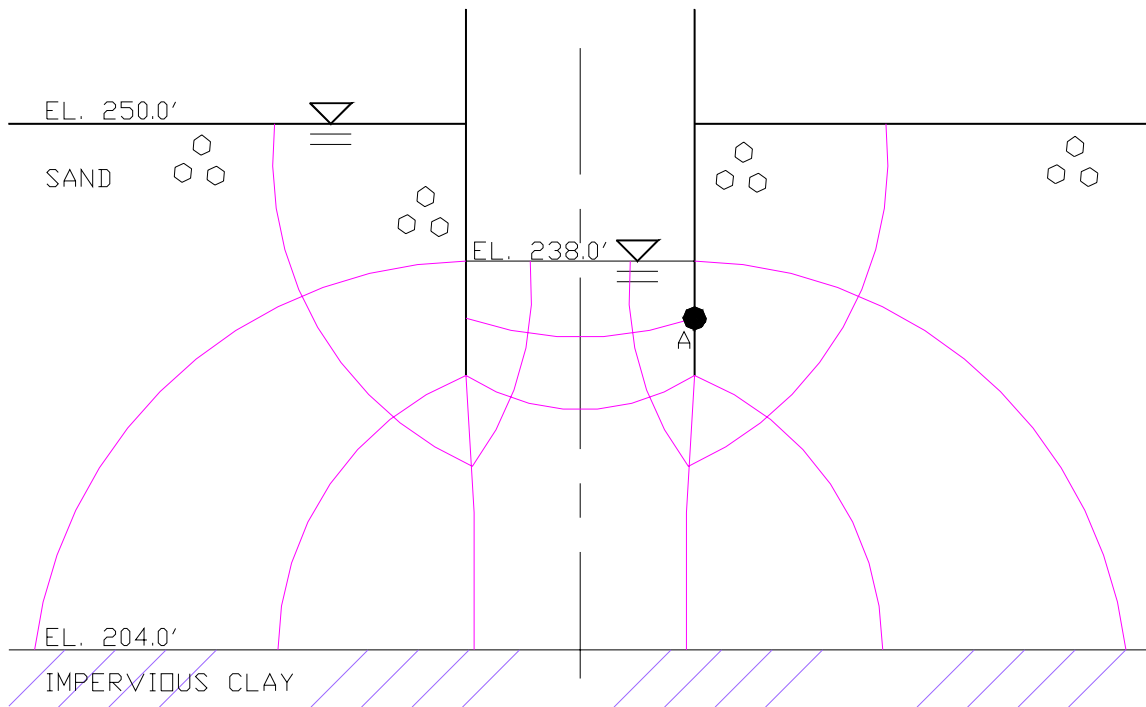
- a) 1.9×10^{-4}
- b) 2.6×10^{-4}
- c) 3.2×10^{-4}
- d) 4.4×10^{-4}

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103. A 10 foot wide rectangular channel is to be built to convey water. It will be placed on a 2% grade and will discharge into a natural earth channel. Design discharge is 300 cfs. If a stilling basin could be used to prevent erosion, it should be:

- a) Located at least 100 feet upstream of the end of the concrete channel
- b) Designed to slow down water velocity and trap sediment
- c) Constructed with a baffled outlet structure
- d) Designed to have the hydraulic jump occur within the basin

104. A cross-section of an excavation is as shown below. Two sheetpiles are used to support a 20' wide x 12' deep utility excavation in a sandy soil, characterized by a permeability of 0.1 ft./min., a void ratio of 0.5 and a specific gravity of 2.75. The bottoms of the sheetpiles are driven to a depth of 34' below the ground surface and the interior of the excavation is dewatered to an elevation of 238.0 ft.



The saturated unit weight in lbs/ft³ of the sandy soil is most nearly:

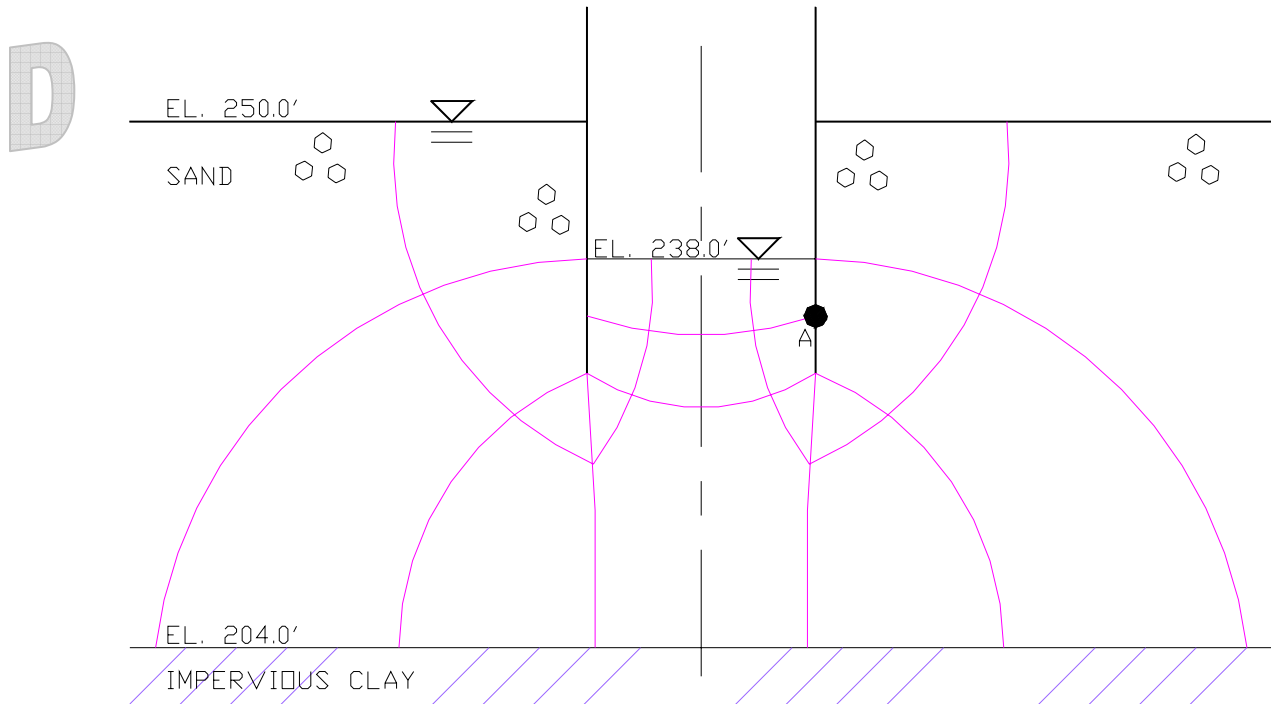
- a) 73.5
- b) 124.8
- c) 135.2

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d) 140.4

105. A cross-section of an excavation is as shown below. Two sheetpiles are used to support a 20' wide x 12' deep utility excavation in a sandy soil, characterized by a permeability of 0.1 ft./min., a void ratio of 0.5 and a specific gravity of 2.75. The bottoms of the sheetpiles are driven to a depth of 34' below the ground surface and the interior of the excavation is dewatered to an elevation of 238.0 ft.

The engineer in charge of the project has provided the following flow net for the excavation section to be evaluated:



When evaluated over a 100 foot length of excavation, the total inflow rate of water in ft^3/min into the foundation is approximately:

- a) 40
- b) 80
- c) 120
- d) 160

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106. The maximum liquid operating level in a waste storage pond is elevation 1212.0 feet. The bottom of the waste storage pond is at elevation 1200.0 feet and has 4:1 sideslopes. The pond has a storage capacity of 1,000,000 gallons. A soil liner will be used to minimize seepage from the waste storage pond. The hydraulic conductivity of the soil liner material is 1.9×10^{-6} cm/s. The maximum allowable seepage rate is 0.25 inches/day. The thickness of the soil liner in inches, required in the bottom of the pond is most near:

- a) 128
- b) 37
- c) 50
- d) 4

107. Which of the following statements is NOT true for installation of thrust blocking on irrigation piping with rubber gasket joints?

- a) Thrust blocking is required where the pipe changes size.
- b) Thrust blocking is required where the pipe changes slope.
- c) Thrust blocking is required where there is an “in-line” valve.
- d) Thrust blocking is required at the end of the pipeline.

Power and Machinery

108. What width of field cultivator is needed to cover 1000 acres in two weeks with a probability of a working day of 30%? Only 10 hours per day can be devoted to this operation and the speed and field efficiency are typical.

- a) 30
- b) 35
- c) 40
- d) 45

109. The drawbar power to pull an 8 shank chisel plow with 10 cm twisted shovels at a typical speed of 8 km/h in medium textured soil at a depth of 20 cm would most nearly be?

- a) 25
- b) 35
- c) 45
- d) 55

110. Consider a tractor having a 270 cm wheel base and static (no load) front and rear axle weights of 50 kN and 25 kN, respectively. This tractor has a hitch point 60 cm behind the rear axle and 50 cm above ground level. How much load will be on the front axle if there is a horizontal load on the hitch of 35 kN?

- a) 17
- b) 18
- c) 19

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d) 20

111. What is the PTO power requirement for a pull-type forage harvester moving at typical speed in wilted alfalfa? The mower-conditioner cut width was 14 feet per swath and the yield was 3 tons of dry matter per acre. The silage is being harvested at 65% moisture (35% dry matter) with a 0.35 inch theoretical length of cut.

a) 75
b) 80
c) 100
d) 110

112. Estimate total fuel required in gallons to plant 1000 acres using a 30 ft wide row-crop planter requiring an average 100 hp at the drawbar in tilled soil? The tractor used has MFWD (mechanical front wheel drive) and an engine with 190 hp net engine power. Assume typical field efficiency and speed.

a) 600
b) 700
c) 800
d) 900

113. What minimal material yield strength in MPa is needed for a 4 cm diameter power transmission shaft transmitting 20 kW at 1000 rpm if the condition is heavy shock and a factor of safety of 2.0 is applied? The shaft has a coupler at each end so bending moment is negligible.

a) 190
b) 210
c) 382
d) 570

114. If a $\frac{3}{4}$ " diameter grade 8 bolt is used as a hitch pin in double shear, what is the maximum permissible static horizontal load in pounds if a shock factor of 3.0 is assumed for dynamic loading.

a) 3300
b) 4400
c) 6623
d) 9750

Processing / Handling of Biological Products

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115. Air at 70°F and 50% relative humidity is being moved up through a bed of wet granular material. The material is wet enough and the bed is deep enough so that the air reaches saturation before it leaves the bed. At what temperature (°F) does the air leave the bed?

- a) 50
- b) 105
- c) 58.5
- d) 70

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116. Air at 20°C and 60% relative humidity is being moved through a bin of corn which has a moisture content 21% wet basis. What moisture (%) will the corn come to?

- a) 6
- b) 21
- c) 15.5
- d) 13

117. Which of the following would be the most important consideration as it relates to handling characteristics of manure?

- a) Btu/lb
- b) micro-nutrient concentration
- c) solids content
- d) organic matter

118. Principles of Unit Operations

119. Standards, codes, and regulations

Structures and Environment

120. In a structural member, inflection points will be located where:

- a) the internal moment becomes zero
- b) external loads are applied
- c) the properties on the member changes
- d) force vectors intersect

121. In a building load analysis, structural members are considered to be:

- a) live loads

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- b) occupancy loads
 - c) non-loads (weight of members ignored)
 - d) dead loads
122. The design wind pressure on a building would be greater:
- a) immediately adjacent to a shelterbelt than in an open field
 - b) near the ground compared to the top of a 40 ft silo
 - c) in a coastal region than in an interior USA location
 - d) in the middle of a city compared to open country
123. The most important factor influencing design (compressive) strength concrete is:
- a) temperature of water
 - b) size of aggregate
 - c) water to cement ratio
 - d) mixing time
124. What would be the best selection for a building to house 2000 finishing pigs?
- a) 120 ft x 133 ft with 20 pens
 - b) 50 ft x 400 ft with 50 pens
 - c) 40 ft x 200 ft with 100 pens
 - d) 80 ft x 500 ft with 80 pens
125. The problem of condensation on interior wall surfaces can be reduced by:
- a) adding insulation to the wall
 - b) increasing air flow across the wall
 - c) increasing the air temperature
 - d) all of the above
126. In a cold climate such as North Dakota, it is recommended that a vapor barrier be installed near the:
- a) inside (warm) surface
 - b) outside (cold) surface
 - c) middle of the wall
 - d) not recommended
127. The ventilation capacity in cubic feet per minute for a room holding 200 nursery pig should be at least:

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- a) 600
- b) 35
- c) 15,000
- d) 7,000

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Biological Systems

128. Principles of Ergonomics suggest that when designing a workstation, the most appropriate goal is to:

- a) maximize the productivity of the worker assigned to the workstation.
- b) ensure that an mean worker is physically capable of completing the task(s).
- c) ensure that a minimum number of tools are needed complete the task(s).
- d) ensure that the maximum number of workers are physically capable of completing the task(s).

129. Atmospheric concentration of pollutant X in the atmosphere is measured at 0.3 ng/m^3 . What is most nearly the mass in kilograms of the pollutant in the atmosphere? Assume a mixed air boundary layer of 3,000 m and the radius of the earth is 6.3×10^6 meters.

- a) 4.5×10^6
- b) 1.5×10^5
- c) 4.6×10^9
- d) 5.0×10^9

130. Biological Systems/Biological Processes

131. Principle of Organic and Biochemistry

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Agricultural Engineering Principles

132. A blast freezer is being used for freezing of bread doughs (35% water, 9% protein, 4% fat, 51% carbohydrate and 1% ash). Air at a temperature of -20°F and a velocity of approximately 10 ft/s moves around the doughs which rest, single file, side-to-side on a belted conveyor. Bread doughs entering the freezer are essentially cylindrical in shape with a length of 8 inches, a diameter of 2.5 inches and an initial temperature of 90°F .

Freezing time is approximately 1.5 hour for a dough. Assuming an enthalpy decrease of 100 Btu/dough during the entire freezing and cooling process, and a spacing of doughs 2.5 inches apart on a 250 foot conveyor in a freezer, average rate of heat removal (Btu/hr) in the freezer is most nearly:

- a) 3.3×10^3
 - b) 1.9×10^4
 - c) 4.0×10^4
 - d) 8.0×10^4
133. Core Knowledge
134. Core Knowledge
135. Equipment Applications, pumps, fans, sensors
136. Equipment Applications, pumps, fans, sensors
137. Equipment Applications, pumps, fans, sensors
138. Equipment Applications, pumps, fans, sensors
139. Equipment Applications, pumps, fans, sensors
140. Professional Practice