Board Exam Desk

Agricultural and Biosystems Engineering Reviewer

Agricultural and Biosystems Engineering Licensure Examination | PRC | 120 original questions

2026 Edition | Updated November 2026

Original board-style practice questions with an answer key.

Practice questions

Agricultural and Biosystems Power and Machinery Engineering

1. A rotary tiller with a working width of 2.4 m operates at 6 km/h with a field efficiency of 80%. What is its effective field capacity?

A. 1.80 ha/h
B. 11.52 ha/h
C. 1.15 ha/h
D. 1.44 ha/h

2. A tractor pulls an implement with a steady drawbar pull of 12 kN at a forward speed of 5.4 km/h. What is the drawbar power?

A. 13.4 kW
B. 8.0 kW
C. 64.8 kW
D. 18.0 kW

3. A PTO shaft delivers a torque of 450 N·m at the standard speed of 540 rpm. What power is transmitted?

A. 25.45 kW
B. 4.05 kW
C. 34.11 kW
D. 243.00 kW

4. Corn is to be planted at 0.75 m between rows and 0.25 m between hills, two seeds per hill. If 1,000 seeds weigh 300 g, how many kilograms of seed are needed per hectare (no allowance for losses)?

A. 48.0 kg/ha
B. 60.0 kg/ha
C. 32.0 kg/ha
D. 16.0 kg/ha

5. A boom sprayer has 12 nozzles spaced 0.5 m apart, each discharging 0.8 L/min, and travels at 4 km/h. What is the application rate?

A. 240 L/ha
B. 20 L/ha
C. 120 L/ha
D. 360 L/ha

6. In a slip test, the drive wheels of a tractor cover 100 m in 20 revolutions with no load, but only 85 m in 20 revolutions while pulling a plow. What is the wheel slip?

A. 85.0%
B. 15.0%
C. 17.6%
D. 1.5%

7. A four-cylinder engine has a bore of 100 mm and a stroke of 120 mm. What is its total piston displacement?

A. 4.80 L
B. 0.94 L
C. 3.77 L
D. 15.08 L

8. A diesel engine develops 30 kW brake power while consuming 9 L/h of fuel (density 0.84 kg/L, heating value 45 MJ/kg). What is its brake thermal efficiency?

A. 68.3%
B. 37.8%
C. 26.7%
D. 31.7%

9. An engine burns 9 L/h of diesel (density 0.84 kg/L) while producing 30 kW brake power. What is its brake specific fuel consumption?

A. 0.300 kg/kW·h
B. 0.188 kg/kW·h
C. 0.252 kg/kW·h
D. 3.968 kg/kW·h

10. In a four-stroke diesel engine, how is the fuel-air mixture ignited?

A. By a glow plug that stays on during operation
B. By the heat of air compressed to a high temperature
C. By a spark plug firing near top dead center
D. By a magneto supplying a timed high-voltage pulse

11. Which of the following implements is classified as secondary tillage equipment?

A. Moldboard plow
B. Spike-tooth harrow
C. Chisel plow
D. Subsoiler

12. A 150 mm motor pulley turning at 1,800 rpm drives a 450 mm pulley on a grain cleaner by a V-belt. Neglecting slip, what is the speed of the driven pulley?

A. 5,400 rpm
B. 1,200 rpm
C. 1,500 rpm
D. 600 rpm

13. An 18-tooth pinion carrying 50 N·m drives a 54-tooth gear. Neglecting friction losses, what torque is available at the gear shaft?

A. 16.7 N·m
B. 300 N·m
C. 150 N·m
D. 86 N·m

14. A three-bottom moldboard plow, each bottom cutting 0.30 m wide, works at a depth of 0.20 m in soil with a unit draft of 50 kN/m². What is the plow draft?

A. 90.0 kN
B. 45.0 kN
C. 3.0 kN
D. 9.0 kN

15. Adding ballast weight to the drive wheels of a tractor mainly serves to

A. reduce wheel slip and improve traction
B. lower the rolling resistance on soft soil
C. increase the forward speed in each gear
D. raise the engine's rated power output

16. A hydraulic cylinder with an 80 mm bore operates at a system pressure of 16 MPa. What is the theoretical extending force?

A. 321.7 kN
B. 128.0 kN
C. 80.4 kN
D. 102.4 kN

17. In an axial-flow rice thresher, how does the crop material move relative to the threshing cylinder?

A. It passes once across the cylinder at right angles
B. It moves spirally along the length of the cylinder axis
C. It is held stationary while the drum rubs it
D. It drops vertically through a pair of rollers

18. A four-stroke, four-cylinder engine (bore 100 mm, stroke 120 mm) runs at 2,000 rpm with an indicated mean effective pressure of 800 kPa. What is the indicated power?

A. 12.6 kW
B. 157.9 kW
C. 100.5 kW
D. 50.3 kW

19. An engine has an indicated power of 50 kW and a brake power of 40 kW. What is its mechanical efficiency?

A. 20%
B. 125%
C. 80%
D. 90%

20. A 4-ha field is harrowed with a 3 m implement at 5 km/h, and the job takes 3.5 hours in total. What is the field efficiency?

A. 68.6%
B. 131.2%
C. 23.8%
D. 76.2%

21. A four-wheel tractor costs PHP 1,200,000, has a salvage value of 10% of its purchase price and a service life of 10 years. What is the annual straight-line depreciation?

A. PHP 96,000
B. PHP 108,000
C. PHP 132,000
D. PHP 120,000

22. A tractor uses 6 L of fuel per hour while plowing at an effective field capacity of 0.8 ha/h. With diesel at PHP 60/L, what is the fuel cost per hectare?

A. PHP 360
B. PHP 75
C. PHP 288
D. PHP 450

23. For the same tractor, which power rating is normally the lowest?

A. Indicated power
B. PTO power
C. Drawbar power
D. Engine brake power

24. A standard three-point hitch connects the implement to the tractor through

A. one lower link and two upper links
B. a single drawbar pin and a safety chain
C. two lower links and one upper (top) link
D. three parallel lower links of equal length

25. A wind turbine with a 4 m rotor diameter faces a 6 m/s wind (air density 1.2 kg/m³) and has a power coefficient of 0.35. What power does the rotor extract?

A. 95 W
B. 1,629 W
C. 2,280 W
D. 570 W

26. A flat-plate solar collector of 2 m² receives an irradiance of 800 W/m² and delivers 640 W of useful heat to the water. What is the collector efficiency?

A. 50%
B. 80%
C. 32%
D. 40%

27. What is the main purpose of fitting steel cage wheels to a hand tractor for lowland rice land preparation?

A. To gain traction and avoid sinking in puddled soil
B. To raise travel speed on farm roads
C. To reduce engine fuel consumption on dry land
D. To level the field after harrowing

28. An electric motor driving a rice mill delivers 5 kW at the shaft with an efficiency of 85%. What electrical power does it draw?

A. 5.75 kW
B. 6.70 kW
C. 4.25 kW
D. 5.88 kW

29. An engine cylinder has a swept volume of 900 cm³ and a clearance volume of 60 cm³. What is the compression ratio?

A. 16
B. 1.067
C. 15
D. 0.0625

30. A tractor engine produces a maximum torque of 320 N·m and a torque of 260 N·m at rated speed. What is its torque reserve (torque backup)?

A. 23.1%
B. 18.8%
C. 81.2%
D. 123.1%

Agricultural and Biosystems Structures and Environment Engineering

31. A naturally cooled poultry house must remove 12 kW of sensible heat while keeping inside air no more than 4 °C above outside. Using air density 1.2 kg/m³ and cp 1.006 kJ/kg·K, what ventilation rate is required?

A. 2.49 m³/s
B. 3.58 m³/s
C. 9.94 m³/s
D. 2.98 m³/s

32. A barn wall of 50 m² has an overall heat transfer coefficient of 2.5 W/m²·K. With a 10 °C indoor-outdoor temperature difference, what is the conduction heat flow?

A. 125 W
B. 12,500 W
C. 1,250 W
D. 200 W

33. A wall consists of 200 mm of masonry (k = 1.0 W/m·K) and 50 mm of insulation (k = 0.04 W/m·K). Inside and outside surface resistances are 0.12 and 0.04 m²·K/W. What is the overall U-value?

A. 0.621 W/m²·K
B. 2.439 W/m²·K
C. 0.690 W/m²·K
D. 1.610 W/m²·K

34. The dew point temperature of moist air is the temperature at which

A. a wetted thermometer stops falling in an air stream
B. the air becomes saturated when cooled at constant humidity ratio
C. the air holds its maximum enthalpy at a given pressure
D. relative humidity equals half its saturation value

35. Moist air at standard atmospheric pressure (101.325 kPa) has a water vapor partial pressure of 2.0 kPa. What is its humidity ratio?

A. 0.0123 kg/kg dry air
B. 0.0125 kg/kg dry air
C. 0.0197 kg/kg dry air
D. 0.0063 kg/kg dry air

36. Air in a greenhouse at 30 °C has a vapor pressure of 2.0 kPa. If the saturation vapor pressure at 30 °C is 4.247 kPa, what is the relative humidity?

A. 55.4%
B. 21.2%
C. 47.1%
D. 52.9%

37. A simply supported timber purlin spans 4 m and carries a uniformly distributed load of 3 kN/m including self-weight. What is the maximum bending moment?

A. 24.0 kN·m
B. 12.0 kN·m
C. 4.0 kN·m
D. 6.0 kN·m

38. A rectangular timber beam 100 mm wide and 200 mm deep resists a bending moment of 6 kN·m about its strong axis. What is the maximum bending stress?

A. 18.0 MPa
B. 90.0 MPa
C. 6.0 MPa
D. 9.0 MPa

39. A 100 mm × 100 mm timber post, 3 m long with both ends pinned, has E = 10 GPa. What is its Euler critical buckling load?

A. 9.3 kN
B. 91.4 kN
C. 22.8 kN
D. 365.5 kN

40. A cylindrical steel bin 4 m in diameter is filled with palay to a level depth of 5 m. Taking the bulk density as 580 kg/m³, about how many tonnes does the bin hold?

A. 46.4 t
B. 145.8 t
C. 36.4 t
D. 12.1 t

41. Grain with an angle of internal friction of 30° and a unit weight of 8 kN/m³ is stored in a shallow bin. Using Rankine's theory, what is the lateral pressure on the wall 3 m below the grain surface?

A. 8.0 kPa
B. 24.0 kPa
C. 12.0 kPa
D. 72.0 kPa

42. Greenhouses warm up in sunlight mainly because the glazing

A. reflects incoming infrared back onto the crop canopy
B. transmits short-wave solar radiation but blocks long-wave re-radiation
C. absorbs most visible light and re-emits it as heat
D. stops all convection between inside and outside air

43. An evaporative cooling pad with 80% saturation efficiency treats outside air at 34 °C dry bulb and 26 °C wet bulb. What is the dry-bulb temperature of the air leaving the pad?

A. 26.0 °C
B. 27.2 °C
C. 32.4 °C
D. 27.6 °C

44. In the Philippines, the long axis of an open-sided animal house is usually oriented east-west in order to

A. let rainwater drain toward the west
B. maximize morning sun on the feeding area
C. minimize direct sunlight striking the long walls and the animals
D. align the roof ridge with typhoon tracks

45. A farm shed has 12 isolated square footings, each 1.2 m × 1.2 m and 0.30 m thick. What is the total volume of concrete needed for the footings?

A. 0.432 m³
B. 5.184 m³
C. 7.776 m³
D. 4.320 m³

46. For concrete made with the same materials and properly cured, increasing the water-cement ratio generally

A. shortens the curing period needed
B. has no effect on strength, only on color
C. lowers the compressive strength of the hardened concrete
D. raises the compressive strength of the hardened concrete

47. A 16 mm diameter steel tie rod in a roof truss carries an axial tensile force of 30 kN. What is the normal stress in the rod?

A. 298.4 MPa
B. 37.3 MPa
C. 0.6 MPa
D. 149.2 MPa

48. A 100 mm × 200 mm rectangular beam spanning 4 m carries a uniform load of 3 kN/m. What is the maximum shear stress at the support section?

A. 0.45 MPa
B. 0.30 MPa
C. 0.90 MPa
D. 0.60 MPa

49. A 20 m × 10 m feed mill floor needs an average illuminance of 200 lux. Each lamp emits 3,000 lumens; coefficient of utilization is 0.6 and maintenance factor 0.8. How many lamps are needed?

A. 28 lamps
B. 7 lamps
C. 23 lamps
D. 14 lamps

50. A single-phase 230 V water heater-and-fan load draws 2.2 kW at a power factor of 0.9. What current does it take?

A. 10.63 A
B. 9.57 A
C. 6.14 A
D. 8.61 A

51. Animals in a closed barn release 5 kg of water vapor per hour. Inside air is to be held at a humidity ratio of 0.016 kg/kg while outside air has 0.012 kg/kg. What mass flow of dry air must be ventilated?

A. 1,250 kg/h
B. 417 kg/h
C. 179 kg/h
D. 312 kg/h

52. As ambient temperature rises toward body temperature, how does the heat loss of livestock change?

A. Heat is lost mainly by conduction to the air
B. A larger share of heat is lost as latent heat by evaporation
C. Sensible heat loss increases while latent loss stops
D. Total heat production drops to zero

53. Moist air is at 30 °C dry bulb with a humidity ratio of 0.015 kg/kg dry air. Using h = 1.006t + W(2501 + 1.86t), what is its specific enthalpy?

A. 68.5 kJ/kg dry air
B. 30.2 kJ/kg dry air
C. 67.7 kJ/kg dry air
D. 76.2 kJ/kg dry air

54. In a king-post roof truss, the king post is the member that

A. braces the rafter diagonally to the wall
B. runs vertically from the apex down to the tie beam
C. runs horizontally between the two wall plates
D. forms the sloping top chord from eave to ridge

55. A piggery of 200 finishers produces 5 L of manure and wash water per head per day. What storage volume is needed to hold 90 days of production?

A. 900 m^3
B. 45 m^3
C. 30 m^3
D. 90 m^3

56. A biogas digester has a working volume of 12 m^3 and receives 0.4 m^3 of slurry per day. What is the hydraulic retention time?

A. 3 days
B. 30 days
C. 4.8 days
D. 48 days

57. The combustible gas that makes up the largest share of biogas from anaerobic digestion is

A. ammonia
B. carbon monoxide
C. hydrogen sulfide
D. methane

58. A simply supported 100 mm × 200 mm timber beam (E = 10 GPa) spans 4 m and carries 3 kN/m uniformly. What is its midspan deflection?

A. 120.0 mm
B. 15.0 mm
C. 24.0 mm
D. 3.7 mm

59. In an insulated cold-storage wall in a humid climate, the vapor retarder should be placed

A. on the warm (outer) side of the insulation
B. in the middle of the insulation layer
C. only on the floor slab
D. on the cold (inner) side of the insulation

60. A column carries a service load of 180 kN onto soil with an allowable bearing pressure of 150 kPa. Neglecting footing weight, what minimum side length is needed for a square footing?

A. 1.20 m
B. 0.60 m
C. 1.10 m
D. 0.91 m

Land and Water Resources Engineering

61. A 30-ha watershed has a runoff coefficient of 0.4. For a design rainfall intensity of 60 mm/h, what peak runoff rate does the rational method give?

A. 5.00 m³/s
B. 720 m³/s
C. 2.00 m³/s
D. 0.20 m³/s

62. Reference evapotranspiration is 5 mm/day and the crop coefficient at mid-season is 1.1. What is the crop evapotranspiration?

A. 5.5 mm/day
B. 6.1 mm/day
C. 4.5 mm/day
D. 4.0 mm/day

63. A loam soil has a field capacity of 30% and a permanent wilting point of 15% (both by volume). With a 0.6 m root zone and 50% allowable depletion, what is the net irrigation depth?

A. 90 mm
B. 45 mm
C. 75 mm
D. 4.5 mm

64. A crop uses 5.5 mm/day and the net irrigation depth per application is 45 mm. What is the longest irrigation interval that avoids exceeding the allowable depletion, in whole days?

A. 6 days
B. 8 days
C. 9 days
D. 12 days

65. A net irrigation depth of 45 mm is to be applied by a surface method with 75% application efficiency. What gross depth must be delivered?

A. 60 mm
B. 34 mm
C. 75 mm
D. 56 mm

66. A pump lifts 20 L/s against a total dynamic head of 25 m with a pump efficiency of 70%. What brake power is required at the pump shaft?

A. 9.40 kW
B. 3.43 kW
C. 4.91 kW
D. 7.01 kW

67. A rectangular concrete-lined canal is 2 m wide with water 1 m deep, a bed slope of 0.0004 and Manning's n of 0.025. What is the discharge?

A. 1.60 m³/s
B. 1.22 m³/s
C. 1.01 m³/s
D. 0.50 m³/s

68. Water flows at 1.5 m/s in a 150 mm diameter irrigation pipeline. What is the discharge?

A. 106.0 L/s
B. 22.5 L/s
C. 17.7 L/s
D. 26.5 L/s

69. A 500 m long, 150 mm diameter pipe carries water at 1.5 m/s. With a Darcy friction factor of 0.02, what is the friction head loss?

A. 5.10 m
B. 7.65 m
C. 15.29 m
D. 1.15 m

70. During a long rain on initially dry soil, the infiltration rate typically

A. decreases with time toward a nearly constant basic rate
B. rises and falls in cycles with rainfall intensity
C. stays constant from the start of the rain
D. increases steadily until runoff begins

71. Using the Universal Soil Loss Equation with R = 500, K = 0.3, LS = 1.2, C = 0.2 and P = 0.5 (units consistent with t/ha/yr), what is the predicted average annual soil loss?

A. 180 t/ha/yr
B. 36 t/ha/yr
C. 90 t/ha/yr
D. 18 t/ha/yr

72. In the Universal Soil Loss Equation, the benefit of contour farming or strip cropping is represented by the

A. support practice factor P
B. soil erodibility factor K
C. rainfall erosivity factor R
D. cover-management factor C

73. Bench terraces are to be built on a uniform 20% land slope with a vertical interval of 1.0 m between terraces. What is the horizontal spacing between terrace risers on the original slope?

A. 4.0 m
B. 0.2 m
C. 20.0 m
D. 5.0 m

74. A sharp-crested rectangular weir without end contractions is 1.5 m long and the head over the crest is 0.30 m. Using Q = 1.84LH^1.5 (SI), what is the discharge?

A. 0.136 m^3/s
B. 0.828 m^3/s
C. 0.454 m^3/s
D. 1.014 m^3/s

75. An aquifer has a hydraulic conductivity of 20 m/day. Under a hydraulic gradient of 0.005, how much water flows through a cross-section of 100 m^2 per day?

A. 4,000 m^3/day
B. 10 m^3/day
C. 2,000 m^3/day
D. 0.1 m^3/day

76. Three rain gauges record 40, 55 and 70 mm, and their Thiessen polygon areas are 20, 50 and 30 km^2 respectively. What is the Thiessen-weighted mean rainfall?

A. 56.5 mm
B. 55.0 mm
C. 165.0 mm
D. 53.5 mm

77. A storm of 100 mm falls on a watershed with an SCS curve number of 80. Using S = 25400/CN − 254 (mm) and Ia = 0.2S, what is the direct runoff depth?

A. 61.2 mm
B. 46.6 mm
C. 50.5 mm
D. 87.3 mm

78. Each mango seedling needs 12 L of water per day and is served by two drip emitters rated 4 L/h each. How long should the system run daily?

A. 0.67 h
B. 6.0 h
C. 1.5 h
D. 3.0 h

79. Sprinklers discharging 0.5 L/s each are spaced 12 m along the lateral and 18 m between laterals. What is the average application rate?

A. 6.00 mm/h
B. 8.33 mm/h
C. 1.39 mm/h
D. 12.50 mm/h

80. Five catch cans in a sprinkler test collect 10, 12, 8, 11 and 9 mm. What is the Christiansen uniformity coefficient?

A. 80%
B. 12%
C. 94%
D. 88%

81. The USDA soil textural triangle classifies a soil according to its

A. organic matter, pH and salinity
B. bulk density, porosity and color
C. field capacity, wilting point and infiltration
D. percentages of sand, silt and clay

82. Field capacity is best described as the soil water content

A. remaining after free drainage of gravitational water has largely stopped
B. measured after oven drying at 105 °C
C. when every soil pore is filled with water
D. at which plants wilt and fail to recover overnight

83. A soil sample has a bulk density of 1.33 g/cm³ and a particle density of 2.65 g/cm³. What is its total porosity?

A. 50.2%
B. 66.2%
C. 49.8%
D. 13.2%

84. A soil with a bulk density of 1.4 g/cm³ has a gravimetric water content of 25%. What is its volumetric water content (water density 1.0 g/cm³)?

A. 35%
B. 17.9%
C. 25%
D. 39%

85. A well fully penetrates a confined aquifer 20 m thick with K = 15 m/day. At steady pumping, observation wells 10 m and 100 m away differ in head by 1.5 m. What is the pumping rate (Thiem equation)?

A. 1,228 m^3/day
B. 628 m^3/day
C. 614 m^3/day
D. 2,827 m^3/day

86. A farm pond must supply a 3-ha vegetable plot with 80 mm gross irrigation depth. If seepage and evaporation will consume 20% of the stored water, what minimum storage capacity is needed?

A. 3,000 m^3
B. 1,920 m^3
C. 2,880 m^3
D. 2,400 m^3

87. The main purpose of installing subsurface drains in a waterlogged field is to

A. raise soil temperature during planting
B. lower the water table below the crop root zone
C. carry surface runoff from upland areas
D. store rainfall for later irrigation

88. Water flows in an open channel at a depth of 0.8 m with a mean velocity of 2 m/s. What is the specific energy?

A. 0.204 m
B. 0.902 m
C. 1.208 m
D. 1.004 m

89. Which irrigation method generally has the highest potential application efficiency when well designed and managed?

A. Wild flooding
B. Furrow irrigation
C. Drip irrigation
D. Basin flooding

90. In watershed hydrology, the time of concentration is the time required for

A. the soil to reach field capacity after a storm
B. the hydrograph to recede back to base flow
C. rainfall intensity to reach its peak value
D. runoff from the hydraulically most remote point to reach the outlet

Agricultural and Biosystems Processing, Food and Bioprocess Engineering

91. Palay has a moisture content of 20% wet basis. What is its moisture content on a dry basis?

A. 25.0%
B. 20.0%
C. 80.0%
D. 16.7%

92. 1,000 kg of palay is dried from 24% to 14% moisture (wet basis). How much water is removed?

A. 100.0 kg
B. 116.3 kg
C. 139.5 kg
D. 131.6 kg

93. A milling test on 1,000 kg of palay yields 650 kg of milled rice, of which 520 kg are head rice. What is the head rice recovery based on palay?

A. 65%
B. 13%
C. 52%
D. 80%

94. A grain dryer heats 2 m³/s of air (density 1.15 kg/m³, cp 1.006 kJ/kg·K) from 30 °C to 45 °C. What is the heating rate?

A. 34.7 kW
B. 104.1 kW
C. 30.2 kW
D. 124.9 kW

95. The equilibrium moisture content of a grain is the moisture content at which it

A. is completely free of bound water
B. neither gains nor loses moisture in air of a given temperature and humidity
C. can be milled with the highest head rice yield
D. begins to germinate during storage

96. A centrifugal dryer fan draws 2.0 kW at 1,000 rpm. If its speed is raised to 1,200 rpm in the same system, what power will it draw according to the fan laws?

A. 2.40 kW
B. 4.15 kW
C. 3.46 kW
D. 2.88 kW

97. A bucket elevator has 1.5 L buckets spaced 0.30 m apart on a belt moving at 1.5 m/s. Buckets fill to 75% with grain of bulk density 600 kg/m³. What is the capacity?

A. 24.30 t/h
B. 3.65 t/h
C. 12.15 t/h
D. 16.20 t/h

98. A canned low-acid food requires a 12-log reduction of a target spore whose D-value at the process temperature is 0.25 min. What process time is required at that temperature?

A. 12.0 min
B. 3.0 min
C. 0.25 min
D. 48.0 min

99. A spore has a D-value of 2.5 min at 110 °C and a z-value of 10 °C. What is its D-value at 120 °C?

A. 0.25 min
B. 25.0 min
C. 2.27 min
D. 1.25 min

100. 2,000 kg of fresh vegetables (cp 3.8 kJ/kg·K) must be cooled from 30 °C to 10 °C in 10 hours. What is the average product cooling load?

A. 1.20 kW
B. 253.3 kW
C. 4.22 kW
D. 6.33 kW

101. Which size-reduction law states that the energy required is proportional to the new surface area created?

A. Bond's law
B. Kick's law
C. Rittinger's law
D. Stokes' law

102. Corn with a Bond work index of 12 kWh/t is ground from a feed size (80% passing) of 2,000 μm to a product size of 500 μm. Using Bond's law, what specific energy is required?

A. 5.37 kWh/t
B. 18.00 kWh/t
C. 0.268 kWh/t
D. 2.68 kWh/t

103. Which dryer commonly used for palay in the Philippines is a batch, fixed-bed type in which heated air is forced upward through a stationary grain layer?

A. Continuous-flow mixing dryer
B. Flat-bed dryer
C. Rotary drum dryer
D. Spray dryer

104. A rubber-roll husker removes the hull from palay mainly by

A. shearing between two rolls turning at different peripheral speeds
B. abrasion on a rotating emery stone cone
C. crushing between two rolls at equal speeds
D. impact against a fixed steel ring

105. In a counterflow heat exchanger, juice is heated from 20 °C to 40 °C by hot water cooling from 90 °C to 50 °C. What is the log mean temperature difference?

A. 39.2 °C
B. 40.0 °C
C. 30.8 °C
D. 20.0 °C

106. An evaporator concentrates 1,000 kg/h of fruit juice from 10% to 40% total solids. How much water is evaporated?

A. 300 kg/h
B. 750 kg/h
C. 250 kg/h
D. 667 kg/h

107. Ground corn (9% crude protein) and soybean meal (44% crude protein) are blended into an 18% protein ration. What percentage of the mix should be soybean meal?

A. 37.1%
B. 40.9%
C. 74.3%
D. 25.7%

108. The conventional high-temperature short-time (HTST) pasteurization of milk heats it to at least

A. 121 °C for 15 minutes
B. 100 °C for 1 second
C. 72 °C for 15 seconds
D. 63 °C for 15 seconds

109. Below roughly which water activity is growth of virtually all microorganisms, including xerophilic molds and osmophilic yeasts, prevented?

A. 0.85
B. 0.60
C. 0.95
D. 0.90

110. Hermetic storage of grain controls insect pests mainly by

A. releasing a fumigant from the bag lining
B. raising the grain temperature above 60 °C
C. depleting oxygen and building up carbon dioxide in the sealed container
D. drying the grain to below 5% moisture

111. An aspirator in a grain cleaner separates light impurities from grain chiefly on the basis of differences in

A. magnetic susceptibility
B. terminal velocity in an air stream
C. surface color and gloss
D. particle length and width

112. For a storage hopper to empty by gravity, the hopper walls should be inclined

A. at an angle flatter than the angle of repose
B. at an angle steeper than the material's angle of repose
C. horizontally, with a vibrator at the outlet
D. at exactly 45° for every granular material

113. How much heat must be removed to turn 100 kg of water at 20 °C into ice at 0 °C? Use cp = 4.186 kJ/kg·K and latent heat of fusion 334 kJ/kg.

A. 234.1 MJ
B. 8.4 MJ
C. 41.8 MJ
D. 33.4 MJ

114. Using Siebel's equation for foods above freezing, cp = 3.349X + 0.837 kJ/kg·K (X = mass fraction of water), what is the specific heat of a fruit with 80% water?

A. 4.02 kJ/kg·K
B. 1.51 kJ/kg·K
C. 2.68 kJ/kg·K
D. 3.52 kJ/kg·K

115. A dryer evaporates 100 kg of water per hour while being supplied 120 kW of heat. Taking the latent heat of vaporization as 2,400 kJ/kg, what is the drying (thermal) efficiency?

A. 44.4%
B. 180.0%
C. 52.2%
D. 55.6%

116. Thin-layer drying of corn follows MR = (M − Me)/(M0 − Me) = e^(−kt) with k = 0.25 h■¹. If M0 = 30% and Me = 10% (dry basis), what is the moisture content after 4 hours?

A. 11.0% db
B. 17.4% db
C. 7.4% db
D. 25.6% db

117. In a modern rice mill, the machine that removes the bran layer from brown rice is the

A. paddy separator
B. whitener
C. destoner
D. husker

118. A recirculating batch dryer holds 6 t of palay. Drying takes 8 h and loading plus unloading take another 2 h per batch. What is its average output capacity?

A. 3.00 t/h
B. 0.75 t/h
C. 0.50 t/h
D. 0.60 t/h

119. Homogenization of milk is done mainly to

A. break fat globules into smaller sizes so cream does not separate
B. raise the fat content to a standard level
C. destroy pathogenic bacteria by heating
D. remove water to concentrate milk solids

120. Parboiling palay (soaking, steaming, then drying before milling) raises head rice yield mainly because it

A. lowers the kernel protein content
B. removes the bran layer before husking
C. dissolves the husk so it separates easily
D. gelatinizes the starch and seals cracks, hardening the kernel

Answer key

Agricultural and Biosystems Engineering

1. C. 1.15 ha/h

EFC = w × v × Ef / 10 = 2.4 × 6 × 0.80 / 10 = 1.15 ha/h (w in m, v in km/h).

2. D. 18.0 kW

P = F × v = 12 kN × (5.4/3.6) m/s = 18.0 kW.

3. A. 25.45 kW

P = 2πNT/60 = 2π × 540 × 450 / 60 = 25,447 W ≈ 25.45 kW.

4. C. 32.0 kg/ha

Hills/ha = 10,000/(0.75 × 0.25) = 53,333; seeds = 106,667; mass = 106,667 × 0.30 g = 32.0 kg.

5. A. 240 L/ha

Rate = 600 × Q / (w × v) = 600 × 9.6 / (6 × 4) = 240 L/ha (Q in L/min, w in m, v in km/h).

6. B. 15.0%

Slip = (100 – 85)/100 × 100 = 15.0%, based on the no-load travel distance.

7. C. 3.77 L

Vd = (π/4)D²L × n = (π/4)(0.10)²(0.12)(4) = 0.00377 m³ = 3.77 L.

8. D. 31.7%

Fuel energy rate = 9 × 0.84 × 45 / 3.6 = 94.5 kW; ηbt = 30/94.5 = 31.7%.

9. C. 0.252 kg/kW·h

bsfc = (9 × 0.84) kg/h / 30 kW = 0.252 kg/kW·h.

10. B. By the heat of air compressed to a high temperature

Diesel engines are compression-ignition engines: fuel is injected into air heated by high compression and self-ignites.

11. B. Spike-tooth harrow

Harrows break clods and level soil after primary tillage; plows, subsoilers and chisels do the initial deep cutting and loosening.

12. D. 600 rpm

N1D1 = N2D2, so N2 = 1,800 × 150/450 = 600 rpm.

13. C. 150 N·m

Torque increases with the gear ratio: T2 = 50 × (54/18) = 150 N·m (speed drops by the same factor).

14. D. 9.0 kN

Draft = unit draft × width × depth = 50 × (3 × 0.30) × 0.20 = 9.0 kN.

15. A. reduce wheel slip and improve traction

Ballast increases dynamic load on the drive wheels, raising the traction available before excessive slip occurs.

16. C. 80.4 kN

F = p × πD²/4 = 16×10■ × π(0.08)²/4 = 80,425 N ≈ 80.4 kN.

17. B. It moves spirally along the length of the cylinder axis

Axial-flow threshers use guide vanes on the cover to move material helically along the drum, giving repeated threshing and separation.

18. D. 50.3 kW

IP = pm × Vd × N/(2 × 60) = 800 × 0.00377 × 2000/120 = 50.3 kW (four-stroke: one power stroke every 2 revolutions).

19. C. 80%

ηm = BP/IP = 40/50 = 80%; the 10 kW difference is friction power.

20. D. 76.2%

Theoretical capacity = 3 × 5/10 = 1.5 ha/h; theoretical time = 4/1.5 = 2.667 h; Ef = 2.667/3.5 = 76.2%.

21. B. PHP 108,000

D = (P – S)/L = (1,200,000 – 120,000)/10 = PHP 108,000 per year.

22. D. PHP 450

Fuel use = 6/0.8 = 7.5 L/ha; cost = 7.5 × 60 = PHP 450/ha.

23. C. Drawbar power

Power is lost in friction and then in traction (slip and rolling resistance), so drawbar power is lower than PTO, brake and indicated power.

24. C. two lower links and one upper (top) link

The three-point linkage uses two hydraulically lifted lower links and an adjustable top link.

25. D. 570 W

$P = ½\rho A v^3 Cp = 0.5 \times 1.2 \times 12.566 \times 6^3 \times 0.35 = 570$ W.

26. D. 40%

η = Qu/(G × A) = 640/(800 × 2) = 0.40 = 40%.

27. A. To gain traction and avoid sinking in puddled soil

Cage wheels with lugs bite into soft, flooded soil, providing traction and flotation that pneumatic tires cannot.

28. D. 5.88 kW

Input = output/η = 5/0.85 = 5.88 kW.

29. A. 16

r = (Vs + Vc)/Vc = (900 + 60)/60 = 16.

30. A. 23.1%

Torque reserve = (Tmax – Trated)/Trated = (320 – 260)/260 = 23.1%.

31. A. 2.49 m³/s

V = q/(ρ cp ΔT) = 12/(1.2 × 1.006 × 4) = 2.49 m³/s.

32. C. 1,250 W

q = U × A × ΔT = 2.5 × 50 × 10 = 1,250 W.

33. A. 0.621 W/m²·K

R = 0.12 + 0.2/1.0 + 0.05/0.04 + 0.04 = 1.61 m²·K/W; U = 1/R = 0.621 W/m²·K.

34. B. the air becomes saturated when cooled at constant humidity ratio

Cooling air without adding or removing moisture eventually saturates it; that temperature is the dew point.

35. B. 0.0125 kg/kg dry air

W = 0.622 pv/(P – pv) = 0.622 × 2.0/99.325 = 0.0125 kg/kg.

36. C. 47.1%

RH = pv/ps = 2.0/4.247 = 47.1%.

37. D. 6.0 kN·m

Mmax = wL²/8 = 3 × 4²/8 = 6.0 kN·m at midspan.

38. D. 9.0 MPa

S = bh²/6 = 0.1 × 0.2²/6 = 6.667e-04 m³; σ = M/S = 6,000/6.667e-04 = 9.0 MPa.

39. B. 91.4 kN

Pcr = π²EI/L² with I = b■/12 = 8.333×10■■ m■: π² × 10×10■ × 8.333×10■■ / 3² = 91.4 kN.

40. C. 36.4 t

V = (π/4)(4²)(5) = 62.83 m³; mass = 62.83 × 580 = 36,442 kg ≈ 36.4 t.

41. A. 8.0 kPa

k = (1 – sin 30°)/(1 + sin 30°) = 1/3; p = k w h = (1/3)(8)(3) = 8.0 kPa.

42. B. transmits short-wave solar radiation but blocks long-wave re-radiation

Glass and many plastics pass solar short-wave radiation but are largely opaque to the long-wave radiation emitted by warm surfaces inside.

43. D. 27.6 °C

t2 = t1 – η(t1 – twb) = 34 – 0.80(34 – 26) = 27.6 °C.

44. C. minimize direct sunlight striking the long walls and the animals

An east-west long axis keeps the long sides facing north and south, so the low morning and afternoon sun shines mostly on the short ends.

45. B. 5.184 m³

V = 12 × 1.2 × 1.2 × 0.30 = 5.184 m³.

46. C. lowers the compressive strength of the hardened concrete

Excess water leaves voids as it evaporates, so strength falls as the water-cement ratio rises.

47. D. 149.2 MPa

σ = P/A = 30,000/[(π/4)(0.016)²] = 149.2 MPa.

48. A. 0.45 MPa

V = wL/2 = 6 kN; τmax = 1.5V/A = 1.5 × 6,000/0.02 = 0.45 MPa.

49. A. 28 lamps

N = E × A/(F × CU × MF) = 200 × 200/(3,000 × 0.6 × 0.8) = 27.8, so 28 lamps.

50. A. 10.63 A

I = P/(V × pf) = 2,200/(230 × 0.9) = 10.63 A.

51. A. 1,250 kg/h

■a = moisture load/(Wi – Wo) = 5/(0.016 – 0.012) = 1,250 kg dry air per hour.

52. B. A larger share of heat is lost as latent heat by evaporation

A smaller air-to-body temperature difference reduces sensible loss, so animals rely increasingly on evaporative (latent) cooling such as panting and sweating.

53. A. 68.5 kJ/kg dry air

h = 1.006(30) + 0.015(2501 + 1.86 × 30) = 30.18 + 38.35 = 68.5 kJ/kg.

54. B. runs vertically from the apex down to the tie beam

The king post is the central vertical member connecting the ridge to the middle of the bottom chord (tie beam).

55. D. 90 m³

V = 200 × 5 L × 90 d = 90,000 L = 90 m³.

56. B. 30 days

HRT = digester volume/daily feed = 12/0.4 = 30 days.

57. D. methane

Biogas is typically about half to two-thirds methane, with most of the rest carbon dioxide.

58. B. 15.0 mm

δ = 5wL■/(384EI), I = bh³/12 = 6.667×10■■ m■: 5(3,000)(4■)/(384 × 10¹■ × 6.667×10■■) = 15.0 mm.

59. A. on the warm (outer) side of the insulation

Vapor moves from warm humid air toward the cold side; a retarder on the warm side keeps moisture from condensing inside the insulation.

60. C. 1.10 m

A = P/qa = 180/150 = 1.2 m²; side = √1.2 = 1.10 m.

61. C. 2.00 m³/s

Q = CiA/360 = 0.4 × 60 × 30/360 = 2.00 m³/s (i in mm/h, A in ha).

62. A. 5.5 mm/day

ETc = Kc × ETo = 1.1 × 5 = 5.5 mm/day.

63. B. 45 mm

dn = (FC – PWP) × Dr × MAD = 0.15 × 600 mm × 0.5 = 45 mm.

64. B. 8 days

Interval = 45/5.5 = 8.2 days; rounding down to 8 days keeps depletion within the limit.

65. A. 60 mm

dg = dn/Ea = 45/0.75 = 60 mm.

66. D. 7.01 kW

Water power = ρgQH = 1000 × 9.81 × 0.020 × 25 = 4.905 kW; brake power = 4.905/0.70 = 7.01 kW.

67. C. 1.01 m³/s

A = 2 m², P = 4 m, R = 0.5 m; V = (1/n)R^(2/3)S^(1/2) = 40 × 0.630 × 0.02 = 0.504 m/s; Q = AV = 1.01 m³/s.

68. D. 26.5 L/s

Q = (π/4)D²V = (π/4)(0.15)²(1.5) = 0.0265 m³/s = 26.5 L/s.

69. B. 7.65 m

hf = f(L/D)(V²/2g) = 0.02 × (500/0.15) × (1.5²/19.62) = 7.65 m.

70. A. decreases with time toward a nearly constant basic rate

Infiltration is high at first because of strong suction gradients, then declines to a steady rate near the saturated hydraulic conductivity.

71. D. 18 t/ha/yr

A = R × K × LS × C × P = 500 × 0.3 × 1.2 × 0.2 × 0.5 = 18 t/ha/yr.

72. A. support practice factor P

P accounts for conservation support practices such as contouring, strip cropping and terracing.

73. D. 5.0 m

Horizontal interval = VI/S = 1.0/0.20 = 5.0 m.

74. C. 0.454 m³/s

Q = 1.84 × 1.5 × 0.30^1.5 = 1.84 × 1.5 × 0.1643 = 0.454 m³/s.

75. B. 10 m³/day

Darcy's law: Q = KiA = 20 × 0.005 × 100 = 10 m³/day.

76. A. 56.5 mm

P = Σ(PiAi)/ΣA = (40×20 + 55×50 + 70×30)/100 = 56.5 mm.

77. C. 50.5 mm

S = 25400/80 – 254 = 63.5 mm; Q = (P – 0.2S)²/(P + 0.8S) = (87.3)²/150.8 = 50.5 mm.

78. C. 1.5 h

Time = daily need/(emitters × rate) = 12/(2 × 4) = 1.5 h.

79. B. 8.33 mm/h

I = 3600q/(Sl × Sm) = 3600 × 0.5/(12 × 18) = 8.33 mm/h.

80. D. 88%

Mean = 10 mm; Σ|x – mean| = 6; CU = 100(1 – 6/(5 × 10)) = 88%.

81. D. percentages of sand, silt and clay

Texture class is set by the relative proportions of the three mineral particle-size separates.

82. A. remaining after free drainage of gravitational water has largely stopped

Field capacity is reached a day or two after thorough wetting, once rapid downward drainage has ceased.

83. C. 49.8%

n = 1 – ρb/ρs = 1 – 1.33/2.65 = 49.8%.

84. A. 35%

θv = θg × ρb/ρw = 0.25 × 1.4 = 0.35 = 35%.

85. A. 1,228 m³/day

Q = 2πKb(h2 – h1)/ln(r2/r1) = 2π × 15 × 20 × 1.5/ln 10 = 1,228 m³/day.

86. A. 3,000 m³

Delivered volume = 30,000 m² × 0.08 m = 2,400 m³; storage = 2,400/0.80 = 3,000 m³.

87. B. lower the water table below the crop root zone

Subsurface drains remove excess groundwater so roots get adequate aeration.

88. D. 1.004 m

E = y + V²/2g = 0.8 + 4/19.62 = 1.004 m.

89. C. Drip irrigation

Drip delivers water at low rates directly to the root zone, minimizing deep percolation, runoff and evaporation losses.

90. D. runoff from the hydraulically most remote point to reach the outlet

The rational method assumes peak runoff when the storm duration equals the time of concentration, so the whole area contributes.

91. A. 25.0%

Mdb = Mwb/(1 – Mwb) = 0.20/0.80 = 25.0%.

92. B. 116.3 kg

Dry matter = 1000 × 0.76 = 760 kg; final mass = 760/0.86 = 883.7 kg; water removed = 1000 – 883.7 = 116.3 kg.

93. C. 52%

Head rice recovery = 520/1000 = 52%; 80% is head rice as a share of milled rice, and 65% is the total milling recovery.

94. A. 34.7 kW

$q = \rho V c_p \Delta T = 1.15 \times 2 \times 1.006 \times 15 = 34.7$ kW.

95. B. neither gains nor loses moisture in air of a given temperature and humidity

EMC depends on air temperature and relative humidity and sets the lower limit for drying in that air.

96. C. 3.46 kW

Power varies with speed cubed: $P2 = 2.0 \times (1200/1000)^3 = 3.46$ kW.

97. C. 12.15 t/h

Buckets/s = 1.5/0.30 = 5; grain = 5 × 1.5 × 0.75 = 5.625 L/s = 3.375 kg/s = 12.15 t/h.

98. B. 3.0 min

F = n × D = 12 × 0.25 = 3.0 min.

99. A. 0.25 min

Raising temperature by one z-value (10 °C) reduces D tenfold: 2.5/10 = 0.25 min.

100. C. 4.22 kW

$Q = mc_p \Delta T = 2000 \times 3.8 \times 20 = 152{,}000$ kJ; over 36,000 s that is 4.22 kW.

101. C. Rittinger's law

Rittinger's law relates energy to new surface (proportional to 1/P – 1/F) and fits fine grinding best.

102. D. 2.68 kWh/t

$E = 10Wi(1/\sqrt{P} - 1/\sqrt{F}) = 120(1/\sqrt{500} - 1/\sqrt{2000}) = 120(0.04472 - 0.02236) = 2.68$ kWh/t.

103. B. Flat-bed dryer

In a flat-bed dryer grain sits on a perforated floor in a plenum box while heated air passes through it; the batch is unloaded when dry.

104. A. shearing between two rolls turning at different peripheral speeds

The speed difference between the rolls creates a shearing action that peels the husk with little kernel breakage.

105. A. 39.2 °C

$\Delta T1 = 90 - 40 = 50$ °C, $\Delta T2 = 50 - 20 = 30$ °C; LMTD = (50 – 30)/ln(50/30) = 39.2 °C.

106. B. 750 kg/h

Solids = 100 kg/h; product = 100/0.40 = 250 kg/h; water removed = 1000 – 250 = 750 kg/h.

107. D. 25.7%

Pearson square: SBM parts = 18 – 9 = 9, corn parts = 44 – 18 = 26; SBM = 9/35 = 25.7%.

108. C. 72 °C for 15 seconds

HTST uses about 72 °C for 15 s; 63 °C for 30 min is the batch (holder) method and 121 °C is a sterilization temperature.

109. B. 0.60

Most bacteria stop near 0.90 and most molds near 0.80, but no microbial growth is known below about 0.60.

110. C. depleting oxygen and building up carbon dioxide in the sealed container

Respiration of grain, insects and microbes inside an airtight enclosure consumes O■ and raises CO■ to levels lethal to insects.

111. B. terminal velocity in an air stream

Chaff and dust have lower terminal velocities than sound kernels, so a controlled upward air stream lifts them away.

112. B. at an angle steeper than the material's angle of repose

Walls steeper than the angle of repose (and wall friction angle) allow the material to slide rather than form a stagnant layer.

113. C. 41.8 MJ

$Q = m(c_p\Delta T + L) = 100(4.186 \times 20 + 334) = 41{,}772$ kJ ≈ 41.8 MJ.

114. D. 3.52 kJ/kg·K

$c_p = 3.349(0.80) + 0.837 = 3.52$ kJ/kg·K.

115. D. 55.6%

Heat used = 100 × 2400/3600 = 66.7 kW; $\eta = 66.7/120 = 55.6\%$.

116. B. 17.4% db

MR = e^(–1) = 0.368; M = 10 + 20 × 0.368 = 17.4% db.

117. B. whitener

Whiteners (abrasive or friction type) strip the bran from brown rice; the husker removes hulls and the separator returns unhusked grain.

118. D. 0.60 t/h

Capacity = 6 t/(8 + 2) h = 0.60 t/h; 0.75 t/h ignores handling time.

119. A. break fat globules into smaller sizes so cream does not separate

Forcing milk through a narrow valve at high pressure shrinks fat globules, keeping them dispersed.

120. D. gelatinizes the starch and seals cracks, hardening the kernel

Steaming gelatinizes starch, which fuses internal fissures so kernels resist breakage during milling.

Topics to review

• Irrigation, drainage and soil-water conservation

• Agricultural power and machinery

• Postharvest processing and storage

• Farm structures and waste management

Online question banks and study resources

Agricultural and Biosystems Engineering - Pass Harbor (Question bank)

Official PRC board information

Current PRC exam programs

Independent study material prepared by Board Exam Desk.