# PRACTICE EXAM 3: POSS SIMULATION

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*Use scratch paper and pencil only. Do not consult notes, study materials, or the answer key during the exam. Answer every question — there is no penalty for wrong answers.*

**SUBTEST 1 — MATHEMATICAL USAGE**

**46 questions | 17 minutes | No calculator**

1. What is the square root of 144?

A. 10

B. 11

C. 12

D. 14

2. A pump moves 360 gallons in 12 minutes. At the same rate, how many gallons will it move in 25 minutes?

A. 750 gallons

B. 720 gallons

C. 800 gallons

D. 900 gallons

3. What is 65% of 200?

A. 120

B. 130

C. 140

D. 150

4. A worker earns $26 per hour. After working 30 hours, how much will they earn?

A. $720

B. $750

C. $760

D. $780

5. Convert 5 hours and 45 minutes into total minutes.

A. 345 minutes

B. 350 minutes

C. 365 minutes

D. 320 minutes

6. Solve for x: $7x - 18 = 31$

A. 5

B. 6

C. 7

D. 8

7. A pipe is 25 yards long. Convert this length to feet.

A. 75 feet

B. 60 feet

C. 90 feet

D. 100 feet

8. What is 5/6 + 1/4 expressed as a fraction in simplest form?

A. 6/10

B. 13/12

C. 7/12

D. 11/12

9. A motor runs at 2,400 RPM. How many revolutions does it complete in 15 seconds?

A. 480

B. 500

C. 540

D. 600

10. If 9 workers complete a job in 16 hours, how many hours would 12 workers take to complete the same job?

A. 8 hours

B. 10 hours

C. 12 hours

D. 14 hours

11. What is 0.6 × 0.7?

A. 0.42

B. 0.44

C. 0.50

D. 4.20

12. A storage tank loses 14 gallons of water per hour. How many gallons does it lose in 8.5 hours?

A. 110 gallons

B. 119 gallons

C. 124 gallons

D. 130 gallons

13. Which fraction is equivalent to 0.375?

A. 1/4

B. 5/8

C. 2/5

D. 3/8

14. A worker is paid $19 per hour. What are the gross earnings for 38 hours?

A. $700

B. $722

C. $740

D. $760

15. What is 16 × 25?

A. 350

B. 375

C. 400

D. 425

16. A pressure gauge reads 110 PSI. Approximately how many feet of water column does this represent? (Use 1 PSI = 2.31 feet of water.)

A. 254 feet

B. 220 feet

C. 280 feet

D. 300 feet

17. Solve for n: 4n + 25 = 5n + 18

A. 5

B. 6

C. 8

D. 7

18. What is the average of 16, 24, 38, 42, and 50?

A. 32

B. 34

C. 36

D. 38

19. A pump's output is 75 gallons per minute. How many gallons does it produce in 1 hour and 24 minutes?

A. 6,000 gallons

B. 6,200 gallons

C. 6,300 gallons

D. 6,500 gallons

20. What is the square root of 81?

A. 9

B. 8

C. 7

D. 11

21. A truck travels at 65 miles per hour. How long does it take to travel 325 miles?

A. 4 hours

B. 4.5 hours

C. 5.5 hours

D. 5 hours

22. What is 3/8 of 96?

A. 32

B. 30

C. 36

D. 40

23. A water tank is 75% full. If the tank holds 1,200 gallons total, how many gallons of water are in the tank?

A. 850 gallons

B. 900 gallons

C. 950 gallons

D. 980 gallons

24. Convert 12 cubic feet to gallons. (Use 1 cubic foot = 7.48 gallons.)

A. 89.76 gallons

B. 84.20 gallons

C. 79.50 gallons

D. 95.40 gallons

25. What is 168 ÷ 14?

A. 11

B. 12

C. 13

D. 14

26. A rectangular tank is 9 feet long, 6 feet wide, and 4 feet deep. What is its volume in cubic feet?

A. 216 cubic feet

B. 200 cubic feet

C. 240 cubic feet

D. 180 cubic feet

27. If a number is increased by 30% to give a result of 130, what is the original number?

A. 90

B. 95

C. 100

D. 110

28. What is the result of 24.6 ÷ 0.3?

A. 75

B. 80

C. 78

D. 82

29. A chemical mixing tank uses water and chemical in a 9:2 ratio. If 90 gallons of water are used, how many gallons of chemical are needed?

A. 18 gallons

B. 20 gallons

C. 25 gallons

D. 22 gallons

30. What is 7/12 − 1/3 expressed as a fraction in simplest form?

A. 1/4

B. 1/3

C. 5/12

D. 1/2

31. A motor's speed decreases by 12%. If the original speed was 1,500 RPM, what is the new speed?

A. 1,300 RPM

B. 1,310 RPM

C. 1,320 RPM

D. 1,350 RPM

32. Solve for y: 3(2y − 5) = 21

A. 4

B. 5

C. 7

D. 6

33. What is 25% of 25% of 800?

A. 40

B. 50

C. 60

D. 75

34. A pump operates 5 hours per day. How many minutes does it operate over a 5-day work week?

A. 1,500 minutes

B. 1,400 minutes

C. 1,200 minutes

D. 1,250 minutes

35. What is the value of $4^3 + 2^3$?

A. 56

B. 64

C. 70

D. 72

36. If 36 is 60% of a number, what is the number?

A. 50

B. 55

C. 60

D. 65

37. A fuel tank holds 1,200 gallons. After a 10-hour shift, the level has dropped to 850 gallons. What is the average consumption rate per hour?

A. 35 gallons per hour

B. 40 gallons per hour

C. 32 gallons per hour

D. 38 gallons per hour

38. What is 11/12 − 5/6 expressed as a fraction in simplest form?

A. 5/12

B. 1/3

C. 1/4

D. 1/12

39. A worker earns $25 per hour for the first 40 hours and $37.50 per hour for overtime. What are the total earnings for a 50-hour week?

A. $1,300

B. $1,325

C. $1,375

D. $1,400

40. What is the perimeter of a rectangle that is 18 feet long and 11 feet wide?

A. 50 feet

B. 58 feet

C. 60 feet

D. 64 feet

41. A pipe with an 8-inch diameter has a cross-sectional area of approximately how many square inches? (Use $\pi \approx 3.14$.)

A. 25.12 square inches

B. 32.40 square inches

C. 42.20 square inches

D. 50.24 square inches

42. What is 0.4 expressed as a fraction in simplest form?

A. 2/5

B. 3/8

C. 4/9

D. 1/3

43. A boiler heats 600 gallons of water from 55°F to 145°F. What is the temperature increase?

A. 80°F

B. 85°F

C. 90°F

D. 95°F

44. Two pumps work together to fill a tank. Pump A delivers 40 gallons per minute and Pump B delivers 60 gallons per minute. How long will it take both pumps together to fill a 2,000-gallon tank?

A. 18 minutes

B. 20 minutes

C. 22 minutes

D. 25 minutes

45. What is 7% of 600?

A. 42

B. 44

C. 48

D. 50

46. If $x = 5$ and $y = 3$, what is the value of $2x^2 + 3y - 4$?

A. 45

B. 48

C. 55

D. 60

**SUBTEST 2 — MECHANICAL CONCEPTS**

**44 questions | 20 minutes | Pictorial questions**

47. A first-class lever has a fulcrum located 3 feet from the load and 9 feet from the effort. If the load is 450 pounds, what force is needed to balance it?

A. 150 pounds

B. 100 pounds

C. 75 pounds

D. 60 pounds

48. Two meshing gears have 24 and 72 teeth. If the smaller gear rotates clockwise, the larger gear rotates:

A. Clockwise at the same speed

B. Clockwise at one-third the speed

C. Counterclockwise at one-third the speed

D. Counterclockwise at the same speed

49. A hydraulic piston system has an input piston of 5 square inches and an output piston of 50 square inches. If 100 pounds of force is applied to the input, what force is produced at the output?

A. 500 pounds

B. 1,000 pounds

C. 2,000 pounds

D. 5,000 pounds

50. In a block-and-tackle pulley with 6 supporting rope segments, what force is needed to lift a 1,800-pound load (ignoring friction)?

A. 300 pounds

B. 360 pounds

C. 450 pounds

D. 600 pounds

51. Water flows through a 12-square-inch pipe at 5 feet per second. The pipe narrows to 3 square inches. What is the new water velocity?

A. 10 feet per second

B. 12 feet per second

C. 15 feet per second

D. 20 feet per second

52. A wheel-and-axle system has a wheel radius of 30 inches and an axle radius of 5 inches. What is the mechanical advantage?

A. 5

B. 4

C. 6

D. 8

53. According to Pascal's law, when force is applied to an enclosed liquid:

A. Pressure transmits equally throughout the fluid

B. Volume increases proportionally to applied force

C. Density decreases as pressure rises

D. Temperature decreases throughout the fluid

54. A 5-inch driver pulley turns at 1,500 RPM and is connected by a belt to a 15-inch driven pulley. The driven pulley rotates at:

A. 4,500 RPM

B. 1,500 RPM

C. 750 RPM

D. 500 RPM

55. A wedge that is 16 inches long and 4 inches thick at the wide end has a mechanical advantage of:

A. 2

B. 4

C. 6

D. 8

56. A ball valve uses what kind of internal element to control flow?

A. A gate sliding perpendicular to flow

B. A movable disk on a stationary seat

C. A hollow perforated ball that rotates 90°

D. A flexible diaphragm pressed against a seat

57. A pneumatic system contains air at 60 PSI in a 12-cubic-foot tank. If the air is compressed to 4 cubic feet at constant temperature, what is the new pressure?

A. 60 PSI

B. 180 PSI

C. 240 PSI

D. 300 PSI

58. A loading ramp is 20 feet long and rises 4 feet. What is its mechanical advantage?

A. 5

B. 4

C. 6

D. 8

59. The primary advantage of a chain drive over a belt drive is that chains:

A. Operate quietly under all conditions

B. Are always less expensive to install

C. Do not slip and transmit positive motion

D. Require less alignment precision

60. A pressure gauge reads "absolute zero PSI." This corresponds to:

A. Atmospheric pressure

B. A perfect vacuum

C. Half of atmospheric pressure

D. Twice atmospheric pressure

61. As the back pressure on a centrifugal pump increases, the flow rate:

A. Increases significantly

B. Remains exactly constant

C. Increases briefly, then returns to baseline

D. Decreases progressively

62. A second-class lever is characterized by:

A. The load between the fulcrum and the effort

B. The fulcrum between the load and the effort

C. The effort between the fulcrum and the load

D. No fulcrum at all

63. A vertical column of water 75 feet tall produces approximately what pressure at its base?

A. 25 PSI

B. 32.5 PSI

C. 40 PSI

D. 50 PSI

64. According to Newton's second law of motion, the acceleration of an object is:

A. Proportional to its mass

B. Independent of any force applied

C. Equal to its weight in pounds

D. Equal to the force divided by the mass

65. A check valve is installed primarily to:

A. Throttle the flow to a precise rate

B. Reduce friction loss in the piping

C. Prevent reverse flow when a pump stops

D. Provide overpressure protection for the system

66. Two meshing gears: the driver has 18 teeth and the driven has 54 teeth. If the driver rotates at 1,200 RPM, the driven rotates at:

A. 400 RPM

B. 600 RPM

C. 1,800 RPM

D. 3,600 RPM

67. The conservation principle that applies to all simple machines states that:

A. Force can be multiplied without any loss in distance

B. Distance can be multiplied without any loss in force

C. Both force and distance can be multiplied simultaneously

D. The product of force and distance is conserved across input and output

68. A worker pushes a 400-pound crate up a 16-foot ramp that rises 4 feet. The minimum theoretical force required is:

A. 200 pounds

B. 100 pounds

C. 80 pounds

D. 50 pounds

69. The formula for weight is $W = m \times g$, where g represents:

A. The mass of the object

B. The volume of the object

C. The acceleration due to gravity

D. The temperature of the object

70. Operating a centrifugal pump against a fully closed discharge valve will cause:

A. Maximum flow with minimum pressure

B. Stable normal operation

C. Increased mechanical efficiency

D. Rapid heating of the trapped fluid

71. The friction force between two surfaces:

A. Is proportional to the normal force pressing them together

B. Is independent of the surfaces' weight

C. Increases dramatically with surface lubrication

D. Acts in the same direction as the motion

72. A single fixed pulley provides which mechanical advantage?

A. 2

B. 1

C. 0

D. 4

73. When the driven gear has fewer teeth than the driver gear, the driven gear rotates:

A. At the same speed as the driver

B. Slower than the driver

C. In the opposite direction at half-speed

D. Faster than the driver

74. A long steel pipe heated by hot steam will:

A. Decrease in diameter

B. Expand significantly along its length

C. Maintain its exact original dimensions

D. Lose mass through evaporation

75. The principle that an object continues in motion at constant velocity unless acted on by a force is part of:

A. Pascal's law

B. Bernoulli's principle

C. Newton's first law (inertia)

D. The continuity equation

76. A 30-pound force on a balanced lever produces a 240-pound output force. The mechanical advantage is:

A. 8

B. 10

C. 12

D. 6

77. The function of a sleeve bearing in a rotating shaft is to:

A. Increase the rotational speed of the shaft

B. Convert rotational motion to linear motion

C. Transmit electrical signals along the shaft

D. Support the shaft while reducing friction through a lubricating film

78. The reason hydraulic systems can transmit force instantaneously is that:

A. Hydraulic fluid is electrically conductive

B. Hydraulic systems use chemical reactions for force transmission

C. Hydraulic fluid is essentially incompressible

D. Hydraulic systems operate at very high temperatures

79. By the continuity equation, a fluid flowing through a section where the pipe area decreases will:

A. Slow down to maintain consistent pressure

B. Speed up to maintain consistent volume flow

C. Stop entirely

D. Compress to occupy the smaller area

80. A V-belt is preferred over a flat belt of the same width because:

A. V-belts are easier to manufacture

B. V-belts cannot break under any load

C. V-belts last longer in extreme cold

D. The wedging action increases friction and grip

81. Heat transfer through the bulk movement of a fluid is called:

A. Conduction

B. Convection

C. Radiation

D. Insulation

82. A 20-tooth driver sprocket connected by a chain to a 40-tooth driven sprocket. If the driver rotates at 600 RPM, the driven sprocket rotates at:

A. 300 RPM

B. 200 RPM

C. 600 RPM

D. 1,200 RPM

83. The outward sensation experienced by a rotating object is best explained as the result of:

A. Pressure waves in the surrounding air

B. Magnetic forces from nearby equipment

C. The object's inertia attempting to maintain straight-line motion

D. Heat generated by rotational friction

84. A flexible coupling is required between two shafts when:

A. The shafts are perfectly aligned and identical

B. Some shaft misalignment is expected during operation

C. The shafts must operate at different speeds

D. No power transmission is needed

85. The energy absorbed when a substance changes phase without changing temperature is called:

A. Sensible heat

B. Specific heat

C. Convective heat

D. Latent heat

86. A pressure relief valve that fails to open when system pressure exceeds the setpoint creates the risk of:

A. Catastrophic equipment failure from overpressure

B. Reduced operating efficiency only

C. Increased fuel consumption only

D. Better-than-expected system performance

87. In a hydraulic jack, the small input piston moves a greater distance than the large output piston because:

A. The output piston has a smaller area

B. The fluid is heated during the lift

C. The total fluid volume must be conserved

D. The hydraulic system loses energy to friction

88. A 6-inch motor pulley rotates at 1,200 RPM and is connected by belt to a 4-inch pulley on a fan. The fan rotates at:

A. 800 RPM

B. 1,800 RPM

C. 2,400 RPM

D. 1,200 RPM

89. The boiling point of water depends primarily on:

A. The pressure above the water surface

B. The volume of water in the container

C. The shape of the container

D. The color of the container

90. Pressure loss in a long pipe carrying flowing fluid increases with:

A. Larger pipe diameter

B. Lower flow rate

C. Smoother interior surfaces

D. Longer pipe length and rougher interior

**SUBTEST 3 — READING COMPREHENSION**

**36 questions | 30 minutes | 5 passages**

**Passage 1**

Steam turbine seals are precision components designed to minimize the leakage of steam from the high-pressure regions of the turbine into lower-pressure areas or into the atmosphere. The most common seal type used in modern utility turbines is the labyrinth seal, which uses a series of closely spaced metal teeth — called knife-edges — that create a tortuous path for any escaping steam. As steam attempts to flow through the labyrinth, it loses pressure progressively at each successive knife-edge, with most of the pressure drop occurring across the small clearances between the rotating shaft and the stationary seal teeth. Because labyrinth seals do not contact the rotating shaft, they do not wear during operation under

*normal conditions and require essentially no routine maintenance. However, severe vibration, thermal expansion mismatches, or improper alignment can cause the seal teeth to rub against the shaft, resulting in seal damage and increased steam leakage. Operators monitor seal performance through observations of steam consumption, gland steam pressure, and the temperature of bearings adjacent to the seal regions, all of which can indicate degraded seal condition.*

91. According to the passage, the primary purpose of steam turbine seals is to:

A. Cool the rotating shaft during operation

B. Provide structural support for the turbine casing

C. Reduce noise generated by the turbine

D. Minimize steam leakage between turbine regions

92. The passage states that the most common seal type in modern utility turbines is the:

A. Carbon ring seal

B. Labyrinth seal

C. Mechanical face seal

D. Packing gland seal

93. According to the passage, labyrinth seals work by:

A. Creating a tortuous path that progressively reduces steam pressure

B. Pressing tightly against the rotating shaft to prevent any leakage

C. Cooling the steam to reduce its volume and pressure

D. Filtering the steam through a porous metal medium

94. As used in the passage, the word "tortuous" most nearly means:

A. Painful to the touch

B. Highly polished

C. Twisting and complex

D. Smooth and direct

95. What can be inferred from the passage about labyrinth seals under normal operating conditions?

A. They require frequent replacement to maintain effectiveness

B. They do not wear and require essentially no routine maintenance

C. They must be lubricated continuously to prevent damage

D. They are removed for inspection during every shutdown

96. The author's primary purpose in this passage is to:

A. Argue that labyrinth seals should be replaced with newer designs

B. Compare the costs of various seal types in industrial applications

C. Critique the maintenance practices for steam turbine seals

D. Explain how steam turbine labyrinth seals function and are monitored

97. According to the passage, operators monitor seal performance through:

A. Steam consumption, gland steam pressure, and bearing temperature

B. Visual inspection of the seal teeth during every operating shift

C. Continuous chemical analysis of the leaking steam

D. Noise level measurements at the turbine exterior

**Passage 2**

*Environmental control systems in modern power plants are essential for limiting the discharge of regulated pollutants into the atmosphere and surrounding waterways. Major emission control technologies include selective catalytic reduction units that reduce nitrogen oxide emissions by injecting ammonia into the flue gas stream and passing the mixture over a catalyst bed. Flue gas desulfurization scrubbers remove sulfur dioxide by spraying a slurry of limestone or lime into the gas stream, where the sulfur compounds react with the calcium and form a solid precipitate that can be collected and disposed of properly. Particulate control is typically accomplished through electrostatic precipitators or fabric filter baghouses, which capture fine ash particles before they exit the stack. On the water side, plants operate cooling water discharge controls and wastewater treatment systems that meet permit requirements for temperature, suspended solids, oil and grease, and various chemical parameters. Operators must monitor environmental control performance continuously through emissions monitors and process instrumentation, and any exceedance of permit limits must be promptly reported to the appropriate regulatory authorities. Failure to maintain environmental compliance can result in significant penalties, regulatory enforcement actions, and damage to the utility's public reputation.*

98. According to the passage, the function of selective catalytic reduction units is to:

A. Capture fine ash particles before they exit the stack

B. Treat cooling water before discharge to receiving waters

C. Reduce nitrogen oxide emissions

D. Remove sulfur dioxide from the flue gas stream

99. The passage states that flue gas desulfurization scrubbers remove sulfur dioxide by:

A. Cooling the flue gas below the sulfur condensation point

B. Spraying limestone or lime slurry into the gas stream

C. Using a magnetic field to separate sulfur compounds

D. Filtering the gas through carbon adsorption beds

100. According to the passage, particulate control in modern power plants is typically accomplished through:

A. Electrostatic precipitators or fabric filter baghouses

B. Cyclone separators with mechanical agitation

C. Water spray towers operating at high pressure

D. Centrifugal separators driven by exhaust gas flow

101. As used in the passage, the word "exceedance" most nearly means:

A. A scheduled maintenance interval

B. The expected operating range of the equipment

C. An amount that goes beyond a permitted limit

D. A reduction below the minimum operating level

102. What can be inferred from the passage about environmental compliance failures?

A. They are typically detected only during scheduled audits

B. They can result in significant penalties and damage to reputation

C. They have minimal consequences for the utility

D. They are corrected automatically by the control systems

103. The author's tone in this passage is best described as:

A. Conversational and casual

B. Argumentative and persuasive

C. Critical and dismissive

D. Informative and authoritative

104. According to the passage, environmental compliance is monitored through:

A. Emissions monitors and process instrumentation

B. Quarterly inspections by regulatory officials

C. Annual self-reporting by plant management

D. Random sampling at the plant property boundary

**Passage 3**

*The generator excitation system is the equipment that supplies the direct current necessary to magnetize the rotor of a synchronous generator. Without proper excitation, a generator cannot produce voltage at its terminals, regardless of how fast it is rotating. Modern excitation systems are typically of the static type, in which the excitation power is drawn from the generator's own output, processed through power electronic rectifiers, and delivered to the rotor through brushes that contact rotating slip rings. Older brushless designs use a small auxiliary generator mounted on the same shaft as the main generator, eliminating the need for slip rings and brushes. The excitation level is controlled by an automatic voltage regulator, which continuously adjusts the rotor field current to maintain generator terminal voltage at the desired setpoint despite changes in load. When the generator load increases, the regulator increases excitation to compensate; when the load decreases, the regulator reduces excitation. Loss of excitation during operation is a serious abnormal condition that can lead to generator instability, unwanted absorption of reactive power from the grid, and potential damage to the generator if not corrected quickly. Excitation system protection trips the generator offline if loss of excitation persists.*

105. According to the passage, the primary function of the generator excitation system is to:

A. Cool the generator rotor during high-load operations

B. Synchronize the generator with the transmission grid

C. Supply direct current to magnetize the rotor

D. Convert the generator output to direct current

106. The passage states that without proper excitation, a generator:

A. Operates at reduced efficiency only

B. Produces alternating current at reduced voltage

C. Operates safely but at lower output

D. Cannot produce voltage at its terminals

107. According to the passage, modern static excitation systems:

A. Use a separate diesel-driven generator for excitation power

B. Draw excitation power from the generator's own output

C. Operate without any electronic components

D. Require continuous manual operator control

108. As used in the passage, the word "compensate" most nearly means:

A. Pay for damages or losses

B. Replace a missing component

C. Offset or counterbalance

D. Reduce the operating workload

109. What can be inferred from the passage about the role of the automatic voltage regulator?

A. It manually adjusts excitation only when commanded by an operator

B. It operates independently of the generator's load conditions

C. It continuously responds to changes in generator load

D. It is used only during emergency conditions

110. The author's primary purpose in this passage is to:

A. Describe how generator excitation systems function

B. Argue that older brushless designs should be retired

C. Compare the costs of various excitation system designs

D. Critique the operating practices of utilities

111. According to the passage, loss of excitation during operation can lead to:

A. Improved generator efficiency

B. Reduced maintenance costs

C. Faster grid synchronization

D. Generator instability and potential damage

**Passage 4**

*The control room is the operational nerve center of a power plant. Operators stationed in the control room continuously monitor and direct all aspects of plant operation, from boiler and turbine performance to auxiliary system status and grid synchronization. Modern control rooms feature large display systems that present real-time operating data, alarms, and trend information drawn from thousands of sensors throughout the plant. Operators interact with the plant through control consoles that allow remote operation of valves, pumps, breakers, and other equipment. Effective control room operation requires not only technical knowledge of plant systems but also strong situational awareness, the ability to prioritize during multiple simultaneous events, and disciplined communication with field operators, maintenance personnel, and external grid dispatchers. Most control rooms are staffed continuously by at least two licensed operators who share monitoring duties and serve as a check on each other's actions. Plant procedures require specific verbal communication protocols for all critical actions, including independent verification before any major equipment manipulation. The control room also serves as the central point for managing emergency response, coordinating with emergency services if needed, and documenting all significant operational events for regulatory reporting and post-event analysis.*

112. According to the passage, the primary role of the control room is to:

A. Test plant equipment during commissioning

B. Continuously monitor and direct all aspects of plant operation

C. Train new operators in plant procedures

D. Conduct administrative tasks for plant management

113. The passage states that modern control rooms feature:

A. Manual gauges that operators check on rounds

B. Telephone-based communication with field workers only

C. Large display systems presenting real-time operating data

D. Single-operator workstations for individual decision-making

114. According to the passage, what skills are required for effective control room operation?

A. Technical knowledge, situational awareness, and disciplined communication

B. Mechanical aptitude and tool-handling experience only

C. Computer programming and software development

D. Marketing and customer relations expertise

115. As used in the passage, the phrase "nerve center" most nearly means:

A. The location of medical emergency response

B. The area with the greatest electrical hazards

C. The most heavily reinforced part of the structure

D. The central command and coordination point

116. What can be inferred from the passage about the requirement for two licensed operators?

A. The second operator is paid significantly more than the first

B. Two operators provide a check on each other's actions

C. The two operators can leave the room briefly when the plant is stable

D. The second operator is in training and not yet fully qualified

117. The author's tone in this passage is best described as:

A. Informative and descriptive

B. Argumentative and persuasive

C. Critical and skeptical

D. Casual and personal

118. According to the passage, what does the control room serve as during emergencies?

A. The location of fire suppression equipment storage

B. The central point for managing emergency response and coordinating with emergency services

C. The temporary refuge for non-essential plant personnel

D. The off-site backup for grid dispatcher functions

**Passage 5**

*Emergency response in a power plant requires preparation, training, and disciplined execution. Every plant maintains an emergency response plan that addresses a range of credible scenarios, including fires, equipment failures, hazardous material releases, severe weather, and security threats. Plant personnel are trained in basic emergency response actions through periodic drills that test their ability to execute the plan under realistic conditions. When an emergency occurs, the first action of any operator who discovers it is to alert the control room and provide a clear, accurate description of the situation. The control room then activates the appropriate response protocols, which may include isolating affected equipment,*

*sounding alarms, dispatching internal response teams, contacting external emergency services, and beginning evacuation procedures if necessary. During the response phase, communication discipline is essential — clear, concise messages using standardized terminology prevent confusion and ensure that all response personnel are working from the same understanding of the situation. After the immediate response is complete, the plant conducts a thorough investigation to identify the root cause of the emergency and develop corrective actions to prevent recurrence. Lessons learned are shared across the utility and, where appropriate, with the broader industry to improve preparedness and response effectiveness.*

119. According to the passage, what is the first action of any operator who discovers an emergency?

A. Begin evacuation procedures immediately

B. Contact external emergency services directly

C. Attempt to stop the source of the emergency alone

D. Alert the control room with a clear description

120. The passage states that emergency response plans address all of the following EXCEPT:

A. Routine equipment maintenance scheduling

B. Fires and equipment failures

C. Hazardous material releases

D. Severe weather and security threats

121. According to the passage, the purpose of periodic drills is to:

A. Document operator performance for performance reviews

B. Identify operators who should be transferred to other positions

C. Test personnel's ability to execute the plan under realistic conditions

D. Reduce the frequency of equipment failures

122. As used in the passage, the word "execute" most nearly means:

A. Bring legal action against

B. Carry out or perform

C. Sign and authorize formally

D. Repeat from memory

123. What can be inferred from the passage about communication during emergency response?

A. It can be informal as long as the message is delivered

B. It is conducted entirely through written log entries

C. It is the responsibility of senior management only

D. It must use standardized terminology to prevent confusion

124. The author's primary purpose in this passage is to:

A. Describe how power plants prepare for and respond to emergencies

B. Argue that current emergency procedures are inadequate

C. Compare emergency response practices across different industries

D. Critique specific emergency response failures

125. According to the passage, after the immediate response is complete, the plant:

A. Returns to normal operation without further investigation

B. Reduces operator staffing to pre-emergency levels

C. Conducts a thorough investigation to identify the root cause

D. Schedules an immediate plant shutdown for inspection

126. The passage indicates that lessons learned from emergencies are:

A. Kept confidential within the plant management team

B. Shared only with regulatory authorities

C. Documented but not formally communicated

D. Shared across the utility and the broader industry

**SUBTEST 4 — FIGURAL REASONING**

**20 questions | 10 minutes | Visual pattern recognition**

127. A sequence shows shapes that change in a fixed cycle: circle, triangle, square, pentagon. If this cycle repeats, what shape appears in Frame 5?

A. Circle

B. Triangle

C. Hexagon

D. Square

128. A sequence shows a square that gains one corner-to-corner diagonal line per frame: 1, 2, 3, 4 lines. How many diagonal lines should Frame 5 contain?

A. 3 lines

B. 4 lines

C. 5 lines

D. 6 lines

129. A 2×2 grid shows: top-left = small filled circle, top-right = large filled circle, bottom-left = small empty circle, bottom-right = ? What should appear in the bottom-right?

A. Small filled circle

B. Large empty circle

C. Large filled circle

D. Small empty circle

130. A sequence shows a clock where the hour hand advances 60° clockwise per frame. Frame 1 is at 12, Frame 2 at 2, Frame 3 at 4, Frame 4 at 6. Where should the hand point in Frame 5?

A. At 12

B. At 4

C. At 10

D. At 8

131. A 2×2 grid shows: top-left = arrow pointing up, top-right = arrow pointing right, bottom-left = arrow pointing left, bottom-right = ? What should appear in the bottom-right?

A. Arrow pointing down

B. Arrow pointing up

C. Arrow pointing right

D. Arrow pointing left

132. A sequence shows a star that doubles its number of points each frame. Frame 1 has 3 points, Frame 2 has 6, Frame 3 has 12. What should Frame 4 show?

A. 18 points

B. 20 points

C. 24 points

D. 30 points

133. A 3×3 grid shows: top row of three small triangles, middle row of three medium triangles, bottom row of two large triangles followed by a question mark. What belongs in the missing cell?

A. A medium triangle

B. A large triangle

C. A small triangle

D. A square

134. A sequence shows a shape that rotates 30° clockwise per frame. Frame 1 is at 0°, Frame 2 at 30°, Frame 3 at 60°, Frame 4 at 90°. What rotation should Frame 5 show?

A. 120°

B. 90°

C. 60°

D. 150°

135. A 2×2 grid shows: top-left = circle, top-right = circle inside circle (two concentric circles), bottom-left = square, bottom-right = ? What should appear in the bottom-right?

A. Two squares stacked vertically

B. Triangle inside square

C. Circle inside square

D. Square inside square (two concentric squares)

136. A sequence shows a row of dots that increases by 2 each frame: 2, 4, 6, 8 dots. How many dots should Frame 5 contain?

A. 9 dots

B. 10 dots

C. 12 dots

D. 14 dots

137. A 2×2 grid shows: top-left = horizontal line, top-right = horizontal line crossed by vertical line (a plus sign), bottom-left = single vertical line, bottom-right = ? What should appear in the bottom-right?

A. Two horizontal lines

B. A plus sign

C. A diagonal line

D. A vertical line crossed by a horizontal line (a plus sign)

138. A sequence shows a triangle that gradually changes color from white to black across four frames: white, light gray, dark gray, almost black. What should Frame 5 show?

A. Fully black triangle

B. White triangle

C. Striped triangle

D. Half-filled triangle

139. A 3×3 grid shows shading patterns that increase from left to right within each row (empty, half-filled, fully filled). The bottom row shows: empty pentagon, half-filled pentagon, ? What belongs in the missing cell?

A. Empty hexagon

B. Half-filled hexagon

C. Fully filled pentagon

D. Empty pentagon

140. A sequence shows alternating patterns: striped, dotted, striped, dotted. What should Frame 5 show?

A. Solid black

B. Striped

C. Dotted

D. Empty

141. A 2×2 grid shows: top-left = small dot, top-right = three small dots arranged in a triangle, bottom-left = small square, bottom-right = ? What should appear in the bottom-right?

A. Two small squares

B. One small square

C. Three small squares arranged in a triangle

D. A circle

142. A sequence shows a pentagon that gains one internal line connecting two corners per frame. Frame 1 has 0 lines, Frame 2 has 1 line, Frame 3 has 2 lines, Frame 4 has 3 lines. What should Frame 5 show?

A. 3 lines

B. 4 lines

C. 5 lines

D. 6 lines

143. A 2×2 grid shows: top-left = white triangle, top-right = black triangle, bottom-left = white circle, bottom-right = ? What should appear in the bottom-right?

A. White circle

B. Black square

C. White square

D. Black circle

144. A sequence shows a clock where the minute hand advances 30 minutes (180°) per frame. Frame 1 is at 12, Frame 2 at 6, Frame 3 at 12, Frame 4 at 6. Where should the hand point in Frame 5?

A. At 12

B. At 3

C. At 6

D. At 9

145. A 3×3 grid shows shapes that gain one side from left to right within each row. The bottom row begins with a triangle (3 sides) and a square (4 sides). What belongs in the missing third cell?

A. A triangle

B. A square

C. A pentagon (5 sides)

D. A hexagon (6 sides)

146. A sequence shows a circle that is divided into equal segments. Frame 1 has 2 segments, Frame 2 has 3, Frame 3 has 4, Frame 4 has 5. How many segments should Frame 5 have?

A. 7 segments

B. 4 segments

C. 5 segments

D. 6 segments

# PRACTICE EXAM 3 — ANSWER KEY AND FULL EXPLANATIONS

**SUBTEST 1 — MATHEMATICAL USAGE (Questions 1–46)**

1. **C** — 12. The square root of 144 is 12 because 12 × 12 = 144. Recognizing common perfect squares — including 121, 144, 169, 196, and 225 — provides instant recognition on Math Sprint questions involving square roots.

2. **A** — 750 gallons. Set up the proportion: 360/12 = x/25. Cross-multiply: 12x = 9,000, so x = 750 gallons. Direct proportional reasoning handles steady-rate flow problems reliably.

3. **B** — 130. Use the 10% anchor: 10% of 200 = 20, so 60% = 120 and 5% = 10. Add: 120 + 10 = 130. The anchor method is the fastest mental approach for percentage calculations.

4. **D** — $780. Multiply $26 × 30 hours = $780. Use decomposition: 26 × 30 = 26 × 3 × 10 = 78 × 10 = 780. Mental decomposition is faster than long multiplication for two-digit problems.

5. **A** — 345 minutes. Convert 5 hours to 300 minutes, then add 45 minutes: 300 + 45 = 345 minutes. Time conversions involving mixed units must be handled by converting to a common unit first.

6. **C** — 7. Add 18 to both sides: 7x = 49. Divide by 7: x = 7. The standard two-step pattern handles every linear equation: undo addition first, then undo multiplication.

7. **A** — 75 feet. Multiply 25 yards × 3 feet per yard = 75 feet. The conversion factor of 3 feet per yard should be at the level of automatic recall.

8. **B** — 13/12. Find a common denominator of 12: 5/6 = 10/12 and 1/4 = 3/12. Add: 10/12 + 3/12 = 13/12. The result is an improper fraction, which is acceptable when it cannot be simplified to a smaller form.

9. **D** — 600. Convert 2,400 RPM to revolutions per second: 2,400 / 60 = 40 revolutions per second. In 15 seconds: 40 × 15 = 600 revolutions. Recognizing the unit conversion embedded in the problem is the key step.

10. **C** — 12 hours. This is an inverse proportion: workers × hours = constant. So 9 × 16 = 12 × x, giving 144 = 12x and x = 12 hours. More workers means less time, which is the inverse-proportion signature.

11. **A** — 0.42. Multiply 0.6 × 0.7 = 0.42. Count two decimal places in the original numbers and place the decimal point that many places from the right in the answer.

12. **B** — 119 gallons. Multiply 14 gallons per hour × 8.5 hours = 119 gallons. Use decomposition: 14 × 8 = 112, then add 14 × 0.5 = 7, giving 119 total.

13. **D** — 3/8. The decimal 0.375 equals 375/1000, which simplifies to 3/8 by dividing both by 125. Memorizing the common decimal-fraction equivalences makes these conversions instant.

14. **B** — $722. Multiply $19 × 38 hours = $722. Use decomposition: 19 × 38 = 20 × 38 − 1 × 38 = 760 − 38 = 722. The round-and-adjust method is fast for multiplication near round numbers.

15. **C** — 400. Use the × 25 shortcut: multiply by 100 and divide by 4. So 16 × 25 = 1,600 / 4 = 400. The × 25 mental math shortcut is one of the highest-leverage patterns to internalize.

16. **A** — 254 feet. Multiply 110 PSI × 2.31 feet of water per PSI ≈ 254 feet. The pressure-to-water-column conversion factor is a core plant operations equivalence used frequently in hydrostatic calculations.

17. **D** — 7. Subtract 4n from both sides: 25 = n + 18. Subtract 18: n = 7. Equations with variables on both sides require collecting variable terms on one side first before applying the standard solving pattern.

18. **B** — 34. Add the five numbers: 16 + 24 + 38 + 42 + 50 = 170. Divide by 5 = 34. Average problems require summing all values and dividing by the count.

19. **C** — 6,300 gallons. Convert 1 hour 24 minutes to 84 minutes total. Multiply 75 gallons per minute × 84 minutes = 6,300 gallons. Always convert mixed time units to a single unit before applying the rate.

20. **A** — 9. The square root of 81 is 9 because 9 × 9 = 81. Memorization of perfect squares from 1 to 15 enables instant recognition on Math Sprint questions.

21. **D** — 5 hours. Use T = D / R = 325 / 65 = 5 hours. The DRT formula handles every distance-rate-time problem reliably regardless of which variable is the unknown.

22. **C** — 36. Multiply 3/8 × 96 = (3 × 96) / 8 = 288 / 8 = 36. Recognizing that 96 / 8 = 12, the calculation simplifies to 3 × 12 = 36 — even faster.

23. **B** — 900 gallons. Multiply 0.75 × 1,200 = 900 gallons. Recognize that 75% is 3/4, so 3/4 × 1,200 = 900. The "of" in percentage problems always signals multiplication.

24. **A** — 89.76 gallons. Multiply 12 × 7.48 = 89.76 gallons. Use decomposition: 12 × 7 = 84, then 12 × 0.48 = 5.76, giving 89.76 total. The conversion factor 1 cubic foot = 7.48 gallons is a memorized plant operations equivalence.

25. **B** — 12. Recognize that 14 × 12 = 168, so 168 / 14 = 12. Memorization of multiplication tables allows for instant division recognition.

26. **A** — 216 cubic feet. Volume = length × width × height = 9 × 6 × 4 = 216 cubic feet. Compute by stages: 9 × 6 = 54, then 54 × 4 = 216.

27. **C** — 100. If x increased by 30% equals 130, then 1.30x = 130, so x = 130 / 1.30 = 100. Always identify the original quantity before applying the percentage relationship.

28. **D** — 82. Move the decimal points: 24.6 / 0.3 = 246 / 3 = 82. Decimal division is simplified by shifting decimal points equally to make the divisor a whole number.

29. **B** — 20 gallons. Set up the proportion: 9 water / 2 chemical = 90 / x. Cross-multiply: 9x = 180, so x = 20 gallons. Cross-multiplication is the universal solving technique for ratio problems.

30. **A** — 1/4. Find a common denominator of 12: 7/12 − 4/12 = 3/12 = 1/4. Always simplify the final fraction to its lowest terms.

31. **C** — 1,320 RPM. A 12% decrease means the new speed is 88% of the original: 1,500 × 0.88 = 1,320 RPM. Always apply the percentage change to the original value.

32. **D** — 6. Distribute first: 6y − 15 = 21. Add 15: 6y = 36. Divide: y = 6. Equations with parentheses require distribution before applying the standard two-step solving pattern.

33. **B** — 50. Find 25% of 800 = 200, then 25% of 200 = 50. Compound percentages of percentages are computed sequentially, applying each percentage to the result of the previous step.

34. **A** — 1,500 minutes. 5 hours per day × 60 minutes per hour = 300 minutes per day. Over 5 days: 300 × 5 = 1,500 minutes. Multi-step conversions can be combined efficiently.

35. **D** — 72. Compute $4^3 = 64$ and $2^3 = 8$. Sum: 64 + 8 = 72. Cube each number separately, then add the results.

36. **C** — 60. If 36 = 0.60 × x, then x = 36 / 0.60 = 60. The setup "Whole = Part / Percentage" handles this category of percentage question reliably.

37. **A** — 35 gallons per hour. Calculate the change: 1,200 − 850 = 350 gallons consumed. Divide by time: 350 / 10 = 35 gallons per hour. Average rate is total change divided by total time.

38. **D** — 1/12. Convert to common denominator of 12: 11/12 − 10/12 = 1/12. Always simplify the final fraction to lowest terms before selecting an answer.

39. **C** — $1,375. Regular pay: 40 × $25 = $1,000. Overtime hours: 50 − 40 = 10. Overtime pay: 10 × $37.50 = $375. Total: $1,000 + $375 = $1,375. Multi-step word problems require careful sequential execution.

40. **B** — 58 feet. Perimeter of a rectangle = 2 × (length + width) = 2 × (18 + 11) = 2 × 29 = 58 feet. Doubling the sum of length and width is faster than adding all four sides individually.

41. **D** — 50.24 square inches. Area of a circle = π × r². Radius = 8 / 2 = 4 inches. Area = 3.14 × 16 = 50.24 square inches. The diameter must be halved to find the radius before applying the area formula.

42. **A** — 2/5. The decimal 0.4 equals 4/10, which simplifies to 2/5 by dividing both by 2. This is one of the common fraction-to-decimal equivalences used across Math Sprint problems.

43. **C** — 90°F. Subtract: 145 − 55 = 90°F. Temperature change is the difference between final and initial temperatures, with units staying the same.

44. **B** — 20 minutes. Combined flow rate: 40 + 60 = 100 gallons per minute. Time to fill: 2,000 / 100 = 20 minutes. Pump rates add when pumps work together to produce combined output.

45. **A** — 42. Use the 10% anchor: 10% of 600 = 60. Then 1% = 6, so 7% = 42. The anchor method handles uncommon percentages by combining or subtracting from familiar ones.

46. **C** — 55. Substitute x = 5 and y = 3: 2(25) + 3(3) − 4 = 50 + 9 − 4 = 55. Apply the order of operations strictly — exponents first, then multiplication, then addition and subtraction.

**SUBTEST 2 — MECHANICAL CONCEPTS (Questions 47–90)**

47. **A** — 150 pounds. Apply the law of the lever: Effort × Effort Arm = Load × Load Arm. So Effort × 9 = 450 × 3, giving Effort = 1,350 / 9 = 150 pounds. The mechanical advantage of 3 reduces the required force by a factor of 3.

48. **C** — Counterclockwise at one-third the speed. Meshing gears always rotate in opposite directions, and the gear ratio determines speed: 24/72 = 1/3. So the larger gear rotates counterclockwise at one-third the speed of the smaller driver gear.

49. **B** — 1,000 pounds. Calculate the pressure: P = F/A = 100/5 = 20 PSI. Apply this pressure to the output piston: F = P × A = 20 × 50 = 1,000 pounds. Hydraulic mechanical advantage equals the ratio of piston areas (50/5 = 10× force multiplier).

50. **A** — 300 pounds. The mechanical advantage of a block-and-tackle equals the number of rope segments supporting the load: MA = 6. Force required = Load / MA = 1,800 / 6 = 300 pounds. Each rope segment shares an equal portion of the load.

51. **D** — 20 feet per second. Apply the continuity equation: $A_1V_1 = A_2V_2$, so 12 × 5 = 3 × $V_2$, giving $V_2$ = 20 feet per second. Fluid speeds up when pipe area decreases because the same volume must pass through the smaller cross-section.

52. **C** — 6. Mechanical advantage of a wheel-and-axle = Wheel Radius / Axle Radius = 30 / 5 = 6. A force applied at the rim of the larger wheel is multiplied at the rim of the smaller axle by the radius ratio.

53. **A** — Pressure transmits equally throughout the fluid. This is Pascal's law, the foundational principle of all hydraulic systems. Pressure exists at every point in the connected fluid simultaneously, regardless of distance or path direction.

54. **D** — 500 RPM. Driven RPM = (Driver Diameter / Driven Diameter) × Driver RPM = (5/15) × 1,500 = (1/3) × 1,500 = 500 RPM. A larger driven pulley turns more slowly than a smaller driver by the same ratio as their diameters.

55. **B** — 4. Mechanical advantage of a wedge = Length / Thickness = 16 / 4 = 4. Long, thin wedges have higher mechanical advantage than short, thick wedges and require less driving force to split material.

56. **C** — A hollow perforated ball that rotates 90°. Ball valves use a hollow ball with a hole through it that rotates 90° to open or close the flow path. They are quick-acting and produce very low pressure drop when fully open.

57. **B** — 180 PSI. Apply Boyle's law: $P_1V_1 = P_2V_2$, so $60 \times 12 = P_2 \times 4$, giving $720 = 4P_2$ and $P_2 = 180$ PSI. Compressing a gas to one-third of its original volume triples its pressure at constant temperature.

58. **A** — 5. Mechanical advantage of a ramp = Length / Height = 20 / 4 = 5. A long, gradual ramp produces high mechanical advantage; a short, steep ramp produces low mechanical advantage.

59. **C** — Do not slip and transmit positive motion. Chain drives use mechanical engagement between sprocket teeth and chain links, eliminating the slippage that can occur with belt drives. This makes chains preferred for high-load and positive-motion applications.

60. **B** — A perfect vacuum. Absolute zero PSI corresponds to a complete absence of pressure — that is, a perfect vacuum. Gauge pressure is measured relative to atmospheric, but absolute pressure is measured relative to a perfect vacuum.

61. **D** — Decreases progressively. The pump curve of a centrifugal pump shows an inverse relationship between pressure and flow: as back pressure rises, the flow rate the pump can deliver drops correspondingly. This is fundamental to centrifugal pump behavior.

62. **A** — The load between the fulcrum and the effort. A wheelbarrow is the classic example: the wheel is the fulcrum, the load sits in the bed, and the operator lifts the handles. Second-class levers always produce mechanical advantage greater than 1.

63. **B** — 32.5 PSI. Use the conversion 1 foot of water ≈ 0.433 PSI. Multiply $75 \times 0.433 = 32.475$ PSI ≈ 32.5 PSI. The hydrostatic pressure depends on the height of the column, not on the volume or shape of the container.

64. **D** — Equal to the force divided by the mass. Newton's second law states $F = m \times a$, which can be rearranged as $a = F/m$. The same force produces less acceleration on a more massive object than on a less massive one.

65. **C** — Prevent reverse flow when a pump stops. Check valves allow fluid to flow in only one direction and close automatically when flow reverses. Without a check valve, fluid would flow backward through a stopped pump and could damage the impeller and drive system.

66. **A** — 400 RPM. The gear ratio is 54/18 = 3, meaning the driven gear rotates at one-third the speed of the driver. So 1,200 / 3 = 400 RPM. The driven gear with more teeth always rotates more slowly than the driver gear.

67. **D** — The product of force and distance is conserved across input and output. Every simple machine obeys this conservation principle. Mechanical advantage trades force for distance — you can multiply force, or you can multiply distance, but never both simultaneously.

68. **B** — 100 pounds. Mechanical advantage of the ramp = 16 / 4 = 4. Required force = Load / MA = 400 / 4 = 100 pounds. The ramp reduces the required force by a factor equal to its mechanical advantage.

69. **C** — The acceleration due to gravity. In the formula W = m × g, the variable g represents the acceleration due to gravity, approximately 9.8 m/s² or 32.2 ft/s² on Earth's surface. Weight equals mass multiplied by gravitational acceleration.

70. **D** — Rapid heating of the trapped fluid. When a centrifugal pump runs against a closed valve, the impeller continues adding energy to fluid that cannot escape, causing rapid temperature rise that can damage seals and vaporize the fluid.

71. **A** — Is proportional to the normal force pressing them together. Friction depends directly on the normal force pressing the surfaces together — a heavier object on the same surface experiences more friction than a lighter one.

72. **B** — 1. A single fixed pulley changes the direction of force but does not multiply it — the input and output forces are equal. The mechanical advantage of 1 means you must pull with the same force as the load weight.

73. **D** — Faster than the driver. When the driven gear has fewer teeth than the driver, the gear ratio is less than 1 and the driven gear rotates faster while producing less torque. Speed and torque are inversely related in any gear system.

74. **B** — Expand significantly along its length. Most materials, including steel, expand when heated and contract when cooled. This is why piping systems incorporate expansion loops, expansion joints, and slip fittings to safely accommodate thermal expansion.

75. **C** — Newton's first law (inertia). Newton's first law states that an object at rest stays at rest and an object in motion stays in motion at constant velocity unless acted on by an external force. This is the principle of inertia.

76. **A** — 8. Mechanical advantage = Output Force / Input Force = 240 / 30 = 8. The lever multiplies the input force by a factor of 8, with a corresponding cost in distance.

77. **D** — Support the shaft while reducing friction through a lubricating film. Sleeve bearings support rotating shafts on a thin film of lubricating oil that prevents direct metal-to-metal contact. The lubricating film is what minimizes friction during operation.

78. **C** — Hydraulic fluid is essentially incompressible. Liquids barely change volume when pressure is applied, allowing pressure to transmit instantaneously throughout the fluid. Gases would compress and absorb energy, producing sluggish response.

79. **B** — Speed up to maintain consistent volume flow. By the continuity equation, when pipe area decreases at a constant flow rate, the fluid velocity must increase proportionally. The same volume must pass through the smaller cross-section in the same time.

80. **D** — The wedging action increases friction and grip. The trapezoidal cross-section of a V-belt wedges into matching pulley grooves, creating significantly more friction and contact force than a flat belt could produce on a flat pulley face.

81. **B** — Convection. Heat transfer through the bulk movement of a fluid is convection. Conduction requires direct contact through solid materials, and radiation involves electromagnetic waves through space.

82. **A** — 300 RPM. Driven sprocket RPM = (Driver Teeth / Driven Teeth) × Driver RPM = (20/40) × 600 = 0.5 × 600 = 300 RPM. Larger sprockets rotate more slowly than smaller ones connected by the same chain.

83. **C** — The object's inertia attempting to maintain straight-line motion. The apparent outward force on a rotating object is the result of inertia — the object's natural tendency to travel in a straight line is constrained by the centripetal force pulling it toward the center.

84. **B** — Some shaft misalignment is expected during operation. Flexible couplings tolerate small shaft misalignments without damaging bearings or transmitting harmful vibrations. Rigid couplings require precise alignment but transmit motion without flexibility.

85. **D** — Latent heat. Energy absorbed during a phase change without temperature change is latent heat. The two main forms are latent heat of fusion (solid-to-liquid transition) and latent heat of vaporization (liquid-to-gas transition).

86. **A** — Catastrophic equipment failure from overpressure. A failed pressure relief valve allows system pressure to continue rising past the safety setpoint, potentially causing rupture, explosion, or other catastrophic equipment failure. This is why relief valves are required on every pressurized system.

87. **C** — The total fluid volume must be conserved. The fluid is incompressible, so the volume displaced from the small piston must equal the volume filling the large piston. Since the large piston has more area, the small piston must move farther for the same fluid volume.

88. **B** — 1,800 RPM. Fan RPM = (Motor Pulley Diameter / Fan Pulley Diameter) × Motor RPM = (6/4) × 1,200 = 1.5 × 1,200 = 1,800 RPM. A smaller driven pulley rotates faster than a larger driver pulley.

89. **A** — The pressure above the water surface. Water boils at 212°F at sea-level atmospheric pressure, but at higher pressures the boiling point rises significantly. Power plant boilers exploit this principle to heat water to 545°F or higher without flashing into vapor.

90. **D** — Longer pipe length and rougher interior. Friction loss in piping increases with longer length, smaller diameter, higher flow rates, and rougher interior surfaces. These variables determine the pressure drop a pump must overcome to move fluid through the system.

**SUBTEST 3 — READING COMPREHENSION (Questions 91–126)**

91. **D** — Minimize steam leakage between turbine regions. The opening sentence states this directly: steam turbine seals are "designed to minimize the leakage of steam from the high-pressure regions of the turbine into lower-pressure areas or into the atmosphere."

92. **B** — Labyrinth seal. The passage states explicitly that "the most common seal type used in modern utility turbines is the labyrinth seal." This is a direct factual statement that supports the answer.

93. **A** — Creating a tortuous path that progressively reduces steam pressure. The passage describes labyrinth seals as creating "a tortuous path for any escaping steam," with steam losing "pressure progressively at each successive knife-edge."

94. **C** — Twisting and complex. In the context of a steam path through closely spaced metal teeth, "tortuous" describes a winding, complex route. The other definitions do not match the geometric meaning the passage uses.

95. **B** — They do not wear and require essentially no routine maintenance. The passage states that "labyrinth seals do not contact the rotating shaft" and "do not wear during operation under normal conditions and require essentially no routine maintenance."

96. **D** — Explain how steam turbine labyrinth seals function and are monitored. The passage describes the seal mechanism, behavior, and monitoring methods without arguing for changes or comparing alternatives. It is an explanatory description.

97. **A** — Steam consumption, gland steam pressure, and bearing temperature. The passage states explicitly that operators monitor seal performance through "observations of steam consumption, gland steam pressure, and the temperature of bearings adjacent to the seal regions."

98. **C** — Reduce nitrogen oxide emissions. The passage states that selective catalytic reduction units "reduce nitrogen oxide emissions by injecting ammonia into the flue gas stream and passing the mixture over a catalyst bed."

99. **B** — Spraying limestone or lime slurry into the gas stream. The passage describes flue gas desulfurization scrubbers as "spraying a slurry of limestone or lime into the gas stream, where the sulfur compounds react with the calcium and form a solid precipitate."

100. **A** — Electrostatic precipitators or fabric filter baghouses. The passage states that "particulate control is typically accomplished through electrostatic precipitators or fabric filter baghouses."

101. **C** — An amount that goes beyond a permitted limit. In the regulatory context of "exceedance of permit limits," the word means an excess beyond the allowed amount. This is the precise regulatory meaning of "exceedance."

102. **B** — They can result in significant penalties and damage to reputation. The passage states that "failure to maintain environmental compliance can result in significant penalties, regulatory enforcement actions, and damage to the utility's public reputation."

103. **D** — Informative and authoritative. The passage describes systems and consequences in a neutral, authoritative manner without arguing or critiquing. It uses the prescriptive tone of regulatory documentation.

104. **A** — Emissions monitors and process instrumentation. The passage states that operators "must monitor environmental control performance continuously through emissions monitors and process instrumentation."

105. **C** — Supply direct current to magnetize the rotor. The opening sentence states this directly: the excitation system "supplies the direct current necessary to magnetize the rotor of a synchronous generator."

106. **D** — Cannot produce voltage at its terminals. The passage states that "without proper excitation, a generator cannot produce voltage at its terminals, regardless of how fast it is rotating."

107. **B** — Draw excitation power from the generator's own output. The passage describes static excitation systems as drawing "the excitation power from the generator's own output, processed through power electronic rectifiers."

108. **C** — Offset or counterbalance. In the context of "the regulator increases excitation to compensate" for changes in load, the word means to offset or counterbalance the effect of the load change.

109. **C** — It continuously responds to changes in generator load. The passage states that the regulator "continuously adjusts the rotor field current to maintain generator terminal voltage at the desired setpoint despite changes in load."

110. **A** — Describe how generator excitation systems function. The passage explains the mechanism, types, and behavior of excitation systems without arguing or comparing costs. It is a descriptive overview.

111. **D** — Generator instability and potential damage. The passage states that loss of excitation "can lead to generator instability, unwanted absorption of reactive power from the grid, and potential damage to the generator if not corrected quickly."

112. **B** — Continuously monitor and direct all aspects of plant operation. The passage states this directly: operators in the control room "continuously monitor and direct all aspects of plant operation, from boiler and turbine performance to auxiliary system status and grid synchronization."

113. **C** — Large display systems presenting real-time operating data. The passage states that "modern control rooms feature large display systems that present real-time operating data, alarms, and trend information drawn from thousands of sensors throughout the plant."

114. **A** — Technical knowledge, situational awareness, and disciplined communication. The passage states these explicitly: effective operation requires "technical knowledge of plant systems but also strong situational awareness, the ability to prioritize during multiple simultaneous events, and disciplined communication."

115. **D** — The central command and coordination point. The passage uses "nerve center" to describe the control room as the operational hub of the plant, where all information converges and all major decisions are made.

116. **B** — Two operators provide a check on each other's actions. The passage states that two operators "share monitoring duties and serve as a check on each other's actions." This redundancy supports operational safety.

117. **A** — Informative and descriptive. The passage describes control room features and operations in a neutral, factual manner without arguing or critiquing. It is straightforwardly informative.

118. **B** — The central point for managing emergency response and coordinating with emergency services. The passage states that "the control room also serves as the central point for managing emergency response, coordinating with emergency services if needed."

119. **D** — Alert the control room with a clear description. The passage states this directly: "the first action of any operator who discovers it is to alert the control room and provide a clear, accurate description of the situation."

120. **A** — Routine equipment maintenance scheduling. The passage lists fires, equipment failures, hazardous material releases, severe weather, and security threats — but never mentions routine maintenance. EXCEPT questions require careful elimination of the items the passage actually mentions.

121. **C** — Test personnel's ability to execute the plan under realistic conditions. The passage states that drills "test their ability to execute the plan under realistic conditions." This is the explicit purpose of the drills.

122. **B** — Carry out or perform. In the context of executing the emergency response plan, the word means to carry out or perform the planned actions. This is the operational meaning of execute.

123. **D** — It must use standardized terminology to prevent confusion. The passage states that "clear, concise messages using standardized terminology prevent confusion and ensure that all response personnel are working from the same understanding."

124. **A** — Describe how power plants prepare for and respond to emergencies. The passage outlines preparation, training, response, and follow-up activities in a descriptive manner, without arguing or critiquing.

125. **C** — Conducts a thorough investigation to identify the root cause. The passage states that "after the immediate response is complete, the plant conducts a thorough investigation to identify the root cause of the emergency."

126. **D** — Shared across the utility and the broader industry. The passage states that "lessons learned are shared across the utility and, where appropriate, with the broader industry to improve preparedness and response effectiveness."

**SUBTEST 4 — FIGURAL REASONING (Questions 127–146)**

127. **A** — Circle. The pattern cycles through circle, triangle, square, pentagon. After four shapes, the cycle repeats from the beginning, so Frame 5 returns to circle. Cyclical patterns return to the start after one complete iteration.

128. **C** — 5 lines. The pattern adds one diagonal line per frame: 1, 2, 3, 4, then 5. Each successive frame contains exactly one additional line, making the addition rule consistent and predictable.

129. **B** — Large empty circle. The transformation in the top row is "small to large" (size change). The transformation in the left column is "filled to empty" (color change). Combining both, the bottom-right must be a large empty circle.

130. **D** — At 8. The hour hand advances 60° clockwise per frame: starting at 12, then to 2, 4, 6, and 8. Each frame moves the hand to the next position in the cycle, advancing 60° (which corresponds to 2 hours on a 12-hour clock face).

131. **A** — Arrow pointing down. The transformation in the top row is "rotate 90° clockwise" (up becomes right). Applying this same transformation to the bottom row, the leftward arrow rotates 90° clockwise to become a downward arrow.

132. **C** — 24 points. The pattern doubles the number of points each frame: 3, 6, 12, then 24. Each successive frame doubles the previous frame's count.

133. **B** — A large triangle. The grid pattern shows triangles of increasing size from top to bottom (small, medium, large). The bottom row already contains large triangles, so the missing third cell must also be a large triangle to maintain the pattern.

134. **A** — 120°. The shape rotates 30° clockwise per frame: 0°, 30°, 60°, 90°, then 120°. Each successive frame adds another 30° to the cumulative rotation.

135. **D** — Square inside square (two concentric squares). The transformation in the top row is "single shape becomes two concentric shapes of the same type." Applying this same transformation to the bottom row, the single square becomes two concentric squares.

136. **B** — 10 dots. The pattern adds 2 dots per frame: 2, 4, 6, 8, then 10. The arithmetic progression of +2 per frame makes Frame 5 contain 10 dots.

137. **D** — A vertical line crossed by a horizontal line (a plus sign). The transformation in the top row is "single horizontal line becomes a plus sign." Applying this same transformation to the bottom row, the single vertical line becomes a vertical line crossed by a horizontal line — a plus sign.

138. **A** — Fully black triangle. The pattern shows progressive darkening from white through gray shades. Frame 5 continues the trend by reaching fully black, completing the color gradient transformation.

139. **C** — Fully filled pentagon. The pattern shows increasing fill levels from left to right within each row: empty, half-filled, fully filled. The bottom row already has empty and half-filled pentagons, so the missing third position must be a fully filled pentagon.

140. **B** — Striped. The pattern alternates striped and dotted: striped, dotted, striped, dotted, striped. Frame 5 follows the alternation by returning to striped.

141. **C** — Three small squares arranged in a triangle. The transformation in the top row is "one becomes three arranged in a triangle pattern." Applying this same transformation to the bottom row, one small square becomes three small squares arranged in a triangle.

142. **B** — 4 lines. The pattern adds one internal line per frame: 0, 1, 2, 3, then 4. Each successive frame adds exactly one more line inside the pentagon, making the addition rule consistent.

143. **D** — Black circle. The transformation in the top row is "white to black" (color change). Applying this same transformation to the bottom row, the white circle becomes a black circle. The shape stays consistent within each row; only the color changes.

144. **A** — At 12. The minute hand advances 180° per frame, alternating between 12 and 6: 12, 6, 12, 6, then 12. Frame 5 follows the alternation by returning to 12.

145. **C** — A pentagon (5 sides). The pattern within each row adds one side: triangle (3), square (4), then pentagon (5). The bottom row continues this progression with a pentagon as the third element.

146. **D** — 6 segments. The pattern adds one segment per frame: 2, 3, 4, 5, then 6. Each successive frame contains one more equal segment than the previous frame, making the addition rule predictable.