PRACTICE EXAM 6: POSS SIMULATION

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 25^2?

A. 525

B. 600

C. 625

D. 675

2. A pump moves 360 gallons in 9 minutes. How many gallons does it move in 24 minutes at the same rate?

A. 960 gallons

B. 800 gallons

C. 1,000 gallons

D. 1,080 gallons

3. What is 70% of 90?

A. 54

B. 56

C. 60

D. 63

4. Solve for x: $5x + 8 = 43$

A. 6

B. 7

C. 8

D. 9

5. Convert 7 hours and 15 minutes to total minutes.

A. 405 minutes

B. 415 minutes

C. 425 minutes

D. 435 minutes

6. A pipe is 168 inches long. How many feet is that?

A. 14 feet

B. 12 feet

C. 16 feet

D. 18 feet

7. What is 7/8 + 1/6 expressed as a fraction in simplest form?

A. 8/14

B. 22/24

C. 25/24

D. 1 1/4

8. A motor runs at 900 RPM. How many revolutions does it complete in 20 seconds?

A. 250

B. 300

C. 350

D. 400

9. If 14 workers complete a project in 12 days, how many days would 21 workers take to complete the same project?

A. 8 days

B. 9 days

C. 10 days

D. 7 days

10. What is 0.45 × 0.6?

A. 0.20

B. 0.25

C. 0.27

D. 0.30

11. A storage tank gains 19 gallons of fluid per hour. How many gallons does it gain in 7.5 hours?

A. 130 gallons

B. 138 gallons

C. 145 gallons

D. 142.5 gallons

12. Which fraction is equivalent to 0.625?

A. 3/8

B. 5/8

C. 7/12

D. 4/9

13. A worker is paid $32 per hour. What are the gross earnings for 28 hours?

A. $896

B. $912

C. $876

D. $850

14. What is 28 × 25?

A. 600

B. 650

C. 680

D. 700

15. A pressure gauge reads 130 PSI. How many feet of water column does this represent? (Use 1 PSI = 2.31 feet of water.)

A. 270 feet

B. 300.3 feet

C. 320 feet

D. 350 feet

16. Solve for n: $7n - 11 = 5n + 13$

A. 8

B. 10

C. 12

D. 14

17. What is the average of 20, 25, 35, 40, and 50?

A. 34

B. 36

C. 32

D. 38

18. A pump's output is 95 gallons per minute. How many gallons does it produce in 1 hour and 36 minutes?

A. 8,200 gallons

B. 8,800 gallons

C. 9,000 gallons

D. 9,120 gallons

19. What is the square root of 256?

A. 14

B. 16

C. 18

D. 20

20. A truck travels at 60 miles per hour. How long does it take to travel 390 miles?

A. 5.5 hours

B. 6 hours

C. 6.5 hours

D. 7 hours

21. What is 4/9 of 81?

A. 36

B. 30

C. 32

D. 40

22. A water tank is 85% full. If the tank holds 2,000 gallons total, how many gallons of water are in the tank?

A. 1,500 gallons

B. 1,600 gallons

C. 1,650 gallons

D. 1,700 gallons

23. Convert 36 quarts to gallons. (Use 1 gallon = 4 quarts.)

A. 6 gallons

B. 8 gallons

C. 9 gallons

D. 10 gallons

24. What is 264 ÷ 24?

A. 10

B. 11

C. 12

D. 13

25. A rectangular tank is 14 feet long, 9 feet wide, and 6 feet deep. What is its volume?

A. 720 cubic feet

B. 756 cubic feet

C. 800 cubic feet

D. 840 cubic feet

26. If a number is increased by 75% to give a result of 245, what is the original number?

A. 130

B. 145

C. 150

D. 140

27. What is the result of 35.7 ÷ 0.7?

A. 51

B. 50

C. 53

D. 55

28. A chemical mixing tank uses water and chemical in an 8:3 ratio. If 96 gallons of water are used, how many gallons of chemical are needed?

A. 30 gallons

B. 32 gallons

C. 36 gallons

D. 40 gallons

29. What is 5/6 ÷ 1/3 expressed as a fraction in simplest form?

A. 5/18

B. 5/2

C. 1/2

D. 3/5

30. A motor's speed increases by 35%. If the original speed was 1,000 RPM, what is the new speed?

A. 1,200 RPM

B. 1,250 RPM

C. 1,300 RPM

D. 1,350 RPM

31. Solve for y: $4(y + 5) = 36$

A. 4

B. 5

C. 6

D. 7

32. What is 24% of 150?

A. 30

B. 32

C. 36

D. 40

33. A pump operates 9 hours per day. How many minutes does it operate over a 6-day week?

A. 3,000 minutes

B. 3,240 minutes

C. 3,360 minutes

D. 3,500 minutes

34. What is the value of 2^5?

A. 16

B. 24

C. 28

D. 32

35. If 90 is 45% of a number, what is the number?

A. 200

B. 220

C. 250

D. 270

36. A fuel tank holds 1,800 gallons. After a 9-hour shift, the level has dropped to 1,395 gallons. What is the average consumption rate per hour?

A. 35 gallons per hour

B. 40 gallons per hour

C. 42 gallons per hour

D. 45 gallons per hour

37. What is 5/8 × 4/15 expressed as a fraction in simplest form?

A. 1/8

B. 2/9

C. 1/6

D. 3/8

38. A worker earns $35 per hour for the first 40 hours and $52.50 per hour for overtime. What are the total earnings for a 49-hour week?

A. $1,820

B. $1,872.50

C. $1,950

D. $2,000

39. What is the perimeter of a rectangle that is 24 feet long and 16 feet wide?

A. 80 feet

B. 76 feet

C. 88 feet

D. 90 feet

40. A pipe with a 14-inch diameter has a cross-sectional area of approximately how many square inches? (Use $\pi \approx 3.14$.)

A. 110 square inches

B. 130 square inches

C. 140 square inches

D. 153.86 square inches

41. What is 0.8 expressed as a fraction in simplest form?

A. 5/9

B. 7/12

C. 4/5

D. 6/11

42. A boiler heats water from 75°F to 235°F. What is the temperature increase?

A. 140°F

B. 160°F

C. 180°F

D. 200°F

43. Two pumps work together to fill a tank. Pump A delivers 45 gallons per minute and Pump B delivers 75 gallons per minute. How long will it take both pumps together to fill a 2,400-gallon tank?

A. 12 minutes

B. 15 minutes

C. 18 minutes

D. 20 minutes

44. What is 5% of 920?

A. 46

B. 48

C. 50

D. 52

45. A 192-foot length of pipe is cut into sections that are each 8 feet long. How many full sections can be cut?

A. 22 sections

B. 23 sections

C. 24 sections

D. 26 sections

46. If $x = 4$ and $y = 2$, what is the value of $3x^2 - y^3 + 6$?

A. 38

B. 46

C. 50

D. 56

SUBTEST 2 — MECHANICAL CONCEPTS

44 questions | 20 minutes | Pictorial questions

47. A first-class lever has a fulcrum 5 feet from a 400-pound load and 10 feet from the effort. What force is required to balance the load?

A. 50 pounds

B. 100 pounds

C. 150 pounds

D. 200 pounds

48. Two meshing gears have 20 and 80 teeth. If the smaller gear rotates clockwise at 800 RPM, the larger gear rotates:

A. Counterclockwise at 3,200 RPM

B. Counterclockwise at 200 RPM

C. Clockwise at 200 RPM

D. Clockwise at 3,200 RPM

49. A hydraulic system has an input piston of 3 square inches and an output piston of 75 square inches. If 80 pounds of force is applied to the input, what force is produced at the output?

A. 1,000 pounds

B. 1,500 pounds

C. 2,000 pounds

D. 2,500 pounds

50. In a block-and-tackle system with 7 supporting rope segments, what force is required to lift a 2,800-pound load (ignoring friction)?

A. 400 pounds

B. 350 pounds

C. 500 pounds

D. 700 pounds

51. Water flows through a 30-square-inch pipe at 4 feet per second. The pipe narrows to 6 square inches. What is the new water velocity?

A. 12 feet per second

B. 15 feet per second

C. 18 feet per second

D. 20 feet per second

52. A wheel-and-axle system has a wheel radius of 28 inches and an axle radius of 4 inches. What mechanical advantage does it provide?

A. 6

B. 7

C. 8

D. 9

53. According to Pascal's law, in a confined incompressible fluid:

A. Pressure transmits equally in all directions throughout the fluid

B. Pressure is concentrated at the largest pipe opening

C. Pressure decreases as it moves through the fluid

D. Pressure exists only in the direction of fluid flow

54. A 5-inch driver pulley turns at 2,000 RPM and is connected by a belt to a 10-inch driven pulley. What is the speed of the driven pulley?

A. 4,000 RPM

B. 2,000 RPM

C. 1,000 RPM

D. 1,500 RPM

55. A wedge that is 14 inches long and 2 inches thick at the wide end has a mechanical advantage of:

A. 4

B. 5

C. 6

D. 7

56. A check valve uses what mechanism to prevent backflow?

A. A motorized actuator that closes when commanded

B. A hinged flap or spring-loaded element that closes automatically

C. An external operator who manually closes it

D. A pneumatic piston that detects pressure changes

57. A pneumatic tank contains 60 cubic feet of air at 75 PSI. If the air is compressed to 20 cubic feet at constant temperature, what is the new pressure?

A. 225 PSI

B. 300 PSI

C. 150 PSI

D. 180 PSI

58. A loading ramp is 18 feet long and rises 6 feet. What is its mechanical advantage?

A. 2

B. 4

C. 3

D. 6

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

A. Transmit positive motion without slipping

B. Are quieter under all operating conditions

C. Cost less to install in all applications

D. Operate without any mechanical contact

60. The hydrostatic pressure at the base of a fluid column depends on:

A. The width of the container at the base

B. The shape of the container

C. The temperature of the fluid above

D. The height of the column and the fluid density

61. As back pressure on a centrifugal pump rises:

A. Flow rate increases proportionally with pressure

B. Flow rate decreases progressively

C. Flow rate remains exactly constant

D. Flow rate fluctuates randomly

62. A second-class lever produces a mechanical advantage that is:

A. Always greater than 1

B. Always less than 1

C. Always equal to 1

D. Equal to zero

63. A vertical column of water 90 feet tall produces a pressure at its base of approximately:

A. 35 PSI

B. 32 PSI

C. 38.97 PSI

D. 45 PSI

64. According to Newton's second law of motion, a force applied to an object produces:

A. No effect unless the object is initially at rest

B. The same acceleration regardless of object mass

C. An acceleration only in the horizontal plane

D. An acceleration equal to force divided by mass

65. The primary purpose of a check valve in a pump discharge line is to:

A. Throttle the discharge flow to a precise rate

B. Prevent reverse flow when the pump stops

C. Filter contaminants from the discharge fluid

D. Provide overpressure protection for the pump

66. Two meshing gears: the driver has 45 teeth and the driven has 15 teeth. If the driver rotates at 200 RPM, the driven rotates at:

A. 600 RPM

B. 300 RPM

C. 100 RPM

D. 800 RPM

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

A. Energy can be created if mechanical advantage is high enough

B. Force can always be multiplied without any cost

C. Distance can always be multiplied without any cost

D. Work (force × distance) is conserved across input and output

68. A worker pushes a 600-pound crate up a 24-foot ramp that rises 4 feet. The minimum theoretical force required is:

A. 200 pounds

B. 150 pounds

C. 100 pounds

D. 75 pounds

69. The relationship $W = m \times g$ defines weight as the product of:

A. Mass and the acceleration due to gravity

B. Volume and density

C. Pressure and surface area

D. Velocity and time

70. A centrifugal pump operating against a fully closed discharge valve will:

A. Increase its flow rate substantially

B. Operate at maximum efficiency

C. Reverse the flow direction automatically

D. Produce maximum pressure but zero flow with rapid fluid heating

71. Friction between two surfaces in contact:

A. Acts in the direction of motion to assist movement

B. Decreases as the normal force increases

C. Always opposes the direction of motion

D. Has no measurable effect on rotating equipment

72. The mechanical advantage of a single fixed pulley is:

A. 1

B. 2

C. 3

D. 4

73. When the driven gear has more teeth than the driver gear in a meshed pair:

A. The driven gear rotates faster than the driver

B. The driven gear rotates slower but produces more torque

C. The driven gear stops rotating entirely

D. No power transmits between the gears

74. When a long steel pipe carrying steam is heated significantly:

A. The pipe shrinks in length

B. The pipe density increases

C. The pipe maintains its exact original dimensions

D. The pipe expands and requires expansion provisions

75. The principle that an object continues in motion at constant velocity unless acted on by an external force is best described as:

A. Pascal's law

B. Bernoulli's principle

C. Newton's first law (inertia)

D. The continuity equation

76. A 40-pound force on a balanced lever produces a 320-pound output force. The mechanical advantage is:

A. 8

B. 6

C. 10

D. 12

77. The primary function of a thrust bearing is to:

A. Increase rotational speed of the shaft

B. Convert linear motion to rotational motion

C. Provide overspeed protection

D. Support axial loads along the shaft

78. The reason hydraulic systems can produce very high output forces with relatively small input forces is that:

A. The system uses chemical reactions for force amplification

B. The same pressure acts across a much larger output piston area

C. Friction in the system multiplies the applied force

D. The fluid is heated during operation to expand and produce force

79. By the continuity equation, when fluid flows from a wider pipe section into a narrower section:

A. The fluid speeds up to maintain constant volume flow

B. The fluid stops entirely

C. The fluid reverses direction

D. The fluid pressure increases proportionally

80. A V-belt drive is preferred over a flat belt drive because:

A. V-belts are easier to manufacture and cheaper

B. V-belts require no maintenance over their service life

C. The wedging action increases friction and grip

D. V-belts can transmit electricity in addition to power

81. Heat transfer through electromagnetic waves, requiring no medium, is called:

A. Radiation

B. Conduction

C. Convection

D. Insulation

82. A 24-tooth driver sprocket connected by a chain to a 72-tooth driven sprocket. If the driver rotates at 540 RPM, the driven sprocket rotates at:

A. 1,620 RPM

B. 180 RPM

C. 360 RPM

D. 270 RPM

83. The outward sensation experienced by a rotating object is best understood as:

A. A real fundamental force unique to rotation

B. The effect of magnetic forces from nearby equipment

C. The result of pressure waves in surrounding air

D. The result of inertia attempting to maintain straight-line motion

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

A. The shafts are perfectly aligned and identical

B. No power transmission is needed

C. Some shaft misalignment is anticipated during operation

D. The shafts will operate at different speeds

85. The energy released when steam at 212°F condenses into water at 212°F (with no temperature change) is called the:

A. Sensible heat

B. Latent heat of vaporization

C. Specific heat capacity

D. Convective heat

86. A pressure relief valve that fails to open at the setpoint creates the immediate risk of:

A. Catastrophic failure of the pressurized equipment

B. Reduced operating efficiency only

C. Faster than expected component wear

D. Lower than normal operating temperatures

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

A. The fluid expands during the lift

B. The output piston has a smaller area than the input

C. The hydraulic system loses energy to friction

D. The total fluid volume must be conserved

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

A. 800 RPM

B. 1,800 RPM

C. 2,400 RPM

D. 3,200 RPM

89. The boiling temperature of water:

A. Depends on the pressure above the water surface

B. Is fixed at 212°F regardless of conditions

C. Depends only on the volume of water

D. Decreases as pressure above the water increases

90. Pressure loss in a long section of pipe carrying flowing fluid:

A. Decreases with longer pipe length

B. Is unaffected by pipe diameter

C. Increases with longer length, smaller diameter, and rougher interior

D. Depends only on the temperature of the fluid

SUBTEST 3 — READING COMPREHENSION

36 questions | 30 minutes | 5 passages

Passage 1

Stack emissions monitoring systems continuously measure the concentrations of regulated pollutants in the gas streams exiting plant smokestacks. The pollutants typically monitored include sulfur dioxide, nitrogen oxides, carbon monoxide, particulate matter, and in some cases mercury. Continuous emissions monitoring systems — commonly abbreviated as CEMS — use specialized analytical instruments that draw representative gas samples from the stack and measure the concentration of each pollutant in real time. The data from these monitors is recorded continuously and transmitted to both plant operators and regulatory authorities, providing transparent verification that emissions remain within permitted limits. Calibration of CEMS instruments is performed regularly to ensure measurement accuracy, and any extended periods of monitor downtime must be documented and may require missed-data substitution following established regulatory procedures. Operators rely on emissions data to make real-time adjustments to combustion conditions, fuel mix, and emissions control system operation. Sustained exceedances of permit limits can result in regulatory penalties, mandatory operational changes, and in severe cases, loss of operating permits. The investment in reliable emissions monitoring is therefore essential to both regulatory compliance and operational continuity.

91. According to the passage, the primary function of stack emissions monitoring systems is to:

A. Reduce the cost of plant operating fuels

B. Continuously measure regulated pollutant concentrations in stack gas streams

C. Generate alerts for routine maintenance schedules

D. Calculate the financial cost of emissions per kilowatt-hour

92. The passage states that pollutants typically monitored include all of the following EXCEPT:

A. Sulfur dioxide

B. Nitrogen oxides

C. Particulate matter

D. Atmospheric oxygen content

93. According to the passage, CEMS instruments measure pollutants by:

A. Examining stack ash samples after each shift

B. Using infrared cameras pointed at the stack outlet

C. Drawing representative gas samples from the stack

D. Analyzing fuel composition before combustion

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

A. Open and visible to others

B. Made of clear material

C. Easy to manipulate

D. Resistant to interference

95. What can be inferred from the passage about CEMS calibration?

A. It is performed only after equipment failures occur

B. It is performed regularly to ensure measurement accuracy

C. It is performed once at the time of installation only

D. It is performed only by external regulatory inspectors

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

A. Argue for stricter emissions limits in current regulations

B. Compare the costs of different CEMS designs

C. Critique the accuracy of current emissions monitoring

D. Describe how stack emissions monitoring systems function and matter

97. According to the passage, what can result from sustained exceedances of permit limits?

A. Increased operator wages and bonuses

B. Recognition by industry trade associations

C. Regulatory penalties, mandatory changes, and possible loss of permits

D. Automatic system shutdown without operator involvement

Passage 2

Condenser tube cleaning is a maintenance activity essential to maintaining condenser performance and overall plant efficiency. Over time, deposits accumulate on the inside surfaces of condenser tubes from the cooling water passing through them. These deposits reduce the heat transfer rate between the steam on the outside of the tubes and the cooling water inside, which raises condenser pressure and reduces turbine efficiency. Several cleaning methods are commonly employed, depending on the type and severity of the deposits. Mechanical cleaning uses brushes, scrapers, or other tools driven through each tube to physically dislodge deposits, often as part of a scheduled outage. On-line cleaning systems use sponge balls or plastic projectiles continuously circulated through the tubes during operation, providing gentle continuous scrubbing that prevents deposits from building up significantly. Chemical cleaning uses circulating solvents that dissolve specific deposit types, particularly hard scale or biological films. Operators monitor condenser performance through measurements of cooling water temperature rise, condenser back pressure, and turbine heat rate, all of which can indicate the buildup of tube-side deposits. Timely cleaning maintains plant efficiency and prevents costly forced outages.

98. According to the passage, the primary purpose of condenser tube cleaning is to:

A. Maintain condenser performance and overall plant efficiency

B. Reduce the volume of cooling water required by the plant

C. Comply with utility insurance requirements

D. Improve the visual appearance of the condenser

99. The passage states that deposits inside condenser tubes:

A. Improve the strength of the condenser tubes

B. Have no significant effect on plant performance

C. Increase the heat transfer rate

D. Reduce the heat transfer rate and raise condenser pressure

100. According to the passage, on-line cleaning systems use:

A. Sponge balls or plastic projectiles continuously circulated through the tubes

B. Mechanical brushes inserted manually each shift

C. Heated water injected at high velocity

D. Strong acids that operators apply directly to the tube interior

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

A. Coat with a protective layer

B. Reattach firmly in place

C. Remove or break loose

D. Filter out and capture

102. What can be inferred from the passage about chemical cleaning?

A. It is the only effective cleaning method for any deposit type

B. It dissolves specific deposit types, particularly hard scale or biological films

C. It is used only during emergency outages

D. It eliminates the need for any other cleaning method

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

A. Argumentative and persuasive

B. Casual and informal

C. Critical and skeptical

D. Informative and authoritative

104. According to the passage, operators monitor condenser performance through:

A. Cooling water temperature rise, condenser back pressure, and turbine heat rate

B. Visual inspections of the tubes during every shift

C. Annual third-party laboratory tests of tube samples

D. Color change in the cooling water flowing through the system

Passage 3

Plant electrical grounding systems serve two critical safety functions: they provide a safe path for electrical fault currents to flow to ground, and they maintain conductive metal equipment at the same electrical potential to prevent dangerous voltage differences between objects. The grounding system consists of an extensive network of buried copper conductors connected to grounding electrodes — usually copper-clad steel rods driven deep into the earth, supplemented by ground grids in switchyards and other areas with high fault current potential. All major equipment frames, structural steel, and electrical neutral points are bonded to this grounding network, ensuring that any fault current finds a low-resistance path

to earth rather than passing through people or sensitive equipment. The effectiveness of the grounding system depends on the resistance of the connection to earth, which is measured periodically using specialized test instruments. High ground resistance can result from corroded connections, broken conductors, or deteriorated soil conditions, and it requires prompt corrective action to maintain safety. Grounding system inspections are routine in plants, and the integrity of grounding connections is verified before any new equipment is placed in service.

105. According to the passage, plant electrical grounding systems serve which two critical safety functions?

A. Generate electricity and store excess energy

B. Reduce equipment costs and improve efficiency

C. Provide a safe path for fault currents and maintain equal potential between equipment

D. Insulate equipment from environmental moisture and pests

106. The passage states that grounding electrodes are typically:

A. Aluminum cables suspended overhead

B. Copper-clad steel rods driven deep into the earth

C. Plastic-coated wires laid on the ground surface

D. Hollow ceramic tubes filled with conductive fluid

107. According to the passage, all major equipment frames, structural steel, and electrical neutral points are:

A. Insulated from each other to prevent current flow

B. Painted with conductive coatings

C. Wrapped in protective fabric covers

D. Bonded to the grounding network

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

A. Insulated and separated electrically

B. Coated with protective material

C. Connected electrically

D. Locked with mechanical fasteners

109. What can be inferred from the passage about high ground resistance?

A. It is normal and expected during plant operation

B. It improves the safety of the grounding system

C. It can result from corroded connections or deteriorated conditions

D. It eliminates the need for periodic testing

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

A. Describe the function and importance of plant electrical grounding systems

B. Argue that current grounding standards are inadequate

C. Compare the costs of various grounding system designs

D. Critique the maintenance practices of utilities

111. According to the passage, the integrity of grounding connections is verified:

A. Only after a major electrical incident

B. Only by external regulatory inspectors

C. Through annual self-reporting only

D. Before any new equipment is placed in service

Passage 4

Vibration monitoring is a fundamental tool for assessing the condition of rotating equipment such as pumps, fans, motors, turbines, and generators. All rotating machinery produces some level of vibration during operation, but excessive or changing vibration patterns often indicate developing mechanical problems such as bearing wear, shaft misalignment, mass imbalance, or coupling defects. Continuous vibration monitoring systems use sensors mounted on bearing housings to measure vibration amplitude and frequency in real time. The collected data is analyzed to identify trends and to compare current readings against established baseline values. When vibration exceeds preset alarm thresholds, the monitoring system alerts operators, allowing them to investigate and address the underlying cause before equipment damage occurs. For critical equipment, vibration trip protection automatically removes the equipment from service if vibration exceeds dangerous levels, preventing potential catastrophic failures. Periodic vibration analysis by trained specialists supplements continuous monitoring, providing detailed diagnostic information that can pinpoint specific defects within rotating assemblies. The combination of continuous monitoring and periodic analysis represents the predictive maintenance approach that has largely replaced reactive maintenance in modern plants.

112. According to the passage, vibration monitoring is used to assess the condition of:

A. Rotating equipment such as pumps, fans, motors, turbines, and generators

B. Electrical wiring and switchgear

C. Boiler tubes and heat exchangers

D. Chemical injection systems and storage tanks

113. The passage states that excessive or changing vibration patterns often indicate:

A. Improved equipment efficiency

B. Developing mechanical problems

C. Routine startup procedures

D. Normal operational changes

114. According to the passage, continuous vibration monitoring systems use:

A. Annual visual inspections of all rotating shafts

B. Operator hand checks on each shift

C. External laboratory testing of metal samples

D. Sensors mounted on bearing housings to measure vibration in real time

115. As used in the passage, the word "baseline" most nearly means:

A. The lowest possible value

B. A maximum permitted limit

C. A reference value for comparison

D. An emergency shutdown threshold

116. What can be inferred from the passage about vibration trip protection?

A. It is used only on non-critical auxiliary equipment

B. It automatically removes critical equipment from service to prevent catastrophic failure

C. It requires operator approval before activating

D. It eliminates the need for periodic vibration analysis

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

A. Informative and authoritative

B. Argumentative and persuasive

C. Casual and personal

D. Critical and dismissive

118. According to the passage, the combination of continuous monitoring and periodic analysis represents:

A. A regulatory requirement only for nuclear plants

B. The predictive maintenance approach that has replaced reactive maintenance

C. An optional supplementary safety measure

D. A method used only during commissioning of new equipment

Passage 5

Operator certification programs ensure that plant operators possess the knowledge and skills required to perform their duties safely and effectively. The certification process typically includes formal classroom instruction, simulator training, on-the-job training under qualified supervision, and a series of written and practical examinations. Topics covered include plant systems and equipment, normal operating procedures, abnormal and emergency procedures, safety practices, regulatory requirements, and operator administrative duties. Certification levels generally progress from auxiliary operator to plant operator to senior reactor operator or shift supervisor, with each level requiring additional training and demonstrated competency. Certified operators must maintain their certification through continuing training that addresses new procedures, equipment modifications, lessons learned from industry events, and refresher coverage of complex topics. Periodic requalification examinations verify that certified operators retain the knowledge needed to perform their duties effectively. Loss of certification can result from extended absence from operating duties, failure to complete required training, failure of requalification examinations, or significant performance issues during operations. Restoring lost certification typically requires repeating significant portions of the original certification process, which is why maintaining current certification is treated as a fundamental career obligation by working operators.

119. According to the passage, the certification process typically includes:

A. Only formal classroom instruction

B. Only on-the-job training

C. Only written examinations

D. Classroom instruction, simulator training, on-the-job training, and examinations

120. The passage states that certification levels generally progress from:

A. Auxiliary operator to plant operator to senior reactor operator or shift supervisor

B. Trainee to apprentice to journeyman

C. Helper to assistant to operator

D. Maintenance technician to instrument technician to operator

121. According to the passage, certified operators must maintain their certification through:

A. Annual physical examinations

B. Quarterly disciplinary reviews

C. Continuing training that addresses new procedures, equipment changes, and lessons learned

D. Monthly observation by supervisors

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

A. Personal preference for specific tasks

B. Demonstrated ability or skill

C. Length of employment

D. Salary level achieved

123. What can be inferred from the passage about loss of certification?

A. It is treated as a serious career setback by working operators

B. It typically has minimal long-term impact

C. It cannot be reversed once it occurs

D. It is automatically restored after a brief waiting period

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

A. Argue that current certification standards are too strict

B. Compare certification programs across different utilities

C. Critique the cost of operator training programs

D. Describe how operator certification programs function and matter

125. According to the passage, restoring lost certification typically requires:

A. A simple verbal commitment to retraining

B. Approval from a single supervisor

C. Repeating significant portions of the original certification process

D. A small administrative fee and brief refresher session

126. The passage indicates that maintaining current certification is treated by working operators as:

A. An optional supplementary qualification

B. A fundamental career obligation

C. A temporary requirement during initial employment only

D. A regulatory burden imposed externally

SUBTEST 4 — FIGURAL REASONING

20 questions | 10 minutes | Visual pattern recognition

127. A sequence shows shapes that appear superimposed on each other. Frame 1 shows a circle. Frame 2 shows a circle with a triangle on top of it. Frame 3 shows the same with a square added. Frame 4 shows the same with a pentagon added. What should Frame 5 add?

A. A hexagon on top

B. A second circle

C. A triangle removed

D. A diamond on top

128. A 2×2 grid shows: top-left = single horizontal line, top-right = three parallel horizontal lines, bottom-left = single circle, bottom-right = ? What should appear in the bottom-right?

A. Two circles

B. Two horizontal lines

C. Three circles

D. One square

129. A circle is divided into four equal quadrants. A black dot starts in the top-right quadrant in Frame 1. In each successive frame the dot moves clockwise to the next quadrant. Frame 1 = top-right, Frame 2 = bottom-right, Frame 3 = bottom-left, Frame 4 = top-left. Where should the dot be in Frame 5?

A. Bottom-left

B. Top-right

C. Center of circle

D. Top-left

130. A sequence shows shapes that get nested inside each other in successive frames: square alone (Frame 1), square inside a larger square (Frame 2), three nested squares (Frame 3), four nested squares (Frame 4). How many nested squares should Frame 5 show?

A. 6 nested squares

B. 3 nested squares

C. 4 nested squares

D. 5 nested squares

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

A. Arrow pointing left with a black tip

B. Arrow pointing up with a white tip

C. Arrow pointing down with a white tip

D. Arrow pointing right with a white tip

132. A sequence shows a clock where the hour hand advances 60° per frame. Frame 1 is at 12 (0°). Frame 2 at 2 (60°). Frame 3 at 4 (120°). Frame 4 at 6 (180°). What rotation should Frame 5 show?

A. 90°

B. 180°

C. 200°

D. 240°

133. A 3×3 grid shows shapes in each row that decrease in size from left to right. The bottom row begins with a large hexagon and a medium hexagon. What belongs in the missing third cell?

A. A small hexagon

B. A medium hexagon

C. A large hexagon

D. A small pentagon

134. A sequence shows a star with one point being filled black per frame. Frame 1: 1 point filled. Frame 2: 2 filled. Frame 3: 3 filled. Frame 4: 4 filled. How many filled points should Frame 5 show?

A. 4 points filled

B. 6 points filled

C. 5 points filled

D. 8 points filled

135. A 2×2 grid shows: top-left = empty triangle, top-right = empty square, bottom-left = filled triangle, bottom-right = ? What should appear in the bottom-right?

A. Empty circle

B. Filled square

C. Empty square

D. Filled triangle

136. A sequence shows a hexagon that gains one internal connecting line per frame. Frame 1 has 0 internal lines. Frame 2 has 1. Frame 3 has 2. Frame 4 has 3. How many internal lines should Frame 5 contain?

A. 6 internal lines

B. 5 internal lines

C. 3 internal lines

D. 4 internal lines

137. A 2×2 grid shows: top-left = circle with a dot in the center, top-right = circle with a small triangle in the center, bottom-left = square with a dot in the center, bottom-right = ? What should appear in the bottom-right?

A. Square with a dot in the center

B. Square with a small triangle in the center

C. Triangle with a dot in the center

D. Circle with a small square in the center

138. A sequence shows shapes that combine direction-and-shape changes. Frame 1: triangle pointing up. Frame 2: square (no direction). Frame 3: pentagon pointing up. Frame 4: hexagon (no direction). What should Frame 5 show?

A. A square pointing up

B. A pentagon pointing down

C. A circle

D. A heptagon pointing up

139. A 3×3 grid shows shapes whose color rotates by one position per row: top row = white, gray, black. Middle row = gray, black, white. Bottom row = black, white, ? What color belongs in the missing cell?

A. Gray

B. Black

C. White

D. Striped

140. A sequence shows a circle that is shaded in increasing fractions per frame. Frame 1: empty (0% shaded). Frame 2: 1/4 shaded. Frame 3: 1/2 shaded. Frame 4: 3/4 shaded. What should Frame 5 show?

A. 1/4 shaded again

B. 1/2 shaded again

C. Fully shaded (100%)

D. Empty again (0%)

141. A 2×2 grid shows: top-left = a single small circle, top-right = three small circles in a row, bottom-left = a single small square, bottom-right = ? What should appear in the bottom-right?

A. Two small squares

B. Three small squares in a row

C. Two small circles

D. One small triangle

142. A sequence shows a square that loses one corner per frame, becoming a triangle, line, point. Frame 1: 4 corners. Frame 2: 3. Frame 3: 2. Frame 4: 1. What should Frame 5 show?

A. 4 corners again

B. 2 corners

C. 0 corners (nothing remaining)

D. A circle

143. A 2×2 grid shows: top-left = upward-pointing triangle, top-right = leftward-pointing triangle, bottom-left = downward-pointing triangle, bottom-right = ? What should appear in the bottom-right?

A. Downward-pointing triangle

B. Rightward-pointing triangle

C. Leftward-pointing triangle

D. Upward-pointing triangle

144. A sequence shows a clock where the minute hand advances 45° per frame. Frame 1 is at 12 (0°). Frame 2 at 1:30 (45°). Frame 3 at 3 (90°). Frame 4 at 4:30 (135°). What rotation should Frame 5 show?

A. 180°

B. 135°

C. 225°

D. 90°

145. A 3×3 grid shows shapes that gain one element from left to right within each row. The bottom row shows: 1 dot, 2 dots, ? How many dots belong in the missing cell?

A. 4 dots

B. 5 dots

C. 6 dots

D. 3 dots

146. A sequence shows a triangle that is mirrored across its vertical axis in alternating frames. Frame 1 shows a small mark on the left side. Frame 2 mirrors it (mark on the right). Frame 3 mirrors it again (mark on the left). Frame 4 mirrors it (mark on the right). Where should the mark be in Frame 5?

A. Right side

B. In the center

C. Left side

D. Both sides

PRACTICE EXAM 6 — ANSWER KEY AND FULL EXPLANATIONS

SUBTEST 1 — MATHEMATICAL USAGE (Questions 1–46)

1. **C** — 625. Use the squaring shortcut for numbers ending in 5: take the leading digit (2), multiply by the next integer (3) to get 6, then append 25. Result: 625. This trick works for every number ending in 5.

2. **A** — 960 gallons. Set up the proportion: 360/9 = x/24. Cross-multiply: 9x = 8,640, so x = 960 gallons. Direct proportional reasoning handles steady-rate flow problems reliably.

3. **D** — 63. Use the 10% anchor: 10% of 90 = 9, so 70% = 63. Multiply 9 × 7 directly to confirm. The anchor method is the fastest mental approach for percentage calculations.

4. **B** — 7. Subtract 8 from both sides: 5x = 35. Divide by 5: x = 7. The standard two-step pattern handles every linear equation: undo addition first, then undo multiplication.

5. **D** — 435 minutes. Convert 7 hours to 420 minutes, then add 15 minutes: 420 + 15 = 435 minutes. Mixed time-unit conversions must be handled by converting to a common unit first.

6. **A** — 14 feet. Divide 168 inches by 12 inches per foot = 14 feet. The conversion factor of 12 inches per foot should be at the level of automatic recall.

7. **C** — 25/24. Find a common denominator of 24: 7/8 = 21/24 and 1/6 = 4/24. Add: 21/24 + 4/24 = 25/24. The fraction is improper and cannot be reduced further.

8. **B** — 300. Convert 900 RPM to revolutions per second: 900 / 60 = 15 revolutions per second. In 20 seconds: 15 × 20 = 300 revolutions. Recognizing the unit conversion embedded in the problem is the key step.

9. **A** — 8 days. This is an inverse proportion: workers × days = constant. So 14 × 12 = 21 × x, giving 168 = 21x and x = 8 days. More workers means less time, which is the inverse-proportion signature.

10. **C** — 0.27. Multiply 0.45 × 0.6 = 0.270. Count two decimal places in the original numbers and place the decimal point that many places from the right in the answer.

11. **D** — 142.5 gallons. Multiply 19 gallons per hour × 7.5 hours = 142.5 gallons. Use decomposition: 19 × 7 = 133, then 19 × 0.5 = 9.5, giving 142.5 total.

12. **B** — 5/8. The decimal 0.625 equals 625/1000, which simplifies to 5/8 by dividing both by 125. Memorizing the common decimal-fraction equivalences makes these conversions instant.

13. **A** — $896. Multiply $32 × 28 hours = $896. Use decomposition: 32 × 28 = 32 × (30 − 2) = 960 − 64 = 896. The round-and-adjust method is fast for multiplication near round numbers.

14. **D** — 700. Use the × 25 shortcut: multiply by 100 and divide by 4. So 28 × 25 = 2,800 / 4 = 700. The × 25 mental math shortcut is one of the highest-leverage patterns to internalize.

15. **B** — 300.3 feet. Multiply 130 PSI × 2.31 feet of water per PSI = 300.3 feet. The pressure-to-water-column conversion factor is a core plant operations equivalence used frequently in hydrostatic calculations.

16. **C** — 12. Subtract 5n from both sides: 2n − 11 = 13. Add 11: 2n = 24. Divide: n = 12. Equations with variables on both sides require collecting variables before applying the standard pattern.

17. **A** — 34. Add the five numbers: 20 + 25 + 35 + 40 + 50 = 170. Divide by 5 = 34. Average problems require summing all values and dividing by the count.

18. **D** — 9,120 gallons. Convert 1 hour 36 minutes to 96 minutes total. Multiply 95 gallons per minute × 96 minutes = 9,120 gallons. Always convert mixed time units before applying the rate.

19. **B** — 16. The square root of 256 is 16 because 16 × 16 = 256. Memorization of perfect squares from 1 to 20 enables instant recognition.

20. **C** — 6.5 hours. Use T = D / R = 390 / 60 = 6.5 hours. The DRT formula handles every distance-rate-time problem reliably regardless of which variable is the unknown.

21. **A** — 36. Multiply 4/9 × 81 = (4 × 81) / 9 = 324 / 9 = 36. Recognizing that 81 / 9 = 9, the calculation simplifies to 4 × 9 = 36.

22. **D** — 1,700 gallons. Multiply 0.85 × 2,000 = 1,700 gallons. Use the 10% anchor: 10% of 2,000 = 200, so 85% = 2,000 − 300 = 1,700. The "of" in percentage problems always signals multiplication.

23. **C** — 9 gallons. Divide 36 quarts by 4 quarts per gallon = 9 gallons. The 4-quarts-per-gallon conversion is a memorized volume equivalence used frequently in fluid system calculations.

24. **B** — 11. Recognize that 24 × 11 = 264, so 264 / 24 = 11. Memorization of multiplication tables allows for instant division recognition.

25. **B** — 756 cubic feet. Volume = length × width × height = 14 × 9 × 6 = 756 cubic feet. Compute by stages: 14 × 9 = 126, then 126 × 6 = 756.

26. **D** — 140. If x increased by 75% equals 245, then 1.75x = 245, so x = 245 / 1.75 = 140. Always identify the original quantity before applying the percentage relationship.

27. **A** — 51. Move the decimal points: 35.7 / 0.7 = 357 / 7 = 51. Decimal division is simplified by shifting decimal points equally to make the divisor a whole number.

28. **C** — 36 gallons. Set up the proportion: 8 water / 3 chemical = 96 / x. Cross-multiply: 8x = 288, so x = 36 gallons. Cross-multiplication is the universal solving technique for ratio problems.

29. **B** — 5/2. Divide fractions by inverting and multiplying: 5/6 ÷ 1/3 = 5/6 × 3/1 = 15/6 = 5/2. Fraction division uses the "invert and multiply" rule.

30. **D** — 1,350 RPM. A 35% increase means the new speed is 135% of the original: 1,000 × 1.35 = 1,350 RPM. Always apply the percentage change to the original value.

31. **A** — 4. Distribute first: 4y + 20 = 36. Subtract 20: 4y = 16. Divide: y = 4. Equations with parentheses require distribution before applying the standard two-step solving pattern.

32. **C** — 36. Use the 10% anchor: 10% of 150 = 15, so 20% = 30 and 4% = 6. Add: 30 + 6 = 36. The anchor method handles uncommon percentages by combining or subtracting from familiar ones.

33. **B** — 3,240 minutes. 9 hours per day × 60 minutes per hour = 540 minutes per day. Over 6 days: 540 × 6 = 3,240 minutes. Multi-step conversions can be combined efficiently.

34. **D** — 32. Compute 2 × 2 × 2 × 2 × 2 = 4 × 4 × 2 = 32. The fifth power requires four multiplication steps and is commonly tested in foundational arithmetic.

35. **A** — 200. If 90 = 0.45 × x, then x = 90 / 0.45 = 200. The setup "Whole = Part / Percentage" handles this category of percentage question reliably.

36. **D** — 45 gallons per hour. Calculate the change: 1,800 − 1,395 = 405 gallons consumed. Divide by time: 405 / 9 = 45 gallons per hour. Average rate is total change divided by total time.

37. **C** — 1/6. Multiply numerators and denominators: (5 × 4) / (8 × 15) = 20/120 = 1/6. Always simplify the final fraction to lowest terms by dividing both top and bottom by their greatest common factor.

38. **B** — $1,872.50. Regular pay: 40 × $35 = $1,400. Overtime hours: 49 − 40 = 9. Overtime pay: 9 × $52.50 = $472.50. Total: $1,400 + $472.50 = $1,872.50. Multi-step word problems require careful sequential execution.

39. **A** — 80 feet. Perimeter of a rectangle = 2 × (length + width) = 2 × (24 + 16) = 2 × 40 = 80 feet. Doubling the sum of length and width is faster than adding all four sides individually.

40. **D** — 153.86 square inches. Area of a circle = $\pi \times r^2$. Radius = 14 / 2 = 7 inches. Area = 3.14 × 49 = 153.86 square inches. The diameter must be halved to find the radius before applying the area formula.

41. **C** — 4/5. The decimal 0.8 equals 8/10, which simplifies to 4/5 by dividing both by 2. This is one of the common fraction-to-decimal equivalences used across Math Sprint problems.

42. **B** — 160°F. Subtract: 235 − 75 = 160°F. Temperature change is the difference between final and initial temperatures, with units staying the same.

43. **D** — 20 minutes. Combined flow rate: 45 + 75 = 120 gallons per minute. Time to fill: 2,400 / 120 = 20 minutes. Pump rates add when pumps work together to produce combined output.

44. **A** — 46. Use the 10% anchor: 10% of 920 = 92. Then 5% = 46. The anchor method handles uncommon percentages efficiently — half of 10% equals 5%.

45. **C** — 24 sections. Divide 192 / 8 = 24 sections. Word problems involving cutting or partitioning into equal pieces always reduce to simple division.

46. **B** — 46. Substitute x = 4 and y = 2: $3(16) - 8 + 6 = 48 - 8 + 6 = 46$. Apply the order of operations strictly — exponents first, then multiplication, then addition and subtraction.

SUBTEST 2 — MECHANICAL CONCEPTS (Questions 47–90)

47. **D** — 200 pounds. Apply the law of the lever: Effort × Effort Arm = Load × Load Arm. So Effort × 10 = 400 × 5, giving Effort = 2,000 / 10 = 200 pounds. The mechanical advantage of 2 reduces the required force by a factor of 2.

48. **B** — Counterclockwise at 200 RPM. Meshing gears always rotate in opposite directions. The gear ratio is 20/80 = 1/4, so the larger gear rotates at one-quarter the driver speed: 800 / 4 = 200 RPM, in the counterclockwise direction.

49. **C** — 2,000 pounds. Calculate the pressure: $P = F/A = 80/3 \approx 26.67$ PSI. Apply this pressure to the output piston: $F = P \times A = 26.67 \times 75 = 2{,}000$ pounds. Hydraulic mechanical advantage equals the ratio of piston areas (75/3 = 25× force multiplier).

50. **A** — 400 pounds. The mechanical advantage of a block-and-tackle equals the number of rope segments supporting the load: MA = 7. Force required = Load / MA = 2,800 / 7 = 400 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 $30 \times 4 = 6 \times V_2$, 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. **B** — 7. Mechanical advantage of a wheel-and-axle = Wheel Radius / Axle Radius = 28 / 4 = 7. 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 in all directions 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. **C** — 1,000 RPM. Driven RPM = (Driver Diameter / Driven Diameter) × Driver RPM = (5/10) × 2,000 = 0.5 × 2,000 = 1,000 RPM. A larger driven pulley turns more slowly than a smaller driver by the same ratio as the diameters.

55. **D** — 7. Mechanical advantage of a wedge = Length / Thickness = 14 / 2 = 7. Long, thin wedges have high mechanical advantage and require less driving force to split material.

56. **B** — A hinged flap or spring-loaded element that closes automatically. Check valves use simple mechanical elements — a hinged disk, a swing flap, or a spring-loaded poppet — that allow forward flow but close automatically when flow reverses, preventing backflow.

57. **A** — 225 PSI. Apply Boyle's law: $P_1V_1 = P_2V_2$, so $75 \times 60 = P_2 \times 20$, giving $4{,}500 = 20P_2$ and $P_2 = 225$ PSI. Compressing a gas to one-third of its original volume triples its pressure at constant temperature.

58. **C** — 3. Mechanical advantage of a ramp = Length / Height = 18 / 6 = 3. A long, gradual ramp produces high mechanical advantage; a short, steep ramp produces low mechanical advantage.

59. **A** — Transmit positive motion without slipping. 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. **D** — The height of the column and the fluid density. Hydrostatic pressure at any depth equals density × gravity × height. The width of the container, container shape, and fluid temperature have no direct effect on the hydrostatic pressure produced.

61. **B** — Flow rate 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.

62. **A** — Always greater than 1. Second-class levers (load between fulcrum and effort) always produce mechanical advantage greater than 1, meaning they multiply the input force. A wheelbarrow is the classic example.

63. **C** — 38.97 PSI. Use the conversion 1 foot of water ≈ 0.433 PSI. Multiply $90 \times 0.433 = 38.97$ PSI. The hydrostatic pressure depends on the height of the column, not on the volume or shape of the container.

64. **D** — An acceleration equal to force divided by 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. **B** — Prevent reverse flow when the 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** — 600 RPM. The gear ratio is 45/15 = 3, meaning the driven gear rotates at three times the speed of the driver. So $200 \times 3 = 600$ RPM. The driven gear with fewer teeth always rotates faster than the driver gear.

67. **D** — Work (force × 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. **C** — 100 pounds. Mechanical advantage of the ramp = 24 / 4 = 6. Required force = Load / MA = 600 / 6 = 100 pounds. The ramp reduces the required force by a factor equal to its mechanical advantage.

69. **A** — Mass and the acceleration due to gravity. In the formula W = m × g, weight equals mass multiplied by gravitational acceleration (approximately 9.8 m/s^2 or 32.2 ft/s^2 on Earth's surface). This is the fundamental relationship between mass and weight.

70. **D** — Produce maximum pressure but zero flow with rapid fluid heating. When a centrifugal pump runs against a closed valve, it produces shutoff head pressure but zero flow. The impeller continues adding energy to the trapped fluid, causing rapid temperature rise that can damage seals.

71. **C** — Always opposes the direction of motion. Friction acts in the opposite direction of attempted or actual movement, regardless of the type of motion or the surfaces involved. This is a defining characteristic of friction.

72. **A** — 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. **B** — The driven gear rotates slower but produces more torque. When the driven gear has more teeth than the driver, the gear ratio is greater than 1 and the driven gear rotates slower while producing more torque. Speed and torque are inversely related in any gear system.

74. **D** — The pipe expands and requires expansion provisions. Most materials, including steel, expand when heated. Plant piping systems incorporate expansion loops, expansion joints, and slip fittings to safely accommodate this thermal expansion without buckling or rupturing.

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 = 320 / 40 = 8. The lever multiplies the input force by a factor of 8, with a corresponding cost in distance.

77. **D** — Support axial loads along the shaft. Thrust bearings are specifically designed to support loads along the axis of the shaft, distinguishing them from radial bearings that support loads perpendicular to the shaft.

78. **B** — The same pressure acts across a much larger output piston area. Hydraulic systems multiply force by applying pressure (force per unit area) generated at a small piston to a much larger output piston. The same pressure across a larger area produces a larger force.

79. **A** — The fluid speeds up to maintain constant 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. **C** — The wedging action increases friction and grip. The trapezoidal cross-section of a V-belt wedges into matching V-shaped pulley grooves, creating significantly more friction and contact force than a flat belt could produce.

81. **A** — Radiation. Heat transfer through electromagnetic waves, requiring no physical medium, is radiation. Conduction requires direct contact, and convection requires a moving fluid medium.

82. **B** — 180 RPM. Driven sprocket RPM = (Driver Teeth / Driven Teeth) × Driver RPM = (24/72) × 540 = (1/3) × 540 = 180 RPM. Larger sprockets rotate more slowly than smaller ones connected by the same chain.

83. **D** — The result of 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. **C** — Some shaft misalignment is anticipated 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. **B** — Latent heat of vaporization. Energy released when steam condenses to water (or absorbed when water vaporizes to steam) without temperature change is the latent heat of vaporization. The condensation phase change releases the same energy that vaporization absorbs.

86. **A** — Catastrophic failure of the pressurized equipment. A failed relief valve allows 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. **D** — 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** — Depends on 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. **C** — Increases with longer length, smaller diameter, and rougher interior. Friction loss in piping increases with these factors plus higher flow rates. These variables determine the pressure drop a pump must overcome to move fluid through the system.

SUBTEST 3 — READING COMPREHENSION (Questions 91–126)

91. **B** — Continuously measure regulated pollutant concentrations in stack gas streams. The opening sentence states this directly: emissions monitoring systems "continuously measure the concentrations of regulated pollutants in the gas streams exiting plant smokestacks."

92. **D** — Atmospheric oxygen content. The passage lists sulfur dioxide, nitrogen oxides, carbon monoxide, particulate matter, and mercury as monitored pollutants — but never mentions atmospheric oxygen. EXCEPT questions require careful elimination of items the passage actually lists.

93. **C** — Drawing representative gas samples from the stack. The passage states that CEMS "use specialized analytical instruments that draw representative gas samples from the stack and measure the concentration of each pollutant in real time."

94. **A** — Open and visible to others. In the context of "providing transparent verification that emissions remain within permitted limits," the word means open and visible — the data is accessible to operators, regulators, and the public.

95. **B** — It is performed regularly to ensure measurement accuracy. The passage states that "calibration of CEMS instruments is performed regularly to ensure measurement accuracy." This is direct factual support.

96. **D** — Describe how stack emissions monitoring systems function and matter. The passage describes emissions monitoring functions and consequences without arguing for stricter limits or comparing system designs. It is a descriptive overview.

97. **C** — Regulatory penalties, mandatory changes, and possible loss of permits. The passage states that "sustained exceedances of permit limits can result in regulatory penalties, mandatory operational changes, and in severe cases, loss of operating permits."

98. **A** — Maintain condenser performance and overall plant efficiency. The opening sentence states this directly: condenser tube cleaning is "essential to maintaining condenser performance and overall plant efficiency."

99. **D** — Reduce the heat transfer rate and raise condenser pressure. The passage states that deposits "reduce the heat transfer rate between the steam on the outside of the tubes and the cooling water inside, which raises condenser pressure and reduces turbine efficiency."

100. **A** — Sponge balls or plastic projectiles continuously circulated through the tubes. The passage states that "on-line cleaning systems use sponge balls or plastic projectiles continuously circulated through the tubes during operation."

101. **C** — Remove or break loose. In the context of "tools driven through each tube to physically dislodge deposits," the word means to remove or break loose the deposits from the tube interior.

102. **B** — It dissolves specific deposit types, particularly hard scale or biological films. The passage states that "chemical cleaning uses circulating solvents that dissolve specific deposit types, particularly hard scale or biological films."

103. **D** — Informative and authoritative. The passage describes condenser tube cleaning methods in a neutral, factual manner using prescriptive operational language, characteristic of training documentation.

104. **A** — Cooling water temperature rise, condenser back pressure, and turbine heat rate. The passage states that operators "monitor condenser performance through measurements of cooling water temperature rise, condenser back pressure, and turbine heat rate."

105. **C** — Provide a safe path for fault currents and maintain equal potential between equipment. The passage states the two functions directly: grounding systems "provide a safe path for electrical fault currents to flow to ground, and they maintain conductive metal equipment at the same electrical potential."

106. **B** — Copper-clad steel rods driven deep into the earth. The passage states that grounding electrodes are "usually copper-clad steel rods driven deep into the earth, supplemented by ground grids in switchyards."

107. **D** — Bonded to the grounding network. The passage states that "all major equipment frames, structural steel, and electrical neutral points are bonded to this grounding network." Bonding ensures all equipment is at the same electrical potential.

108. **C** — Connected electrically. In the context of safety grounding, "bonded" means electrically connected so that all metal parts share the same potential, eliminating dangerous voltage differences between objects.

109. **C** — It can result from corroded connections or deteriorated conditions. The passage states that "high ground resistance can result from corroded connections, broken conductors, or deteriorated soil conditions, and it requires prompt corrective action."

110. **A** — Describe the function and importance of plant electrical grounding systems. The passage describes grounding system functions, components, and maintenance without arguing or comparing costs. It is a descriptive overview.

111. **D** — Before any new equipment is placed in service. The passage states explicitly that "the integrity of grounding connections is verified before any new equipment is placed in service."

112. **A** — Rotating equipment such as pumps, fans, motors, turbines, and generators. The opening sentence states this directly: vibration monitoring assesses "rotating equipment such as pumps, fans, motors, turbines, and generators."

113. **B** — Developing mechanical problems. The passage states that "excessive or changing vibration patterns often indicate developing mechanical problems such as bearing wear, shaft misalignment, mass imbalance, or coupling defects."

114. **D** — Sensors mounted on bearing housings to measure vibration in real time. The passage states that continuous vibration monitoring systems "use sensors mounted on bearing housings to measure vibration amplitude and frequency in real time."

115. **C** — A reference value for comparison. In the context of "established baseline values" used to compare current readings against, the word means a reference standard for comparison purposes.

116. **B** — It automatically removes critical equipment from service to prevent catastrophic failure. The passage states that for critical equipment, "vibration trip protection automatically removes the equipment from service if vibration exceeds dangerous levels, preventing potential catastrophic failures."

117. **A** — Informative and authoritative. The passage describes vibration monitoring systems and procedures in a neutral, factual manner using technical operational language, characteristic of training documentation.

118. **B** — The predictive maintenance approach that has replaced reactive maintenance. The passage states that "the combination of continuous monitoring and periodic analysis represents the predictive maintenance approach that has largely replaced reactive maintenance in modern plants."

119. **D** — Classroom instruction, simulator training, on-the-job training, and examinations. The passage states that "the certification process typically includes formal classroom instruction, simulator training, on-the-job training under qualified supervision, and a series of written and practical examinations."

120. **A** — Auxiliary operator to plant operator to senior reactor operator or shift supervisor. The passage states that "certification levels generally progress from auxiliary operator to plant operator to senior reactor operator or shift supervisor."

121. **C** — Continuing training that addresses new procedures, equipment changes, and lessons learned. The passage states that operators must maintain certification "through continuing training that addresses new procedures, equipment modifications, lessons learned from industry events, and refresher coverage."

122. **B** — Demonstrated ability or skill. In the context of "additional training and demonstrated competency," the word means proven ability or skill in performing the required duties.

123. **A** — It is treated as a serious career setback by working operators. The passage states that "maintaining current certification is treated as a fundamental career obligation by working operators," implying that loss of certification is a serious setback.

124. **D** — Describe how operator certification programs function and matter. The passage describes the certification process, maintenance requirements, and consequences without arguing for changes or comparing programs. It is a descriptive overview.

125. **C** — Repeating significant portions of the original certification process. The passage states that "restoring lost certification typically requires repeating significant portions of the original certification process."

126. **B** — A fundamental career obligation. The passage states explicitly that "maintaining current certification is treated as a fundamental career obligation by working operators."

SUBTEST 4 — FIGURAL REASONING (Questions 127–146)

127. **A** — A hexagon on top. The pattern adds a new shape on top of the existing layered figure each frame, with each new shape having one more side than the previous: triangle (3 sides), square (4), pentagon (5), then hexagon (6). The progression continues by adding the next polygon.

128. **C** — Three circles. The transformation in the top row is "1 becomes 3" (one horizontal line becomes three parallel horizontal lines). Applying the same transformation to the bottom row, one circle becomes three circles.

129. **B** — Top-right. The dot moves clockwise through the four quadrants, completing one full rotation in four frames. After Frame 4 (top-left), Frame 5 returns to the starting position (top-right) and begins a new cycle.

130. **D** — 5 nested squares. The pattern adds one nested square per frame: 1, 2, 3, 4, then 5. Each successive frame adds exactly one more nested square inside the existing arrangement.

131. **A** — Arrow pointing left with a black tip. The pattern in the top row rotates 90° clockwise (up becomes right). Applying the same rotation to the bottom row, down becomes left. The black tip is preserved across the transformation.

132. **D** — 240°. The hour hand advances 60° clockwise per frame: 0°, 60°, 120°, 180°, then 240°. Each successive frame adds 60° to the cumulative rotation.

133. **A** — A small hexagon. The pattern within each row shows the same shape with decreasing size from left to right (large, medium, small). The bottom row continues the progression with a small hexagon as the third element.

134. **C** — 5 points filled. The pattern fills one additional point per frame: 1, 2, 3, 4, then 5. Each successive frame fills exactly one more star point than the previous frame.

135. **B** — Filled square. The transformation in the top row is "triangle becomes square" (shape change). The transformation in the left column is "empty becomes filled" (color change). Combining both, the bottom-right must be a filled square.

136. **D** — 4 internal 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 hexagon, making the addition rule consistent.

137. **B** — Square with a small triangle in the center. The transformation in the top row is "dot becomes small triangle" (interior element changes). Applying the same transformation to the bottom row, the dot inside the square becomes a small triangle inside the square.

138. **D** — A heptagon pointing up. The pattern alternates between directional shapes (with point) and non-directional shapes, while gaining one side per frame: triangle (3, point), square (4, no point), pentagon (5, point), hexagon (6, no point), then heptagon (7, point).

139. **A** — Gray. The pattern shifts colors leftward by one position in each row: top row (white, gray, black), middle row (gray, black, white), bottom row (black, white, gray). The missing cell continues the leftward shift with gray.

140. **C** — Fully shaded (100%). The pattern increases shading by 1/4 per frame: 0%, 25%, 50%, 75%, then 100%. Each successive frame fills another quarter of the circle.

141. **B** — Three small squares in a row. The transformation in the top row is "1 becomes 3 in a row." Applying the same transformation to the bottom row, one small square becomes three small squares in a row.

142. **C** — 0 corners (nothing remaining). The pattern reduces the corner count by one per frame: 4, 3, 2, 1, then 0. Frame 5 logically has zero corners, meaning the figure has fully reduced to nothing.

143. **B** — Rightward-pointing triangle. The pattern in the top row rotates 90° counterclockwise (up becomes left). Applying the same rotation to the bottom row, down becomes right. The bottom-right is a rightward-pointing triangle.

144. **A** — 180°. The minute hand advances 45° clockwise per frame: 0°, 45°, 90°, 135°, then 180°. Each successive frame adds 45° to the cumulative rotation.

145. **D** — 3 dots. The pattern within each row adds one dot per cell from left to right: 1, 2, then 3. The bottom row continues the progression to 3 dots in the third cell.

146. **C** — Left side. The pattern alternates between left and right sides: left, right, left, right, then left. Frame 5 follows the alternation by returning to the left side.