Board Exam Desk

Mining Engineering Reviewer

Mining Engineering Licensure Examination | PRC | 120 original questions

2026 Edition | Updated November 2026

Original board-style practice questions with an answer key.

Practice questions

Mining Geology and Exploration

1. A drill hole cuts three mineralized intervals: 2.0 m at 1.8% Cu, 3.5 m at 0.9% Cu and 1.5 m at 2.4% Cu. What is the length-weighted average grade of the composite?

A. 1.48% Cu
B. 1.70% Cu
C. 1.30% Cu
D. 1.62% Cu

2. An exploration team is targeting a porphyry copper system in a volcanic island arc. With which host setting are such deposits most typically associated?

A. Layered mafic intrusions in stable continental cratons
B. Marine evaporite sequences in rift basins
C. Thick quartz-pebble conglomerates in old sedimentary basins
D. Intermediate to felsic calc-alkaline intrusions above subduction zones

3. During mapping, a geologist finds a red-brown, cellular, limonite-rich outcrop overlying altered volcanic rocks. This outcrop is best interpreted as

A. a primary banded iron formation
B. a gossan formed by weathering of underlying sulfides
C. a laterite developed on limestone
D. a fresh hypogene massive sulfide lens

4. In a weathered copper sulfide deposit, where is the zone of supergene enrichment normally found?

A. At the ground surface, above the leached cap
B. Deep within the unaltered host rock below primary ore
C. Only along faults that cut the oxidized gossan
D. Below the leached cap, near the water table, above primary ore

5. A resource block measures 50 m by 40 m by 10 m and has an in-situ specific gravity of 2.8. What is the tonnage of the block?

A. 20,000 t
B. 56,000 t
C. 48,000 t
D. 70,000 t

6. Podiform chromite deposits, such as those mined in ophiolite belts, are most commonly hosted by which rocks?

A. Granite and pegmatite dikes
B. Shallow marine limestone beds
C. Rhyolitic tuffs and ignimbrites
D. Dunite and harzburgite in the mantle section

7. Nickel laterite deposits develop by prolonged tropical weathering of which parent rock type?

A. Quartz sandstone
B. Ultramafic rocks such as peridotite
C. Granitic gneiss
D. Shale and mudstone

8. A field geologist must identify a mineral that easily scratches quartz on the Mohs scale. Which of the following could it be?

A. Orthoclase
B. Topaz
C. Apatite
D. Calcite

9. A concentrate consisting mainly of sphalerite would be shipped primarily for recovery of which metal?

A. Lead
B. Tin
C. Zinc
D. Copper

10. Which set of textures and minerals best indicates a low-sulfidation epithermal gold vein?

A. Massive magnetite with garnet and pyroxene
B. Colloform-crustiform banded quartz with adularia and bladed calcite
C. Coarse chromite pods in serpentinized dunite
D. Disseminated chalcopyrite in potassic-altered porphyry

11. Which ground geophysical method is best suited for detecting disseminated sulfide mineralization with low overall conductivity?

A. Seismic refraction
B. Gravity survey
C. Induced polarization
D. Ground radiometric survey

12. A drilling contractor reports a 3.0 m core run with 2.55 m of core recovered. What is the core recovery?

A. 15%
B. 77%
C. 90%
D. 85%

13. A block is estimated by inverse distance squared from three samples: 2.0 g/t at 10 m, 1.0 g/t at 20 m and 4.0 g/t at 40 m. What is the estimated block grade?

A. 2.33 g/t
B. 2.00 g/t
C. 1.52 g/t
D. 1.90 g/t

14. On an experimental semivariogram, what does the nugget effect mainly represent?

A. The distance beyond which samples are uncorrelated
B. Variability at very short distances, including sampling error
C. The total variance of the deposit at large distances
D. The direction of greatest grade continuity

15. A basalt dike cuts across a mineralized quartz vein and is itself unmineralized. Which principle shows the dike is younger than the vein?

A. Original horizontality
B. Faunal succession
C. Lateral continuity
D. Cross-cutting relationships

16. A drill hole intersects a planar vein over 10.0 m along the hole, and the hole makes an angle of 60 degrees with the plane of the vein. What is the true thickness?

A. 5.00 m
B. 8.66 m
C. 10.0 m
D. 11.55 m

17. When sampling an alluvial placer for gold, where would the highest concentrations most likely be expected?

A. At the top of the gravel along fast midstream channels
B. In fine clay layers deposited far downstream
C. In bedrock depressions and inside bends where flow slows
D. On the outer cut banks where velocity is highest

18. Under CRIRSCO-style public reporting codes, an Indicated Mineral Resource, after modifying factors are applied, may be converted into which category?

A. Proved Mineral Reserve
B. Measured Mineral Resource
C. Inferred Mineral Resource
D. Probable Mineral Reserve

19. Skarn deposits containing magnetite, copper or tungsten typically form where an intrusion contacts which host rock?

A. Quartzite
B. Granite
C. Limestone or dolomite
D. Coal

20. Which magnetic survey target would give the strongest positive anomaly?

A. A magnetite-rich skarn body
B. A quartz-gold vein without sulfides
C. A thick limestone unit
D. A kaolinite clay alteration zone

Mining Methods and Mine Planning

21. An open pit plan calls for removing 6.0 Mt of waste to expose 1.5 Mt of ore. What is the stripping ratio?

A. 0.25 : 1
B. 5.0 : 1
C. 4.0 : 1
D. 3.0 : 1

22. Ore recovered from a pit yields revenue of 40 $/t, mining and processing the ore costs 22 $/t, and removing waste costs 2.5 $/t. What is the break-even stripping ratio?

A. 16.0 t waste per t ore
B. 8.8 t waste per t ore
C. 6.4 t waste per t ore
D. 7.2 t waste per t ore

23. Pit benches are 10 m high with 70 degree face angles and 6 m wide berms. What is the inter-ramp slope angle?

A. 46 degrees
B. 59 degrees
C. 39 degrees
D. 52 degrees

24. Which deposit is best suited to block caving?

A. A narrow, high-grade vein with weak walls
B. A thin, flat coal seam at shallow depth
C. A small, irregular high-grade pocket near surface
D. A large, massive, low-grade orebody whose rock fragments readily

25. A steeply dipping, irregular, high-grade vein has weak hanging wall rock that cannot stand unsupported. Which method is most appropriate?

A. Sublevel open stoping
B. Block caving
C. Cut-and-fill stoping
D. Room-and-pillar mining

26. Sublevel open stoping is generally feasible only when

A. the ore is flat-lying and less than 2 m thick
B. both ore and wall rocks are competent enough to stand unsupported
C. the hanging wall caves readily behind the face
D. the orebody is soft and must be backfilled at once

27. In shrinkage stoping, only part of the broken ore is drawn off during mining mainly because

A. the ore must cure before it can be hauled
B. drawing all ore would reduce its grade
C. the hoist cannot handle the full tonnage
D. the remaining broken ore serves as the working floor

28. Longwall mining with powered roof shields is most suitable for which deposit?

A. Steep, narrow, erratic gold veins
B. Flat-lying, uniform, tabular seams such as coal
C. Massive porphyry copper bodies
D. Shallow alluvial gravel placers

29. A 90 t haul truck has a cycle time of 24 min, and the operation achieves 50 working minutes per hour. What is the hourly productivity of one truck?

A. 225.0 t/h
B. 168.8 t/h
C. 208.3 t/h
D. 187.5 t/h

30. A shovel needs 3 min to load a truck, and the total truck cycle including loading is 27 min. How many trucks are needed to keep the shovel fully busy?

A. 9 trucks
B. 8 trucks
C. 10 trucks
D. 11 trucks

31. The Lerchs-Grossmann method for determining ultimate open pit limits is based on which technique?

A. Linear regression of grade against depth
B. Monte Carlo simulation of metal prices
C. Graph theory solving the maximum closure of a block model
D. Kriging of grades onto a regular grid

32. A loaded truck with gross weight of 150 t climbs a ramp of 8% grade with rolling resistance of 3%. What rimpull is required, ignoring acceleration?

A. 118 kN
B. 162 kN
C. 74 kN
D. 16.5 kN

33. A shaft must hoist 4,000 t/day; the hoist runs 18 h/day with a 90 s cycle per trip. What minimum skip payload is required?

A. 4.2 t
B. 2.8 t
C. 6.7 t
D. 5.6 t

34. Which placer mining technique uses high-pressure water jets from monitors to break down unconsolidated gravel banks?

A. Bucket-line dredging
B. Drift mining
C. Hydraulicking
D. Dragline stripping

35. In open pit design, bench height is most commonly selected to suit

A. the haul road width
B. the digging reach of the loading equipment
C. the depth of the water table
D. the length of the processing plant

36. A stope was planned to yield 10,000 t at 8.0 g/t Au, but 1,500 t of wall rock at 0.5 g/t was also mined with it. What is the diluted head grade?

A. 6.96 g/t
B. 6.80 g/t
C. 7.35 g/t
D. 7.02 g/t

37. A deposit has 24 Mt of mineable reserves to be extracted in 12 years at 330 operating days per year. What daily production rate is required?

A. 6,060 t/day
B. 5,480 t/day
C. 6,670 t/day
D. 2,000 t/day

38. Square pillars 10 m wide are left with 6 m wide rooms in a room-and-pillar mine. What is the areal extraction ratio?

A. 37.5%
B. 39.1%
C. 64.0%
D. 60.9%

39. Compared with a shaft, a decline (ramp) access is usually preferred for a moderately shallow orebody because it

A. lifts large tonnages from great depth at lower cost
B. requires no ventilation planning
C. allows rubber-tired equipment to drive directly to the workings
D. eliminates the need for ground support

40. Which statement correctly describes the role of a haul road ramp in an open pit?

A. It is a temporary berm used only to catch rockfalls
B. It links benches to the pit exit and flattens the overall slope where it crosses the wall
C. It steepens the overall wall angle to reduce waste
D. It is used only for drainage and never for haulage

Rock Mechanics and Explosives

41. A 2.0 m core run contains intact pieces of 0.25, 0.18, 0.32, 0.12 and 0.40 m, plus many fragments shorter than 10 cm totalling 0.60 m. What is the RQD?

A. 93.5%
B. 30.0%
C. 68.0%
D. 63.5%

42. At 200 m depth with overburden unit weight 25 kN/m3, square pillars 10 m wide are separated by 6 m rooms. Using tributary area theory, what is the average pillar stress?

A. 12.8 MPa
B. 5.0 MPa
C. 8.0 MPa
D. 16.0 MPa

43. A pillar has an estimated strength of 20 MPa and carries an average stress of 12.8 MPa. What is its factor of safety?

A. 0.64
B. 1.56
C. 1.28
D. 2.56

44. What is the approximate vertical in-situ stress at 600 m depth if the average rock unit weight is 27 kN/m3?

A. 1.62 MPa
B. 22.2 MPa
C. 6.0 MPa
D. 16.2 MPa

45. A 54 mm diameter rock core fails under an axial load of 160 kN in a uniaxial compression test. What is the uniaxial compressive strength?

A. 69.9 MPa
B. 54.9 MPa
C. 17.5 MPa
D. 88.6 MPa

46. In a diametral point load test on a 50 mm core, failure occurs at 8.0 kN. What is the uncorrected point load index Is?

A. 0.16 MPa
B. 1.6 MPa
C. 4.1 MPa
D. 3.2 MPa

47. Rock bolts are installed in a thinly bedded mine roof to clamp the layers so they act as one thicker unit. This support mechanism is called

A. suspension
B. beam building
C. keying of a single block
D. surface retention by shotcrete

48. Which parameter is included in Barton's Q-system but is not one of the basic rating parameters of Bieniawski's RMR?

A. Stress reduction factor
B. Rock quality designation
C. Groundwater condition
D. Condition of discontinuities

49. A joint has cohesion of 5 MPa and friction angle of 35 degrees. Using Mohr-Coulomb, what is its shear strength under a normal stress of 10 MPa?

A. 7.0 MPa
B. 13.2 MPa
C. 10.7 MPa
D. 12.0 MPa

50. For planar sliding to be kinematically possible on a joint in a rock slope, the joint should strike roughly parallel to the face and dip

A. less steeply than the face but more steeply than its friction angle
B. more steeply than the face and into the slope
C. at an angle smaller than its friction angle
D. vertically, perpendicular to the slope crest

51. A pit wall shows closely spaced, steep joints dipping into the slope, creating slender columns that rotate outward. This failure mode is

A. planar sliding
B. wedge sliding
C. circular failure in soil
D. toppling

52. A blast hole pattern has a 3.0 m burden, 3.5 m spacing and 10 m bench height, with 70 kg of explosive per hole. What is the powder factor?

A. 0.67 kg/m3
B. 0.23 kg/m3
C. 0.78 kg/m3
D. 0.47 kg/m3

53. What is the loading density of ANFO (850 kg/m3) in a 115 mm diameter blast hole?

A. 35.3 kg/m
B. 4.4 kg/m
C. 8.8 kg/m
D. 11.2 kg/m

54. Why are bench blast holes usually drilled some distance below the planned floor level (subdrilling)?

A. To reduce the amount of stemming required
B. To break the rock fully at grade and avoid leaving a toe
C. To lower the powder factor of the blast
D. To drain groundwater out of the hole

55. The main purpose of stemming the collar of a blast hole is to

A. increase the detonation velocity of the explosive
B. protect the explosive from water inflow at the bottom
C. confine the explosive gases and reduce flyrock and airblast
D. act as the initiating primer for the column charge

56. ANFO is prepared close to oxygen balance by mixing ammonium nitrate prills with fuel oil in approximately what mass proportion?

A. 94% AN and 6% fuel oil
B. 80% AN and 20% fuel oil
C. 60% AN and 40% fuel oil
D. 99% AN and 1% fuel oil

57. Blast holes in a pit floor are full of standing water. Why is plain ANFO a poor choice for these holes?

A. It detonates too quickly in water and fractures the floor
B. It cannot be initiated by any primer
C. It has very poor water resistance and desensitizes when wet
D. It reacts with water to form an explosive gas cloud

58. A structure is 200 m from a blast with 25 kg maximum charge per delay. With site constants K = 1140 and b = 1.6 in PPV = K(R/W^0.5)^-b, what is the predicted PPV?

A. 3.1 mm/s
B. 8.0 mm/s
C. 1.2 mm/s
D. 28.5 mm/s

59. Assigning different delay times to blast holes in a pattern mainly serves to

A. increase the total amount of explosive used
B. make all holes fire at exactly the same instant
C. reduce the charge detonating at once and give each hole relief
D. eliminate the need for stemming

60. A circular tunnel is driven in elastic rock under a hydrostatic in-situ stress of 15 MPa. What is the tangential stress at the tunnel wall?

A. 15 MPa
B. 30 MPa
C. 45 MPa
D. 7.5 MPa

Mineral Processing

61. A copper flotation circuit treats feed at 2.0% Cu, producing concentrate at 25% Cu and tailings at 0.2% Cu. What is the copper recovery?

A. 92.6%
B. 88.0%
C. 7.3%
D. 90.7%

62. For a feed of 2.0% Cu, concentrate of 25% Cu and tailings of 0.2% Cu, what is the ratio of concentration?

A. 12.5
B. 13.8
C. 10.0
D. 15.2

63. A ball mill grinds 200 t/h from F80 = 10,000 um to P80 = 100 um. With a Bond work index of 14 kWh/t, what is the required mill power?

A. 2,520 kW
B. 2,800 kW
C. 1,260 kW
D. 280 kW

64. A tumbling mill has an inside diameter of 4.0 m. Using Nc = 42.3/sqrt(D), what is its speed when run at 75% of critical speed?

A. 15.9 rpm
B. 21.2 rpm
C. 10.6 rpm
D. 28.2 rpm

65. In froth flotation, the main function of a frother such as MIBC is to

A. make sulfide surfaces hydrophobic
B. raise the pulp pH to depress pyrite
C. dissolve gold into solution
D. produce a stable froth of fine bubbles

66. In copper sulfide flotation, lime is commonly added to raise the pH mainly to

A. act as the primary collector for chalcopyrite
B. dissolve gangue silicates
C. depress pyrite while floating copper minerals
D. replace the frother

67. Besides free cyanide, which reactant is essential for gold dissolution during cyanidation?

A. Sulfuric acid
B. Hydrogen gas
C. Dissolved oxygen
D. Sodium chloride

68. In a carbon-in-leach plant, what species does the activated carbon adsorb from solution?

A. Elemental gold particles
B. Free cyanide ions only
C. Ferric hydroxide precipitate
D. The gold cyanide complex, Au(CN)2-

69. A slurry has a pulp density of 1.50 t/m3, and the dry solids have a specific gravity of 2.70. What is the percent solids by mass?

A. 55.6%
B. 33.3%
C. 52.9%
D. 47.1%

70. In a closed ball mill-cyclone circuit, the percent passing 75 um is 40% in cyclone feed, 80% in overflow and 20% in underflow. What is the circulating load?

A. 50%
B. 300%
C. 200%
D. 100%

71. A plant treats ore with coarse free gold and cassiterite in a light quartz gangue. Which separation principle suits a first recovery stage?

A. Froth flotation based on bubble attachment
B. Magnetic separation based on susceptibility
C. Gravity separation based on density difference
D. Leaching based on chemical dissolution of tin

72. Which separation method is typically used to separate conductive minerals such as rutile and ilmenite from non-conductive zircon in mineral sands?

A. High-tension electrostatic separation
B. Dense medium separation
C. Froth flotation with xanthate
D. Low-intensity wet magnetic separation

73. Which comminution law states that the energy required is proportional to the new surface area produced and fits fine grinding best?

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

74. A primary crusher receives ore at 80% passing 600 mm and discharges product at 80% passing 150 mm. What is the reduction ratio?

A. 0.25
B. 4.0
C. 3.0
D. 4.5

75. Using Stokes' law, what is the terminal settling velocity in water (viscosity 0.001 Pa.s) of a 50 um quartz particle of density 2,650 kg/m3?

A. 0.22 mm/s
B. 3.6 mm/s
C. 2.2 mm/s
D. 22 mm/s

76. Which process route is generally most economical for very low-grade, porous oxide gold ore mined in large tonnages?

A. Whole-ore flotation and smelting
B. Gravity tabling of all ore
C. Pressure oxidation followed by CIL
D. Heap leaching with dilute cyanide

77. In a semi-autogenous (SAG) mill, the grinding media consist of

A. steel rods running the full mill length
B. large ore lumps supplemented by a modest charge of steel balls
C. only fine sand added from an outside source
D. ceramic beads smaller than 5 mm

78. A flotation bank needs 12 min residence time for a pulp flow of 6.0 m3/min. Cells have 8 m3 nominal volume, 85% effective. How many cells are required?

A. 9 cells
B. 10 cells
C. 11 cells
D. 13 cells

79. When operators push a flotation circuit to produce a higher concentrate grade, the usual effect on recovery is that it

A. increases in direct proportion to grade
B. stays exactly constant regardless of grade
C. becomes independent of the feed grade
D. decreases, reflecting the grade-recovery trade-off

80. Which piece of equipment is the usual choice for high-capacity primary crushing of hard ore at a large open pit mine?

A. Rod mill
B. Vertical shaft impactor
C. Hammer mill
D. Gyratory crusher

Mine Ventilation, Safety and Environment

81. A mine airway system has a resistance of 0.5 Ns2/m8 and must pass 40 m3/s. If the fan-motor efficiency is 70%, what input power is required?

A. 32.0 kW
B. 22.4 kW
C. 45.7 kW
D. 28.6 kW

82. A mine fan's speed is increased by 20% while the system resistance is unchanged. By what factor does the fan power increase?

A. 1.20
B. 1.73
C. 1.44
D. 2.07

83. Two airways with resistances of 0.4 and 0.9 Ns2/m8 are connected in parallel. What is their equivalent resistance?

A. 0.144 Ns2/m8
B. 1.30 Ns2/m8
C. 0.277 Ns2/m8
D. 0.650 Ns2/m8

84. Methane mixed with air is explosive within which approximate concentration range?

A. 1% to 3% by volume
B. 5% to 15% by volume
C. 20% to 30% by volume
D. 0.5% to 2% by volume

85. After an underground fire, a rescue team is warned of 'whitedamp'. Which gas does this term refer to?

A. Carbon monoxide
B. Methane
C. Hydrogen sulfide
D. Carbon dioxide

86. A coal heading releases 0.3 m3/s of methane. Approximately what airflow is needed to keep the methane concentration at 1% in the return?

A. 3 m3/s
B. 15 m3/s
C. 60 m3/s
D. 30 m3/s

87. Why is hydrogen sulfide especially dangerous to miners at high concentrations?

A. It is lighter than air and collects only at the roof
B. It paralyzes the sense of smell, so its odor warning disappears
C. It is completely odorless at all concentrations
D. It is harmless to breathe but highly explosive

88. In hot, humid underground workings, which measurement best indicates a worker's ability to cool the body by sweat evaporation?

A. Dry-bulb temperature alone
B. Barometric pressure
C. Wet-bulb temperature
D. Rock thermal conductivity

89. An airway measures 4.0 m wide by 3.5 m high and carries 42 m3/s. What is the mean air velocity?

A. 3.0 m/s
B. 2.6 m/s
C. 3.5 m/s
D. 10.5 m/s

90. Natural ventilation in a mine is produced mainly by

A. the rotation of the Earth acting on airways
B. tidal changes in groundwater level
C. magnetic fields produced by electrical cables
D. differences in air density between intake and return air columns

91. Which statement correctly describes a forcing auxiliary ventilation system in a development heading?

A. Air is drawn from the face through duct, so fresh air enters along the heading
B. No duct is used; the main fan alone ventilates the face
C. Air is recirculated through the same duct continuously
D. Fresh air is blown through duct to the face and returns along the heading

92. Acid mine drainage from waste dumps is generated mainly by

A. dissolution of limestone by rainwater
B. evaporation of seawater in tailings ponds
C. oxidation of pyrite and other sulfides exposed to air and water
D. decomposition of organic topsoil

93. Which tailings dam construction method is generally most vulnerable to liquefaction failure in areas of high seismicity?

A. Downstream method
B. Centerline method
C. Upstream method
D. Water-retention dam with impervious core

94. Prolonged inhalation of respirable crystalline silica dust during drilling of quartz-rich rock causes which occupational disease?

A. Asbestosis
B. Byssinosis
C. Silicosis
D. Siderosis

95. A miner carries a filter-type self-rescuer. In which situation will it NOT protect the wearer?

A. Air with moderate carbon monoxide after a fire
B. Smoky air with adequate oxygen
C. An atmosphere seriously deficient in oxygen
D. Air with low levels of dust

96. Before a maintenance crew works on a conveyor drive, what is the main purpose of applying lockout and tagout?

A. To isolate energy sources so equipment cannot be started accidentally
B. To record operating hours for scheduled maintenance
C. To lock the conveyor at maximum speed during testing
D. To transfer control of the drive to the dispatcher

97. In underground coal mines, rock dusting of roadways with inert limestone dust is done primarily to

A. improve the traction of haulage vehicles
B. absorb methane from the mine air
C. prevent the propagation of coal dust explosions
D. neutralize acid water on the floor

98. Two identical drilling machines each produce 90 dB at an operator's position. What is the combined sound level when both run together?

A. 180 dB
B. 90 dB
C. 96 dB
D. 93 dB

99. Rehabilitating disturbed areas of a mine continuously during operations, rather than only at closure, is known as

A. progressive rehabilitation
B. care and maintenance
C. final pit backfilling
D. post-closure monitoring

100. A 500 m airway has a 14 m perimeter, 12 m2 area and friction factor 0.012 Ns2/m4. What pressure drop occurs when it carries 30 m3/s?

A. 21.9 Pa
B. 525 Pa
C. 43.8 Pa
D. 36.5 Pa

Mine Economics and Valuation

101. Mining, processing and overhead costs total 30 $/t of ore, gold sells at 60 $/g and metallurgical recovery is 90%. What is the break-even cut-off grade?

A. 0.50 g/t
B. 0.45 g/t
C. 0.62 g/t
D. 0.56 g/t

102. A project costs 100 M$ now and returns 30 M$ per year for 5 years. At a 10% discount rate, what is its NPV?

A. 50.0 M$
B. 13.7 M$
C. -13.7 M$
D. 8.2 M$

103. A mine requires 100 M$ capital and generates a uniform net cash flow of 30 M$ per year. What is its simple payback period?

A. 3.0 years
B. 3.3 years
C. 4.0 years
D. 2.7 years

104. The Hoskold valuation formula differs from simple present value because it

A. ignores the life of the mine entirely
B. uses a speculative rate plus a safe rate for a sinking fund
C. discounts cash flows at a zero interest rate
D. values only the salvage of plant and equipment

105. A mine earns 10 M$ per year for 10 years. Using the Hoskold formula with a 12% speculative rate and 6% safe rate, what is its present value?

A. 51.1 M$
B. 56.5 M$
C. 73.6 M$
D. 100.0 M$

106. A loader costs 5.0 M$, has a salvage value of 0.5 M$ and a 6-year life. What is its annual straight-line depreciation?

A. 0.75 M$
B. 0.83 M$
C. 0.92 M$
D. 0.68 M$

107. A processing plant cost 60 M$ and will treat a 20 Mt reserve. Using units-of-production depreciation, what is the charge in a year when 2.5 Mt is milled?

A. 6.0 M$
B. 7.5 M$
C. 3.0 M$
D. 8.3 M$

108. The internal rate of return of a mining project is the discount rate at which

A. the payback period equals the mine life
B. the net present value equals zero
C. annual revenue equals annual operating cost
D. the cut-off grade equals the average grade

109. Ore grades 1.2% Cu, recovery is 88%, copper sells at 9,000 $/t, and smelting, refining and freight total 15 $ per tonne of ore. What is the net smelter return per tonne of ore?

A. 95.0 $/t
B. 80.0 $/t
C. 93.0 $/t
D. 108.0 $/t

110. A loan for mine equipment carries 12% nominal annual interest compounded monthly. What is the effective annual rate?

A. 12.00%
B. 12.36%
C. 12.68%
D. 13.12%

111. A 20 M$ equipment loan at 8% is repaid in 5 equal annual payments. What is each payment?

A. 5.01 M$
B. 4.00 M$
C. 5.60 M$
D. 4.32 M$

112. A gold mine produces 1,500 kg of gold per year at a total cash operating cost of 45 M$ per year. What is the cash cost per gram?

A. 30 $/g
B. 33 $/g
C. 3.0 $/g
D. 300 $/g

113. For valuing an operating mine with well-defined reserves and a production schedule, which approach is generally most appropriate?

A. Cost approach based on exploration spending
B. Income approach using discounted cash flow
C. Comparison with land prices of nearby farms
D. Book value from the company balance sheet

114. A study uses a nominal discount rate of 12% and expected inflation of 4%. What is the equivalent real discount rate?

A. 8.0%
B. 16.5%
C. 7.7%
D. 7.0%

115. The theory of optimizing cut-off grade by considering the capacities of the mine, mill and market together is associated with

A. Kenneth Lane
B. Herbert Hoover
C. Georges Matheron
D. Fred Bond

116. A quarry has fixed costs of 24 M$ per year, a selling price of 80 $/t and variable costs of 50 $/t. What annual output is needed to break even?

A. 0.80 Mt
B. 0.30 Mt
C. 0.48 Mt
D. 1.20 Mt

117. On a grade-tonnage curve, raising the cut-off grade normally causes

A. lower tonnage above cut-off but a higher average grade
B. higher tonnage and higher average grade
C. lower tonnage and lower average grade
D. no change in tonnage but a lower average grade

118. What is the present value of a 50 M$ closure liability payable 8 years from now at a 10% discount rate?

A. 26.0 M$
B. 23.3 M$
C. 31.3 M$
D. 45.5 M$

119. A mine has gross revenue of 180 M$ and deductible smelting and freight charges of 20 M$. What is the annual payment under a 2.5% NSR royalty?

A. 4.0 M$
B. 4.5 M$
C. 5.0 M$
D. 3.5 M$

120. Ore contains 1.5 g/t gold and 20 g/t silver. With gold at 65 $/g and silver at 0.80 $/g, and equal recoveries, what is the gold-equivalent grade?

A. 1.75 g/t AuEq
B. 1.81 g/t AuEq
C. 1.62 g/t AuEq
D. 2.25 g/t AuEq

Answer key

Mining Engineering

1. A. 1.48% Cu

Weighted grade = (2.0x1.8 + 3.5x0.9 + 1.5x2.4)/7.0 = 10.35/7.0 = 1.48% Cu; 1.70% is the unweighted mean.

2. D. Intermediate to felsic calc-alkaline intrusions above subduction zones

Porphyry copper deposits form from hydrothermal fluids exsolved from intermediate to felsic calc-alkaline magmas generated in subduction-related arcs.

3. B. a gossan formed by weathering of underlying sulfides

A gossan is the iron-oxide cap left when sulfide minerals near surface are oxidized and leached, so it is a classic surface indicator of buried sulfides.

4. D. Below the leached cap, near the water table, above primary ore

Copper leached from the oxidized zone migrates downward and reprecipitates as secondary sulfides near the water table, above the hypogene (primary) zone.

5. B. 56,000 t

Volume = 50x40x10 = 20,000 m3; tonnage = 20,000 x 2.8 = 56,000 t.

6. D. Dunite and harzburgite in the mantle section

Podiform chromite occurs as pods in the ultramafic mantle sequence (dunite enveloped by harzburgite) of ophiolite complexes.

7. B. Ultramafic rocks such as peridotite

Intense chemical weathering of olivine-rich ultramafic rocks releases nickel, which concentrates in the limonite and saprolite horizons of the laterite profile.

8. B. Topaz

Quartz is 7 on the Mohs scale; topaz is 8 and scratches it, while orthoclase (6), apatite (5) and calcite (3) are softer.

9. C. Zinc

Sphalerite, (Zn,Fe)S, is the principal ore mineral of zinc; galena is lead, cassiterite is tin.

10. B. Colloform-crustiform banded quartz with adularia and bladed calcite

Low-sulfidation epithermal veins typically show banded colloform-crustiform quartz, adularia and bladed calcite, recording boiling of near-neutral fluids.

11. C. Induced polarization

Induced polarization responds to chargeability of disseminated metallic grains even when the rock is not highly conductive.

12. D. 85%

Core recovery = 2.55/3.0 x 100 = 85%.

13. D. 1.90 g/t

Weights 1/100, 1/400, 1/1600; grade = (0.02+0.0025+0.0025)/0.013125 = 1.90 g/t. 2.33 is the plain average and 2.00 uses power 1.

14. B. Variability at very short distances, including sampling error

The nugget is the variogram intercept at zero lag, reflecting micro-scale variability and sampling or assay error; the range is the distance of correlation.

15. D. Cross-cutting relationships

A feature that cuts across another must be younger than the feature it cuts.

16. B. 8.66 m

True thickness = intercept length x sin(angle between hole and vein plane) = 10.0 x sin60 = 8.66 m.

17. C. In bedrock depressions and inside bends where flow slows

Dense gold settles where current velocity drops, such as point bars on inner bends, behind obstructions and in bedrock traps.

18. D. Probable Mineral Reserve

Indicated Resources convert to Probable Reserves; only Measured Resources may become Proved Reserves.

19. C. Limestone or dolomite

Skarns are calc-silicate replacement bodies formed by metasomatism of carbonate rocks at or near intrusive contacts.

20. A. A magnetite-rich skarn body

Magnetite has very high magnetic susceptibility, so magnetite skarns produce strong magnetic highs; quartz, limestone and clays are weakly magnetic.

21. C. 4.0 : 1

Stripping ratio = waste/ore = 6.0/1.5 = 4.0 t of waste per t of ore.

22. D. 7.2 t waste per t ore

Break-even SR = (revenue - ore cost)/waste cost = (40 - 22)/2.5 = 7.2.

23. A. 46 degrees

Horizontal run per bench = 10/tan70 + 6 = 3.64 + 6 = 9.64 m; angle = atan(10/9.64) = 46 degrees.

24. D. A large, massive, low-grade orebody whose rock fragments readily

Block caving is a low-cost bulk method that needs a large, massive orebody that caves and fragments under gravity.

25. C. Cut-and-fill stoping

Cut-and-fill places backfill as mining advances, supporting weak walls while allowing selective extraction of irregular high-grade ore.

26. B. both ore and wall rocks are competent enough to stand unsupported

Open stopes remain empty during extraction, so competent ore and walls are needed to stand over large unsupported spans.

27. D. the remaining broken ore serves as the working floor

Broken ore swells; only the swell increment is drawn so miners can keep standing on the muck pile, with the bulk removed when the stope is complete.

28. B. Flat-lying, uniform, tabular seams such as coal

Longwall needs a continuous, relatively flat, uniform seam so the shearer and shields can advance along a long face.

29. D. 187.5 t/h

Trips per hour = 50/24 = 2.083; productivity = 2.083 x 90 = 187.5 t/h. 225 t/h ignores job efficiency.

30. A. 9 trucks

Match number = truck cycle time/loading time = 27/3 = 9 trucks.

31. C. Graph theory solving the maximum closure of a block model

Lerchs-Grossmann uses graph theory to find the set of blocks (closure) that maximizes total value while honoring slope precedence.

32. B. 162 kN

Total resistance = 3% + 8% = 11%; rimpull = 0.11 x 150 t x 9.81 = 162 kN.

33. D. 5.6 t

Trips/h = 3600/90 = 40; trips/day = 720; payload = 4000/720 = 5.6 t.

34. C. Hydraulicking

Hydraulic mining (hydraulicking) directs high-pressure water through monitors to disintegrate gravel, which is then washed through sluices.

35. B. the digging reach of the loading equipment

Bench height is matched to the shovel or excavator so it can dig the full face safely and efficiently.

36. D. 7.02 g/t

Diluted grade = (10,000x8.0 + 1,500x0.5)/11,500 = 80,750/11,500 = 7.02 g/t; 6.96 assumes the waste carries no gold.

37. A. 6,060 t/day

Annual rate = 24/12 = 2.0 Mt; daily = 2,000,000/330 = 6,060 t/day.

38. D. 60.9%

Extraction = 1 - (10/16)^2 = 1 - 0.391 = 0.609, or 60.9%.

39. C. allows rubber-tired equipment to drive directly to the workings

Declines allow trackless mobile equipment and trucks to travel into the mine, which is flexible and economical for shallower orebodies.

40. B. It links benches to the pit exit and flattens the overall slope where it crosses the wall

Ramps provide haulage access between benches and the surface; their width adds horizontal distance, flattening the overall slope.

41. D. 63.5%

RQD counts only pieces 10 cm or longer: (0.25+0.18+0.32+0.12+0.40)/2.0 = 1.27/2.0 = 63.5%.

42. A. 12.8 MPa

Vertical stress = 0.025 x 200 = 5.0 MPa; pillar stress = 5.0 x (16/10)^2 = 12.8 MPa.

43. B. 1.56

FS = strength/stress = 20/12.8 = 1.56.

44. D. 16.2 MPa

Vertical stress = unit weight x depth = 27 kN/m3 x 600 m = 16,200 kPa = 16.2 MPa.

45. A. 69.9 MPa

Area = pi x (0.027)^2 = 0.002290 m2; UCS = 160 kN/0.002290 m2 = 69.9 MPa.

46. D. 3.2 MPa

Is = P/De^2 = 8,000 N/(0.050 m)^2 = 3.2 MPa.

47. B. beam building

Clamping thin laminations together creates a composite beam that is stiffer and stronger than the separate layers.

48. A. Stress reduction factor

The Q-system uses SRF to account for in-situ stress conditions; RQD, groundwater and joint condition appear in both systems in some form.

49. D. 12.0 MPa

Shear strength = c + normal stress x tan(phi) = 5 + 10 x tan35 = 5 + 7.0 = 12.0 MPa.

50. A. less steeply than the face but more steeply than its friction angle

The plane must daylight in the face (dip less than the face) and be steep enough to overcome friction (dip greater than the friction angle).

51. D. toppling

Toppling involves forward rotation of columns or blocks bounded by steep discontinuities dipping into the face.

52. A. 0.67 kg/m3

Rock per hole = 3.0 x 3.5 x 10 = 105 m3; powder factor = 70/105 = 0.67 kg/m3.

53. C. 8.8 kg/m

Hole area = pi x (0.0575)^2 = 0.01039 m2; loading density = 0.01039 x 850 = 8.8 kg per metre of hole.

54. B. To break the rock fully at grade and avoid leaving a toe

Subdrilling ensures the rock is broken down to floor level so hard toes or humps are not left on the bench.

55. C. confine the explosive gases and reduce flyrock and airblast

Inert stemming keeps gases in the hole longer to do useful work and limits venting that causes flyrock and air overpressure.

56. A. 94% AN and 6% fuel oil

About 94:6 by mass gives near-zero oxygen balance, maximizing energy and minimizing toxic fumes.

57. C. It has very poor water resistance and desensitizes when wet

Ammonium nitrate dissolves in water, so wet ANFO loses sensitivity and energy; emulsions or packaged products are used instead.

58. A. 3.1 mm/s

Scaled distance = 200/sqrt(25) = 40; PPV = 1140 x 40^-1.6 = 3.1 mm/s.

59. C. reduce the charge detonating at once and give each hole relief

Delays limit the charge per delay (reducing vibration) and let each hole break toward a free face created by earlier holes, improving fragmentation.

60. B. 30 MPa

From the Kirsch solution, the boundary tangential stress around a circular opening in a hydrostatic field is 2p = 2 x 15 = 30 MPa.

61. D. 90.7%

R = c(f - t)/[f(c - t)] = 25(1.8)/[2.0(24.8)] = 45/49.6 = 90.7%. 7.3% is the mass yield.

62. B. 13.8

Ratio of concentration F/C = (c - t)/(f - t) = 24.8/1.8 = 13.8.

63. A. 2,520 kW

W = 14(10/sqrt100 - 10/sqrt10000) = 14(1 - 0.1) = 12.6 kWh/t; power = 12.6 x 200 = 2,520 kW.

64. A. 15.9 rpm

Nc = 42.3/sqrt(4.0) = 21.15 rpm; 0.75 x 21.15 = 15.9 rpm.

65. D. produce a stable froth of fine bubbles

Frothers lower surface tension so small, stable bubbles form and carry loaded particles; collectors render minerals hydrophobic.

66. C. depress pyrite while floating copper minerals

At high pH, pyrite flotation by xanthate is suppressed, improving selectivity for copper sulfides.

67. C. Dissolved oxygen

Gold dissolution in cyanide requires an oxidant; dissolved oxygen fulfills this role, as shown by the Elsner reaction.

68. D. The gold cyanide complex, Au(CN)2-

Dissolved gold exists as the aurocyanide complex, which loads onto activated carbon and is later eluted.

69. C. 52.9%

Cw = rho_s(rho_p - 1)/[rho_p(rho_s - 1)] = 2.70(0.50)/[1.50(1.70)] = 52.9%.

70. C. 200%

Circulating load U/O = (o - f)/(f - u) = (80 - 40)/(40 - 20) = 2.0, or 200%.

71. C. Gravity separation based on density difference

Gold and cassiterite are much denser than quartz, so jigs, spirals or tables recover them cheaply by gravity.

72. A. High-tension electrostatic separation

Electrostatic separators exploit differences in electrical conductivity: rutile and ilmenite are conductors, zircon is a non-conductor.

73. A. Rittinger's law

Rittinger's law relates energy to new surface created; Kick's law suits coarse crushing, with Bond's law in between.

74. B. 4.0

Reduction ratio = F80/P80 = 600/150 = 4.0.

75. C. 2.2 mm/s

v = g d^2 (rho_s - rho_f)/(18 mu) = 9.81(50e-6)^2(1650)/(0.018) = 2.2e-3 m/s.

76. D. Heap leaching with dilute cyanide

Heap leaching avoids fine grinding and tank leaching, making it suitable for large tonnages of low-grade, permeable oxide ore.

77. B. large ore lumps supplemented by a modest charge of steel balls

SAG mills rely mainly on coarse ore as media with a small ball charge to aid breakage.

78. C. 11 cells

Effective volume needed = 6.0 x 12 = 72 m3; per cell = 6.8 m3; 72/6.8 = 10.6, rounded up to 11 cells.

79. D. decreases, reflecting the grade-recovery trade-off

Producing cleaner concentrate rejects more middlings and locked particles, so recovery typically falls along the grade-recovery curve.

80. D. Gyratory crusher

Gyratory crushers accept large run-of-mine feed and handle very high throughputs, making them standard primary crushers at large mines.

81. C. 45.7 kW

P = RQ^2 = 0.5 x 1600 = 800 Pa; air power = 800 x 40 = 32 kW; input = 32/0.70 = 45.7 kW.

82. B. 1.73

By fan laws, power varies with speed cubed: 1.2^3 = 1.73.

83. A. 0.144 Ns2/m8

1/sqrt(R) = 1/sqrt(0.4) + 1/sqrt(0.9) = 1.581 + 1.054 = 2.635; R = 0.144 Ns2/m8.

84. B. 5% to 15% by volume

The lower and upper explosive limits of methane in air are about 5% and 15%.

85. A. Carbon monoxide

Whitedamp is the traditional name for carbon monoxide, which is odorless and binds hemoglobin; firedamp is methane, stinkdamp is H2S.

86. D. 30 m3/s

Required airflow is about emission/allowable fraction = 0.3/0.01 = 30 m3/s.

87. B. It paralyzes the sense of smell, so its odor warning disappears

H2S smells like rotten eggs at low levels, but higher concentrations deaden the olfactory nerve, removing the warning while toxicity rises.

88. C. Wet-bulb temperature

Evaporative cooling depends on air humidity, which wet-bulb temperature captures; dry-bulb temperature alone ignores moisture.

89. A. 3.0 m/s

Velocity = Q/A = 42/(4.0 x 3.5) = 42/14 = 3.0 m/s.

90. D. differences in air density between intake and return air columns

Temperature and moisture differences make air columns of different density, creating a natural pressure that drives airflow.

91. D. Fresh air is blown through duct to the face and returns along the heading

Forcing systems push fresh air through duct to discharge near the face, so contaminated air travels back along the drive.

92. C. oxidation of pyrite and other sulfides exposed to air and water

Sulfide oxidation produces sulfuric acid and dissolved metals; neutralizing carbonates reduce the effect.

93. C. Upstream method

Upstream dams are raised on previously deposited loose tailings, which can liquefy under earthquake shaking.

94. C. Silicosis

Silicosis is fibrosis of the lungs caused by respirable crystalline silica.

95. C. An atmosphere seriously deficient in oxygen

A filter self-rescuer catalytically converts CO to CO2 but supplies no oxygen, so it is useless where oxygen is deficient.

96. A. To isolate energy sources so equipment cannot be started accidentally

Lockout-tagout isolates and secures energy sources so no one can energize the machine while people are working on it.

97. C. prevent the propagation of coal dust explosions

Inert dust mixed with coal dust absorbs heat and quenches flame, stopping a coal dust explosion from spreading.

98. D. 93 dB

L = 10 log(2 x 10^9) = 93 dB; doubling identical sources adds about 3 dB.

99. A. progressive rehabilitation

Progressive rehabilitation restores areas as soon as they are no longer needed, reducing closure liability and environmental impact.

100. C. 43.8 Pa

Atkinson: P = K C L Q^2/A^3 = 0.012 x 14 x 500 x 900/1728 = 43.8 Pa.

101. D. 0.56 g/t

Cut-off = cost/(price x recovery) = 30/(60 x 0.90) = 0.56 g/t.

102. B. 13.7 M$

PV of annuity = 30 x 3.7908 = 113.7 M$; NPV = 113.7 - 100 = 13.7 M$. 50 M$ ignores discounting.

103. B. 3.3 years

Payback = 100/30 = 3.3 years.

104. B. uses a speculative rate plus a safe rate for a sinking fund

Hoskold assumes part of income is reinvested in a sinking fund at a safe rate to recover capital, while the investor earns a speculative rate.

105. A. 51.1 M$

Sinking fund factor = 0.06/(1.06^10 - 1) = 0.0759; PV = 10/(0.12 + 0.0759) = 51.1 M$. 56.5 M$ is a single-rate PV at 12%.

106. A. 0.75 M$

Depreciation = (5.0 - 0.5)/6 = 0.75 M$ per year.

107. B. 7.5 M$

Rate = 60/20 = 3 $/t; charge = 3 x 2.5 Mt = 7.5 M$.

108. B. the net present value equals zero

IRR is defined as the discount rate that makes the present value of inflows equal to the present value of outflows.

109. B. 80.0 $/t

Recovered Cu = 0.012 x 0.88 = 0.01056 t; value = 0.01056 x 9,000 = 95.0 $; NSR = 95.0 - 15 = 80.0 $/t.

110. C. 12.68%

Effective rate = (1 + 0.12/12)^12 - 1 = 1.01^12 - 1 = 12.68%.

111. A. 5.01 M$

A = P x i/[1 - (1 + i)^-n] = 20 x 0.08/(1 - 1.08^-5) = 5.01 M$.

112. A. 30 $/g

1,500 kg = 1,500,000 g; cash cost = 45,000,000/1,500,000 = 30 $/g.

113. B. Income approach using discounted cash flow

When reserves and production plans are defined, cash flows can be forecast, so the DCF income approach best captures the property's value.

114. C. 7.7%

Real rate = 1.12/1.04 - 1 = 7.7%; simply subtracting gives the approximate 8.0%.

115. A. Kenneth Lane

Lane's cut-off grade theory balances mining, processing and refining constraints to maximize NPV; Matheron founded geostatistics and Bond developed the work index.

116. A. 0.80 Mt

Break-even output = fixed cost/(price - variable cost) = 24/(80 - 50) = 0.80 Mt.

117. A. lower tonnage above cut-off but a higher average grade

Fewer blocks qualify at a higher cut-off, but those that do have higher average grade.

118. B. 23.3 M$

PV = 50/1.10^8 = 50/2.1436 = 23.3 M$.

119. A. 4.0 M$

NSR = 180 - 20 = 160 M$; royalty = 0.025 x 160 = 4.0 M$. 4.5 M$ wrongly uses gross revenue.

120. A. 1.75 g/t AuEq

AuEq = 1.5 + 20 x 0.80/65 = 1.5 + 0.246 = 1.75 g/t.

Topics to review

- Mine development and extraction methods
- Rock mechanics and ground support
- Mine ventilation, haulage and safety
- Mineral economics and environmental management

Online question banks and study resources

Mining Engineering - Pass Harbor (Question bank)

Official PRC board information

Current PRC exam programs

Independent study material prepared by Board Exam Desk.