

APY

PROVISIONAL ANSWER KEY (CBRT)

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Instructions / સૂચના

Candidate must ensure compliance to the instructions mentioned below, else objections shall not be considered: -

- (1) All the suggestion should be submitted in prescribed format of suggestion sheet Physically.
- (2) Question wise suggestion to be submitted in the prescribed format (Suggestion Sheet) published on the website.
- (3) All suggestions are to be submitted with reference to the Master Question Paper with provisional answer key (Master Question Paper), published herewith on the website. Objections should be sent referring to the Question, Question No. & options of the Master Question Paper.
- (4) Suggestions regarding question nos. and options other than provisional answer key (Master Question Paper) shall not be considered.
- (5) Objections and answers suggested by the candidate should be in compliance with the responses given by him in his answer sheet. Objections shall not be considered, in case, if responses given in the answer sheet /response sheet and submitted suggestions are differed.
- (6) Objection for each question shall be made on separate sheet. Objection for more than one question in single sheet shall not be considered & treated as cancelled.

ઉમેદવારે નીચેની સૂચનાઓનું પાલન કરવાની તકેદારી રાખવી, અન્યથા વાંધા-સૂચન અંગે કરેલ રજૂઆતો ધ્યાને લેવાશે નહીં

- (1) ઉમેદવારે વાંધા-સૂચનો નિયત કરવામાં આવેલ વાંધા-સૂચન પત્રકથી રજૂ કરવાના રહેશે.
- (2) ઉમેદવારે પ્રશ્નપ્રમાણે વાંધા-સૂચનો રજૂ કરવા વેબસાઈટ પર પ્રસિધ્ધ થયેલ નિયત વાંધા-સૂચન પત્રકના નમૂનાનો જ ઉપયોગ કરવો.
- (3) ઉમેદવારે પોતાને પરીક્ષામાં મળેલ પ્રશ્નપુસ્તિકામાં છપાયેલ પ્રશ્નક્રમાંક મુજબ વાંધા-સૂચનો રજૂ ન કરતા તમામ વાંધા-સૂચનો વેબસાઈટ પર પ્રસિધ્ધ થયેલ પ્રોવિઝનલ આન્સર કી (માસ્ટર પ્રશ્નપત્ર)ના પ્રશ્ન ક્રમાંક મુજબ અને તે સંદર્ભમાં રજૂ કરવા.
- (4) માસ્ટર પ્રશ્નપત્ર માં નિર્દિષ્ટ પ્રશ્ન અને વિકલ્પ સિવાયના વાંધા-સૂચન ધ્યાને લેવામાં આવશે નહીં.
- (5) ઉમેદવારે જે પ્રશ્નના વિકલ્પ પર વાંધો રજૂ કરેલ છે અને વિકલ્પ રૂપે જે જવાબ સૂચવેલ છે એ જવાબ ઉમેદવારે પોતાની ઉત્તરવહીમાં આપેલ હોવો જોઈએ. ઉમેદવારે સૂચવેલ જવાબ અને ઉત્તરવહીની જવાબ ભિન્ન હશે તો ઉમેદવારે રજૂ કરેલ વાંધા-સૂચન ધ્યાનમાં લેવાશે નહીં.
- (6) એક પ્રશ્ન માટે એક જ વાંધા-સૂચન પત્રક વાપરવું. એક જ વાંધા-સૂચન પત્રકમાં એકથી વધારે પ્રશ્નોની રજૂઆત કરેલ હશે તો તે અંગેના વાંધા-સૂચનો ધ્યાને લેવાશે નહીં.

001. Which of the following techniques increases strength and stability to an external fixation construct?
- (A) Decreasing total pin separation distance
 - (B) Increased working distance from the pin to fracture site
 - (C) Unicortical pin fixation
 - (D) Decreasing the distance between the bone and the construct
002. Which of the following scenarios of treatment of a humerus fracture best achieves low strain at the fracture site and high stiffness of the treatment construct?
- (A) Functional bracing of a transverse midshaft fracture
 - (B) Comminuted midshaft fracture with locked bridge plate
 - (C) Short oblique fracture with interfragmentary lag screw and locked neutralization plate
 - (D) Uniplane external fixation of a spiral open fracture
003. A 24-year-old female presents with a transverse midshaft humerus fracture. Which of the following implants would create the most compression on both the far and near cortices?
- (A) Compression plate with concave bend (ends bowed towards bone)
 - (B) Large fragment locking plate with 3 bicortical locking screws proximal and distal to the fracture
 - (C) Compression plate with convex bend (ends bowed away from the bone)
 - (D) Sarmiento style fracture brace
004. Which of the following is true regarding rigid locking plate constructs in fracture fixation?
- (A) Locking plates always enhance fracture healing more than conventional plating
 - (B) Locking plates reduce interfragmentary strain more than conventional plating
 - (C) Locking plates are best utilized in diaphyseal fractures
 - (D) Locking plates are contraindicated in patients with osteoporosis
005. A locked plate used in a bridge plate fashion is biomechanically most similar to which of the following fixation methods?
- (A) Lag screw plus non-locked neutralization plate
 - (B) External fixator without compression
 - (C) Lag screw plus locked neutralization plate
 - (D) External fixator used in compression mode
006. Which of the following defines the working distance of a plate in a plate/screw fracture fixation construct?
- (A) The length of the interfragmentary lag screw
 - (B) The length between the 2 screws closest to the fracture on each end of the fracture
 - (C) The distance from the bone to the plate
 - (D) The length from the screw closest to the fracture to the screw furthest from the fracture on the same end of plate
007. The greatest biomechanical difference between unicortical and bicortical locking screws is seen when what force is applied?
- (A) Compression
 - (B) Torsion
 - (C) Distorsion
 - (D) Bending on the side of plate

008. An adolescent patient is treated with a 6mm solid intramedullary nail. Compared to a 12mm solid nail of the same material, the 6mm nail has:
- (A) 1/2 the torsional rigidity (B) 1/4 the torsional rigidity
 (C) 1/16 the torsional rigidity (D) 1/8 the torsional rigidity
009. Locking plate technology has relative indications for use in all of the following, EXCEPT:
- (A) As a bridge for severely comminuted fracture
 (B) Osteoporotic metaphyseal fractures
 (C) Short fracture segments
 (D) Oligotrophic diaphyseal nonunions
010. The resistance to pullout of a screw in osteoporotic bone is increased by all of the following EXCEPT?
- (A) Placement parallel to the trabecular pattern
 (B) Purchase in cortical bone
 (C) Use of a fixed angle (locking screw construct)
 (D) Tapping prior to screw placement
011. A 72-year-old woman presents with severe hip pain after stepping off of a curb. She denies any trauma or prior history of hip pain. Her past medical history is reviewed including a list of her current medications. Which of the following of her medications would place her at increased risk for a non-traumatic hip fracture?
- (A) Phenytoin (B) Simvastatin
 (C) Cephalexin (D) Glipizide
012. A 55-year-old healthy female presents for a routine physical exam. In regards to bone health and osteoporosis prevention, what dose of calcium and vitamin D should be recommended for daily consumption?
- (A) 1,500mg of calcium and 1,000 IUs of vitamin D
 (B) 200mg of calcium and 1,000 IUs of vitamin D
 (C) 50mg of calcium and 5,000 IUs of vitamin D
 (D) 750mg of calcium and 10,000 IUs of vitamin D
013. Risk factors for insufficiency fractures of the pelvic ring include all the following EXCEPT-
- (A) Osteoporosis (B) Total hip replacement with ceramic bearings
 (C) Rheumatoid arthritis (D) Corticosteroid treatment
014. Which of the following definitions best describes the phenomenon of load relaxation?
- (A) Constant loading causing material to continue to deform over time
 (B) Stress at failure (the ultimate stress) divided by the strain at failure (the ultimate strain)
 (C) Decreased peak loads over time with the same amount of elongation
 (D) Stress is proportional to strain up to a limit
015. Which of the following statements defines creep, as it relates to material properties?
- (A) Progressive deformation response to constant force over an extended period of time
 (B) A solid material's ability to deform under tensile stress
 (C) The ability of a materials mechanical properties to vary according to the direction of load
 (D) The rupture of a material under repeated cyclic stresses, at a point below the normal static breaking strength

016. Which of the following is an example of a non-antalgic gait pattern?
- (A) Patient's contralateral step length is shortened with ipsilateral ankle arthritis
 - (B) Patient leans their trunk laterally over the painful leg during stance phase with ipsilateral hip arthritis
 - (C) Patient ambulates on their toes with an ipsilateral calcaneal stress fracture
 - (D) Patient ambulates predominately through the heel for ipsilateral knee arthritis
017. The chi-square test is considered the most appropriate statistical test to analyze categorical data, but is unreliable if there are less than 5 events in any of the groups or the sum of all cells is less than 50. Which test is preferred in place of the chi-square test when these small sample sizes are encountered-
- (A) Fisher exact test
 - (B) Regression analysis
 - (C) Mann-Whitney test
 - (D) Two sample t-test
018. Which of the following defines the incidence of a disease?
- (A) The total number of cases of a disease in a city
 - (B) The number of new cases of a disease diagnosed during a one year time period
 - (C) The average number of cases of a disease per year over the last 10 years
 - (D) The number of existing cases of a disease divided by total population in a city
019. Which of the following terms best describes the probability of finding a significant association in a research study when one truly exists?
- (A) Type 1 (Alpha) error
 - (B) Type 2 (Beta) error
 - (C) Power
 - (D) Relative risk
020. What is the mechanism of action of simple bisphosphonate (e.g. clodronate and etidronate) medications?
- (A) Post-translational carboxylation of vitamin K dependent proteins
 - (B) Decreased osteoblastic activity
 - (C) Inhibits farnesyl diphosphate synthase in osteoclasts
 - (D) Increased osteoclast apoptosis
021. In the treatment of patients with rheumatoid arthritis, TNF-alpha is blocked by which of the following agents-
- (A) Methotrexate
 - (B) Gold
 - (C) Sulphasalazine
 - (D) Etanercept
022. A 20-year-old male is involved in motor vehicle collision and sustains a depressed tibial plateau fracture. When performing surgery, if calcium sulfate is used as the primary bone substitute void filler, an increase in which of the following outcomes may be expected as compared to autograft?
- (A) Increased complications due to serous drainage
 - (B) Improved clinical outcomes as shown by more rapid time to healing
 - (C) Improved clinical outcomes as shown by SF-36 scores
 - (D) Increased complications due to autoimmune reactions and graft rejection

023. You are considering using a frozen allograft distal femoral condyle in your reconstruction of a massive giant-cell tumor of the knee. In counseling your patient regarding the risks of allografts, you explain that 5 years after transplantation, what percentage of donor chondrocytes will be present and viable in the allograft-
- (A) 6-20%
 (B) 21-50%
 (C) greater than 50%
 (D) None, by 5 years the allograft cartilage will be completely acellular
024. Which of the following statements regarding COX-2 is FALSE?
- (A) It causes mesenchymal stem cells to differentiate into osteoblasts
 (B) COX-2 knockout mice heal fractures more quickly than control mice
 (C) COX-2 is an enzyme which converts arachidonic acid to prostaglandin endoperoxide H2
 (D) NSAIDS non-specifically inhibit both COX-1 and COX-2 enzymes
025. All of the following antibiotics function by interfering with protein synthesis by inhibiting ribosomes EXCEPT-
- (A) Gentamycin (B) Tobramycin
 (C) Vancomycin (D) Erythromycin
026. Which class of antibiotics inhibit early fracture healing through toxic effects on chondrocytes-
- (A) Cephalosporins (B) Quinolones
 (C) Penicillins (D) Macrolides
027. A 67-year-old man complains of low-grade fevers and calf pain 2 weeks following a total knee arthroplasty. What is the next appropriate step in management of this patient?
- (A) Plethysmography of lower extremity (B) MRI of lower extremity
 (C) CT angiography of lower extremity (D) Venous ultrasonography
028. During total hip arthroplasty, which of the following interventions increases the risk of pulmonary ventilation-perfusion mismatch the greatest?
- (A) Acetabular reaming
 (B) Cement pressurization of the femoral canal
 (C) Use of a modular femoral stem
 (D) Intra-operative sequential compressive device on the non-operative leg
029. Salter-Harris type I fractures typically occur through which zone of the physis?
- (A) Proliferative zone (B) Zone of maturation
 (C) Zone of degeneration (D) Zone of provisional calcification
030. Which of the following sarcomas is correctly paired with its most common translocation?
- (A) Synovial sarcoma: t(11;22) (B) Ewing's sarcoma: t(12;16)
 (C) Myxoid liposarcoma: t(X;18) (D) Clear cell sarcoma t(12;22)
031. Which of the following laboratory values would be consistent with nutritional rickets?
- (A) increased phosphate level (B) decreased alkaline phosphatase level
 (C) increased vitamin D level (D) increased parathyroid hormone level
032. Tumor necrosis factor receptor 1 is involved in which of the following cellular events?
- (A) Necrosis (B) Agenesis
 (C) Apoptosis (D) Senescence

033. Which of the following configurations creates the least radiation exposure for the operative surgeon during upper extremity surgery?
- (A) Imaging the thumb positioned against the x-ray source with the standard C-arm
 - (B) Imaging the wrist positioned against the x-ray source with the standard C-arm
 - (C) Imaging the thumb positioned against the image intensifier with the mini C-arm
 - (D) Imaging the wrist positioned against the image intensifier with the mini C-arm
034. What laboratory findings would you expect to find in a patient newly diagnosed with renal osteodystrophy?
- (A) Decreased PTH secretion, hypophosphatemia, and hypocalcemia
 - (B) Increased PTH secretion, hyperphosphatemia, and hypocalcemia
 - (C) Decreased PTH secretion, hypophosphatemia, and hypercalcemia
 - (D) Increased PTH secretion, hyperphosphatemia, and hypercalcemia
035. All of the following statements are true of osteocalcin EXCEPT-
- (A) It is the most abundant noncollagenous protein of bone
 - (B) It is secreted by osteoclasts
 - (C) It is involved in mediating calcium homeostasis
 - (D) It has been used as a biochemical marker of bone formation
036. A type IV (delayed-type hypersensitivity reaction) can be seen in which of the following scenarios?
- (A) Packed red blood cell transfusion
 - (B) Platelet transfusion
 - (C) Immune inert scaffold placement
 - (D) Metal plate and screw placement for fracture
037. A surgeon recommends an interscalene regional block to a patient undergoing shoulder arthroscopy. When asked about potential complications, which of the following is most likely to occur?
- (A) Persistent motor neuropathy
 - (B) Sensory neuropathy
 - (C) Complex regional pain syndrome
 - (D) Pneumothorax
038. What is the most appropriate delivery route for pain medication to a morbidly obese post-operative patient to insure a therapeutic plasma concentration?
- (A) Subcutaneous injections
 - (B) Intravenous patient controlled analgesia based on actual body weight
 - (C) Intravenous patient controlled analgesia based on ideal body weight
 - (D) Oral tablets
039. Which of the following motions shows the greatest difference between a normal and ACL deficient knee-
- (A) Posterior femoral translation at 60° flexion
 - (B) Axial rotation in full extension
 - (C) Axial rotation at 50° flexion
 - (D) Varus angulation at 30 ° flexion
040. Ligaments attach to bone by both direct insertion and indirect insertion. Which of the following most accurately describes the order of the four transition zones of direct insertion?
- (A) Ligament > fibrocartilage > mineralized fibrocartilage > bone
 - (B) Ligament > mineralized fibrocartilage > fibrocartilage > bone
 - (C) Ligament > mineralized fibrocartilage > periosteum > bone
 - (D) Ligament > Sharpey's fiber > periosteum > bone

049. When placing a percutaneous retrograde pubic rami screw for fixation of an acetabular fracture, which of the following radiographic views can best ensure that the screw does not exit the posterior aspect of the superior pubic ramus?
- (A) AP pelvis (B) Outlet obturator oblique view
 (C) Inlet iliac oblique view (D) Iliac oblique view
050. A computed tomography (CT) scan has been shown to be indicated for evaluation of all of the following aspects of acetabular fractures, EXCEPT:
- (A) Intra-articular loose bodies
 (B) Fracture piece size and position
 (C) Marginal impaction
 (D) Determination of pre-existing degenerative changes
051. Which statement is true with respect to acetabular fracture surgery as the time between injury and surgery increases?
- (A) decreased chance of anatomic fracture reduction
 (B) decreased risk of heterotopic ossification
 (C) decreased rate of neurologic injury
 (D) decreased rate of infection
052. Which of the following injuries is anticipated to have a 20% chance of mortality and 50% chance of loss of independence at one year when sustained by an 85-year-old female?
- (A) Intra-articular distal humerus fracture (B) Distal radius fracture
 (C) Femoral neck fracture (D) Trimalleolar ankle fracture-dislocation
053. Which of the following cannulated screw configurations used in the treatment of subcapital femoral neck fractures is optimal?
- (A) Inverted triangle pattern with the inferior screw posterior to midline and adjacent to the calcar
 (B) Inverted triangle pattern with the inferior screw anterior to midline and adjacent to the calcar
 (C) Triangle pattern with the superior screw posterior to midline and adjacent to the calcar
 (D) Inverted triangle pattern with the inferior screw posterior to midline and central in the femoral neck
054. During surgical treatment of the most common variation of distal femoral "Hoffa" fractures, which of the following orientations for screw fixation should be used?
- (A) Medial to lateral screw placement across lateral femoral condyle
 (B) Anterior to posterior screw placement across medial femoral condyle
 (C) Medial to lateral screw placement across medial femoral condyle
 (D) Anterior to posterior screw placement across lateral femoral condyle
055. Partial patellectomy is the recommended treatment for which of the following injuries?
- (A) Vertical patella fractures (B) Bipartite patella
 (C) Comminuted inferior pole fracture (D) Stellate patella fracture
056. Lipohemarthrosis of the knee is most likely secondary to which of the following?
- (A) Seronegative monoarticular arthritis (B) Patellar tendon rupture
 (C) Medial meniscus tear (D) Occult fracture

065. The Cotton test evaluates which of the following structures-
- (A) Calcaneofibular ligament (B) Lateral ulnar collateral ligament of the elbow
(C) Ligamentum flavum (D) Ankle syndesmosis
066. The talocrural angle of an ankle mortise x-ray is formed between a line perpendicular to the tibial plafond and a line drawn:
- (A) perpendicular to the medial clear space (B) parallel to the talar body
(C) between the tips of the malleoli (D) perpendicular to the shaft of the fibular
067. Lateral malleolus fractures can be treated with a variety of techniques, including posterior antiglide plating or lateral neutralization plating. What is an advantage of using lateral neutralization plating instead of posterior antiglide plating?
- (A) Decreased joint penetration of distal screws (B) Increased rigidity
(C) Decreased need for delayed hardware removal (D) Decreased peroneal irritation
068. Varus malalignment after a talar neck fracture with medial comminution causes a decrease in what motion
- (A) Tibiotalar dorsiflexion (B) Tibiotalar plantarflexion
(C) Subtalar eversion (D) Subtalar inversion
069. A 34-year-old male has persistent anterolateral ankle pain after a snowboarding injury 1 week ago and is unable to bear weight. Radiographs taken in the emergency room were negative. What is the next step in management?
- (A) MR arthrogram of the ankle (B) Bone scan
(C) CT scan (D) Diagnostic injection
070. A patient sustains a comminuted calcaneus fracture. Three months after the injury the patient complains of shoewear problems secondary to clawing of the lesser toes. What is the most likely explanation for this deformity?
- (A) Sural nerve injury
(B) Tethering of the flexor hallucis longus by fracture fragments
(C) Medial plantar nerve neuropathy
(D) Unrecognized foot compartment syndrome
071. The flexor hallucis longus tendon is at greatest risk of injury with a lateral-to-medial drill or screw during fixation of what structure?
- (A) Lisfranc fracture-dislocation (B) Navicular body fracture
(C) Intra-articular calcaneus fracture (D) Nutcracker cuboid fracture
072. Which of the following variables has the strongest association with poor clinical outcomes in patients who undergo expansive laminoplasty for cervical spondylotic myelopathy?
- (A) Multi-level stenosis (B) Duration of symptoms
(C) Local kyphosis angle > 13 degrees (D) Osteoporosis
073. All of the following clinical signs are characteristic of an upper motor neuron disorder EXCEPT
- (A) Fasciculations (B) Spasticity
(C) Muscle weakness (D) Exaggerated deep tendon reflexes
074. Which classification system for cervical myelopathy focuses exclusively on lower extremity function?
- (A) Nurick
(B) Japanese Orthopaedic Association
(C) Modified Japanese Orthopaedic Association
(D) Ranawat

075. A 35-year-old man complains of clumsiness when buttoning his shirt and frequent episodes of falling when ambulating. Further work-up reveals congenital cervical spinal stenosis with spinal cord compression. Because of his young age, posterior laminoplasty is performed. Which nerve root is most likely to be adversely affected following surgery?
- (A) C2 (B) C3
(C) C4 (D) C5
076. A 30-year-old male is involved in a motor vehicle accident and sustains a fracture-dislocation of the cervical spine. On physical exam he has absent distal motor function, absent sensation, absent rectal tone, and an intact bulbocavernosus reflex. Which term best describes this spinal cord injury pattern?
- (A) Central cord syndrome (B) Incomplete spinal cord injury
(C) Complete spinal cord injury (D) Neurogenic shock
077. A patient presents with a far lateral herniation of the L4-5 disc. Which of the following findings is most likely to be present?
- (A) Lateral foot numbness (B) Anterior thigh numbness
(C) Ankle dorsiflexion weakness (D) Ankle plantar flexion weakness
078. Which of the following methods of determining skeletal maturity correlates most closely with the curve acceleration phase for children with idiopathic scoliosis?
- (A) Lenke classification method (B) Greulich and Pyle method
(C) Oxford method (D) Tanner-Whitehouse III
079. In the treatment of thoracolumbar idiopathic scoliosis using an anterior single rod technique with interbody cages, which of the following variables has been associated with pseudoarthrosis.
- (A) Thoracolumbar/lumbar curve coronal correction > 50%
(B) Smaller adolescents (<50 kg)
(C) Failure to maintain lumbar lordosis of > 45 degree
(D) Thoracic hyperkyphosis (>40 degrees)
080. In a patient with arm pain and paresthesias, which of the following symptoms or physical exam findings supports a cervical radiculopathy as opposed to a peripheral neuropathy
- (A) Relief of pain when holding the arm above the head
(B) Reproduction of pain with tilting head to affected side and rotating head to contralateral side
(C) Compensatory inter-phalangeal joint flexion of the thumb when attempting to pinch
(D) Patient is unable to make "AOK" sign with index finger and thumb
081. A 50-year-old diabetic woman describes left arm pain and tingling in the ulnar side of her hand and wrist. She denies weakness or trouble with fine motor tasks. Her symptoms are worse when she is sleeping without a pillow on her left side, and with her left elbow in an extended position. Sleeping with her left hand above her head seems to improve her symptoms. What is the most likely diagnosis?
- (A) Guyon's canal syndrome (B) Cubital tunnel syndrome
(C) Diabetic neuropathy (D) Cervical radiculopathy
082. During lumbar decompression at L4/5, which of the following decompression techniques will destabilize the spine and require a L4/5 fusion.
- (A) Removal of > 50% of the L4/5 nucleus pulposus
(B) Removal of the L4 and L5 spinous process and interspinous ligament
(C) A medial facetectomy removing 20% of the right L4/5 facet joint
(D) Bilateral resection of the L4 inferior articular process

083. A 32-year-old man underwent a lumbar microdiscectomy and an incidental dural tear occurred. A hemilaminectomy was performed to obtain adequate visualization of the defect, and primary repair of the tear was performed. One month postoperatively he returns to the office complaining of severe headaches and occasional nausea which is worse with standing. He denies fever or chills. On physical exam his wound is well healed with no cellulitis or erythema. WBC and ESR are within normal limits. What is the most likely diagnosis?
- (A) Viral meningitis (B) Bacterial meningitis
(C) Vertigo (D) Cerebrospinal fluid leak
084. What additional diagnostic test is most sensitive to diagnose pediatric spondylolysis when AP and lateral radiographs are normal.
- (A) Flexion-extension lateral radiographs
(B) Oblique radiographs of the of the lumbosacral spine
(C) Single photon emission computed tomography (SPECT)
(D) Indium-labeled bone scan
085. In elderly patients with type II odontoid fractures, which of the following treatment modalities has the highest morbidity and mortality?
- (A) Hard cervical collar (B) Anterior screw osteosynthesis
(C) Halo vest immobilization (D) Posterior cervical stabilization
086. All of the following are characteristics of juvenile ankylosing spondylitis EXCEPT?
- (A) Spinal stiffness (B) Sacroiliitis
(C) Urethritis (D) Enthesitis
087. A 60-year-old male presents with severe low back pain and pain and numbness in his buttocks with prolonged standing. His pain improves with forward bending. Lateral radiographs with flexion and extension reveal L4/5 spondylolisthesis with mobility. MRI shows significant spinal stenosis. Six months of nonoperative management, including epidural corticosteroid injections has failed. The next step in treatment should consist of?
- (A) Lumbar disc arthroplasty (B) Lumbar microdiscectomy
(C) Lumbar decompression and fusion (D) Lumbar decompression only
088. In adult patients with scoliosis, severity of symptoms correlates with which of the following variables?
- (A) Coronal imbalance
(B) Sagittal imbalance
(C) Magnitude of coronal Cobb angle
(D) Number of spine levels involved in the deformity
089. In patients with a stable thoracolumbar burst fracture and no neurologic deficits, operative treatment has what long term outcome when compared to nonoperative management.
- (A) Decreased pain scores (B) Improved return to work status
(C) Improved function (D) Increased disability and complications
090. Cervical facet dislocations are characteristically caused by which of the following mechanisms of injury?
- (A) Flexion-compression (B) Vertical compression
(C) Flexion-distraction (D) Extension-compression

091. A 35-year-old female presents for evaluation of new onset lumbar spine pain. Which of the following physical exam findings is indicative of an organic cause of low back pain symptoms?
- (A) Positive straight-leg raise with patient distraction
 - (B) Pain with axial loading of the spine
 - (C) Diffuse tenderness with palpation of the paraspinal lumbar musculature
 - (D) Lower extremity numbness in a non-dermatomal pattern
092. With regard to the anatomy of the subaxial cervical spine, all of the following are true EXCEPT?
- (A) All subaxial cervical vertebrae have a foramen transversarium
 - (B) The orientation of the superior articular facets transitions from posteromedial to posterolateral as one travels caudad
 - (C) When viewed on axial imaging, the superior articular process is anterior to the inferior articular process
 - (D) The vertebral artery traverses the foramen transversarium at all levels
093. Atlantoaxial instability due to hypoplasia of the odontoid is most commonly seen in which type of mucopolysaccharidosis?
- (A) Hurler's syndrome
 - (B) Morquio's syndrome
 - (C) Hunter's syndrome
 - (D) Sanfilippo's syndrome
094. An 3-year-old girl developed torticollis after a severe respiratory tract infection 8 months ago. A dynamic computed tomographic (CT) is performed and shows fixed rotatory subluxation of C1 and C2 despite maximum rotation of the head. What is the most appropriate next step in management-
- (A) Neck immobilization in a soft cervical collar
 - (B) Traction with maximal tolerated weight followed by halo brace
 - (C) Occipitocervical fusion
 - (D) Posterior atlantoaxial fusion
095. Tightness in which of the following muscles has been implicated as an etiology for congenital muscular torticollis?
- (A) Platysma
 - (B) Omohyoid
 - (C) longus colli
 - (D) sternocleidomastoid
096. In the adult spine, which of the following pedicles have the smallest average transverse diameter-
- (A) T 1
 - (B) T 6
 - (C) T 12
 - (D) T 3
097. You are considering performing an anterior cruciate ligament reconstruction on an adolescent female athlete but are concerned about the possibility of a resultant leg length discrepancy. Which of the following history or physical findings is most reliable at predicting the amount of growth remaining?
- (A) Cessation of changes in shoe size
 - (B) Onset of menarche
 - (C) Secondary sex characteristics
 - (D) Doubling the child's height when she was 2 years of age to determine final height

098. Which of the following bone bruise patterns seen on magnetic resonance imaging (MRI) is most consistent with an anterior cruciate ligament (ACL) tear?
- (A) Medial tibial spine and medial femoral condyle
 - (B) Medial facet of patella and lateral femoral condyle
 - (C) Posterolateral tibia and lateral femoral condyle
 - (D) Posterolateral tibia and medial femoral condyle
099. During shoulder arthroscopy of a 58-year-old female recreational golfer, the rotator cuff is examined and is seen to be intact on the articular side. After a bursectomy is performed in the subacromial space, a bursal sided tear is found measuring 1.5 cm in width and 4 mm in depth with surrounding cuff softening. What is the appropriate management?
- (A) Debride the tear and perform an acromioplasty
 - (B) Abort surgery and start a physical therapy program
 - (C) Convert it to a full-thickness tear and repair it with suture anchors
 - (D) Consider it incidental, as this is a common finding in this age group
100. The lift-off test evaluates internal rotation of the shoulder with the hand placed behind the back. During this test, which muscle exhibits the highest percent of maximal contraction?
- (A) Subscapularis
 - (B) Pectoralis major
 - (C) Pectoralis minor
 - (D) Latissimus dorsi
101. A 25-year-old basketball player sustains an anterior shoulder dislocation during a game that is subsequently reduced with traction. A MRI will most likely show which of the following?
- (A) Humeral avulsion of the glenohumeral ligaments
 - (B) Long head of the biceps tear
 - (C) Superior labrum anterior to posterior tear
 - (D) Anteroinferior labral tear
102. An athlete has recurrent anterior shoulder instability despite non-operative treatment including PT and bracing. What is the best indication for a coracoid transfer (Latarjet) procedure?
- (A) Previous arthroscopic Bankart
 - (B) Previous capsular shrinkage
 - (C) Anterior glenoid deficiency of 25% of the articular surface
 - (D) Hill-Sachs comprising 10% of the articular surface
103. A patient undergoes an MRI arthrogram for recurrent shoulder instability. Based on the imaging, the surgeon feels that arthroscopic treatment is contra-indicated and recommends open treatment. What is the most likely diagnosis?
- (A) Glenolabral articular disruption (GLAD)
 - (B) Humeral avulsion of the glenohumeral ligament (HAGL)
 - (C) Superior labrum tear from anterior and posterior (SLAP)
 - (D) Anterior labro-ligamentous periosteal sleeve avulsion (ALPSA)
104. Regarding muscle biology, all of the following descriptions are correct EXCEPT?
- (A) Isotonic: constant tension as the muscle length changes
 - (B) Isokinetic: constant effort through a variable speed
 - (C) Isometric: contraction with no change in muscle length
 - (D) Eccentric: muscle fibers lengthen as the muscle contracts

105. Which of the following exercises should typically be avoided during the initial therapy following ACL reconstruction?
- (A) Light leg press
 - (B) Use of a stair climbing machine
 - (C) Vertical squat with light dumbbells in each hand
 - (D) Seated leg extensions
106. What is the term used to describe a treatment modality that uses galvanic current and medication?
- (A) Transcutaneous electrical nerve stimulations (TENS)
 - (B) Photophoresis
 - (C) Phonophoresis
 - (D) Iontophoresis
107. What technical error leads to scapular notching after reverse total shoulder arthroplasty?
- (A) Superior placement of the glenoid component
 - (B) Retroverted placement of the glenoid component
 - (C) Inferior placement of the glenoid component
 - (D) Overtensioning of the soft tissue envelope
108. A 26-year-old football offensive lineman presents with shoulder pain which is affecting his ability to block effectively. On exam, he has a positive jerk test and a positive Kim test. What is his most likely diagnosis?
- (A) SLAP tear
 - (B) ALPSA lesion
 - (C) Hill-Sachs lesion
 - (D) Posterior labral tear
109. Which of the following best describes the anatomic relationships of the lateral collateral ligament in the posterolateral corner?
- (A) inserts directly anterior to popliteofibular ligament on the fibula and courses deep to popliteus
 - (B) inserts anterolaterally to popliteofibular ligament on the fibula and courses superficial to popliteus
 - (C) inserts posteromedially to popliteofibular ligament on the fibula and courses deep to popliteus
 - (D) inserts directly posterior to popliteofibular ligament on the fibula and courses superficial to popliteus
110. The pathologic motion of the lateral tibial plateau moving posteriorly to the femoral condyle on a rotational stress examination is best described by which of the following terms?
- (A) Anteromedial rotatory instability
 - (B) Anterolateral rotatory instability
 - (C) Posteromedial rotatory instability
 - (D) Posterolateral rotatory instability
111. Which of the following rehabilitation principles is true regarding non-operative treatment of a grade II PCL tear?
- (A) Quadriceps strengthening and prone range of motion should begin as tolerated
 - (B) Hamstring strengthening and supine range of motion should begin as tolerated
 - (C) Resisted quadriceps and hamstring strengthening, no early range of motion
 - (D) No strengthening for 6 weeks

120. A patient presents complaining of right shoulder pain and weakness following a neck exploration surgery. On exam, he is noted to have winging of the scapula. His EMG shows denervation of the trapezius muscle. This condition is best described as:
- (A) Lateral winging due to spinal accessory nerve injury
 - (B) Medial winging due to spinal accessory nerve injury
 - (C) Lateral winging due to long thoracic nerve injury
 - (D) Medial winging due to long thoracic nerve injury
121. What effect does glucagon have on skeletal muscle?
- (A) Anabolic
 - (B) Catabolic
 - (C) No effect
 - (D) Nootropic
122. Which area of the knee is most likely to be affected by a juvenile osteochondritis dissecans (JOCD) lesion?
- (A) Lateral aspect of the medial femoral condyle
 - (B) Lateral aspect of the lateral femoral condyle
 - (C) Medial aspect of the lateral femoral condyle
 - (D) Medial facet of the patella
123. A football player sustains a suspected shoulder separation. In addition to a true AP and an axillary lateral, which of the following additional radiographic views is most appropriate to evaluate the AC joint?
- (A) West Point view
 - (B) Supraspinatus outlet view
 - (C) Velpeau view
 - (D) Zanca view
124. In comparison to patients with osteoarthritis, patient with inflammatory arthritis undergoing shoulder arthroplasty are more likely to have?
- (A) large inferior humeral osteophyte
 - (B) medialization of the glenohumeral joint line
 - (C) posterior humeral head subluxation
 - (D) sclerotic glenoid
125. The zona orbicularis is the arthroscopic landmark for access to which of the following structures?
- (A) Iliopsoas
 - (B) Pectineus
 - (C) Sartorius
 - (D) Adductor brevis
126. During hip arthroscopy, the sciatic nerve is most at risk with which of the following portal techniques?
- (A) Anterior peritrochanteric portal with limb in internal rotation
 - (B) Anterior peritrochanteric portal with limb in flexion
 - (C) Posterior peritrochanteric portal with limb in internal rotation
 - (D) Posterior peritrochanteric portal with limb in external rotation
127. Which of the following stress fracture locations has the greatest likelihood of delayed healing or developing a non-union?
- (A) Anterior cortex of tibia
 - (B) Postero-medial cortex of tibia
 - (C) Distal fibula
 - (D) Inferior femoral neck
128. A 24-year-old female has moderate arthrosis of the medial facet of the patella and the medial femoral condyle. Which of the following procedures is contraindicated?
- (A) Anterior (Maquet) tibial tubercle osteotomy
 - (B) Anteromedial (Fulkerson) tibial tubercle osteotomy
 - (C) Anterolateral tibial tubercle osteotomy
 - (D) Medial opening wedge high tibial osteotomy

129. The female athlete triad refers to those athletes with: amenorrhea, osteoporosis, and what other entity?
- (A) Eating disorder (B) Stress fractures
(C) Ligamentous laxity (D) Increased rate of ACL tears
130. Which of the following is a computer-based neurocognitive test that assesses the users attention, memory, and processing speed?
- (A) Immediate Post-Concussion Assessment and Cognitive Testing battery (ImPACT)
(B) Standardized Assessment of Concussion (SAC)
(C) Sport Concussion Assessment Tool (SCAT)
(D) Sport Concussion Assessment Tool II (SCAT-2)
131. Which of the following most accurately describes the primary role of satellite cells?
- (A) To act as an intermediary in the cell-signalling pathway for bone remodeling
(B) To regenerate skeletal muscle after muscle injury
(C) To regenerate periosteum after periosteal damage in a child
(D) To bind chemotherapeutic ligands in the treatment of lymphoma of bone
132. Which of the following structures shares the same attachment site as the tendon that undergoes angiofibroplastic hyperplasia during the pathogenesis of tennis elbow?
- (A) Brachioradialis (B) Anconeus
(C) Annular ligament (D) Flexor carpi ulnaris
133. A 24-year-old patient complains of vague right shoulder pain. On physical exam the patient is noted to have weakness with external rotation. EMG findings are consistent with quadrilateral space syndrome. Along with the deltoid, what other muscle is affected?
- (A) Teres major (B) Teres minor
(C) Pectoralis major (D) Supraspinatus
134. Following open pectoralis major transfer to address chronic subscapularis insufficiency, which of the following movements would most likely show weakness if an iatrogenic nerve injury occurred during the pectoralis transfer?
- (A) Elbow flexion (B) Elbow extension
(C) Shoulder external rotation (D) Shoulder adduction
135. During a bench press, when is the pectoralis major insertion at greatest risk of rupture?
- (A) Initiation of upward motion (B) Point of maximum elevation
(C) During downward deceleration (D) When bar is touching chest
136. A 21-year-old female presents with left knee pain for six months. The symptoms are worse climbing stairs and sitting for long periods of time. On physical exam she has a stable knee with no effusion and pain with compression of the patella. Her Q angle is 21 degrees. What is the first step in management?
- (A) tubercle elevation and medialization
(B) strict immobilization and non-weight bearing for four weeks
(C) open chain exercises and a focus on seated leg extensions
(D) closed chain exercises with focus on quadriceps and hamstring strengthening

137. A 24-year-old female marathon runner experiences gradual onset of right groin pain. Initially it was only painful during running, but now it is painful with walking. She has no mechanical symptoms and denies back or lower leg symptoms. On exam, she has pain when attempting a straight leg raise and with passive internal rotation of the hip. Pelvis and hip radiographs demonstrate normal acetabular version and normal femoral head-neck offset. What is the next most appropriate step in her care?
- (A) Intra-articular hip corticosteroid injection
 (B) Tapered oral corticosteroid dosing regimen for one week
 (C) EMG and nerve conduction studies
 (D) MR imaging of the hip
138. A 35-year-old male injured his right shoulder while playing basketball. He presents emergently with significant pain and his shoulder abducted at 140 degree. He is unable to lower his arm. Radiographs will most likely show that his glenohumeral joint has dislocated in what direction?
- (A) Anterior (B) Posterior
 (C) Superior (D) Inferior
139. Patella baja is most likely to occur after which of the following procedures?
- (A) Arthroscopic ACL reconstruction with cadaver allograft
 (B) PCL reconstruction using tibial inlay technique
 (C) High tibial osteotomy
 (D) MPFL reconstruction with semitendinosus autograft
140. An 18-year-old girl has bilateral leg pain. It occurs shortly after she begins running and is improved with rest. When she tries to continue running, she gets paresthesias on the dorsum of the foot. She has normal x-rays. What is the next step in evaluation?
- (A) MRI bilateral tibiae (B) Venous doppler ultrasound
 (C) Non-invasive arterial vascular studies (D) Compartment pressure measurement
141. A 16 year-old dancer has developed popping over the anterior hip. On exam, this can be reproduced by starting with the hip flexed, abducted and external rotated, and then slowly extending it back to a neutral position. She has no pain with internal rotation of the flexed hip. There is no tenderness or popping laterally. The diagnosis can be confirmed using which imaging modality?
- (A) Coventional MRI (B) CT arthrogram
 (C) Ultrasound (D) Weight-bearing radiographs
142. Which of the following portals is generally not used during elbow arthroscopy?
- (A) Antero-lateral (B) Antero-medial
 (C) Postero-lateral (D) Postero-medial
143. A 13-year-old pitcher develops pain over the lateral aspect of his throwing elbow. He has an effusion and a painful click on passive elbow rotation. What is the most likely diagnosis?
- (A) Tommy John lesion (B) Postero-lateral rotatory instability
 (C) Osteochondritis dissecans (D) Stress fracture
144. Which of the following is true of the scapula during an overhead throwing motion?
- (A) It maximally retracts on ball release
 (B) It protracts during late cocking to prevent impingment on the rotator cuff
 (C) It must rotate in the cocking and acceleration phases to prevent impingment on the rotator cuff
 (D) It must remain fixed during the throwing motion to impart maximal energy

145. Which of the following radiographic views is most sensitive for detecting knee joint degenerative changes-
- (A) Weight-bearing AP flexion (B) Non-weight-bearing PA in 45 degrees
 (C) Weight-bearing PA in 45 degrees flexion (D) Merchant
146. Child abuse should be suspected in an isolated spiral femur fracture of a child in which of the following situations?
- (A) Child is smaller than predicted growth charts
 (B) Child has a single parent
 (C) Child has multiple siblings
 (D) Child had not yet achieved walking age
147. Southwick angle (epiphyseal-shaft angle) serves what purpose in the evaluation of a slipped capital femoral epiphysis (SCFE)?
- (A) Determine prognosis for AVN
 (B) Determine the severity of the slip
 (C) Determine the presence or absence of a slip
 (D) Determine the etiology of a slip
148. Hypothyroidism is most commonly associated with which of the following pediatric conditions?
- (A) Legg Calve Perthes (B) Slipped capital femoral epiphysis
 (C) Toxic synovitis (D) Achondroplasia
149. Sequestrum is defined as which of the following?
- (A) reactive bone in acute osteomyelitis
 (B) reactive bone in chronic osteomyelitis
 (C) necrotic bone providing a nidus for infection in chronic osteomyelitis
 (D) healthy bone adjacent to chronic osteomyelitis
150. What is the cause of cubitus varus after a supracondylar humerus fracture in a child-
- (A) Overgrowth of the lateral physis (B) Malunion of the fracture
 (C) Growth arrest of medial physis (D) Injury to the ulnar nerve
151. A 16-year-old female complains of foot pain with ambulation. She previously underwent clubfoot soft tissue releases at 5 months of age. Each of the following are complications or late deformities associated with clubfoot surgery EXCEPT:
- (A) Osteonecrosis of the talus (B) Rigid pes planus
 (C) Intoeing gait (D) Tarsal tunnel syndrome
152. A mutation of PMP22 located at chromosome 17p12 most likely leads to which of the following?
- (A) Weak peroneus longus (B) Strong peroneus brevis
 (C) Strong peroneus tertius (D) Weak tibialis anterior
153. Lateral forefoot and heel posts would be the appropriate orthotic for the foot deformities associated with which of the following conditions?
- (A) Charcot-Marie-Tooth disease
 (B) Stage II posterior tibial tendon insufficiency
 (C) Stage III posterior tibial tendon insufficiency
 (D) Charcot arthropathy

154. A 2-year-old child is diagnosed with a septic hip. Initially, no organisms grew on the standard blood agar plate. However, after 1 week, the offending organism was recovered in an aerobic blood culture medium. Which of the following organisms was the most likely cause?
 (A) Kingella kingae (B) Mycobacterium tuberculosis
 (C) Mycobacterium avium (D) Neisseria
155. Which of the following concepts regarding pediatric hips is true?
 (A) The proximal femoral physis and greater trochanteric apophysis develop from different cartilaginous physes
 (B) The proximal femoral physis grows at a rate of 9 mm per year
 (C) Normal infant femoral anteversion is between 10-20 degrees
 (D) The ossific nucleus of the proximal femur is visible on radiographs by 6 months of age in most children
156. Which of the following pediatric congenital disorders is caused by a glycine substitution in the procollagen molecule?
 (A) Scurvy (B) Osteogenesis imperfecta
 (C) Fibrous dysplasia (D) Diastrophic dysplasia
157. A 14-year-old boy sustains a significant distal femoral physal fracture. Assuming that he has a complete growth arrest, what is the predicted leg length discrepancy?
 (A) 1 cm (B) 2 cm
 (C) 3 cm (D) 4 cm
158. All of the following are associated with neurofibromatosis EXCEPT:
 (A) Smooth bordered café-au-lait spots (B) Posterior-medial bowing of the tibia
 (C) Short, sharp dystrophic scoliosis (D) Cutaneous neuromas
159. An 11-year-old child sustains an elbow dislocation. The elbow is reduced, but post-reduction radiographs demonstrate that the ulnohumeral joint remains slightly incongruent. What is the most likely etiology for this continued incongruity?
 (A) Interposed annular ligament (B) Interposed lateral epicondyle fragment
 (C) Interposed medial epicondyle fragment (D) Interposed ulnar nerve
160. Nonunion following a pediatric lateral condyle fracture has been associated with which of the following?
 (A) Ulnar nerve palsy (B) Radial nerve palsy
 (C) Heterotopic ossification (D) Parsonage Turner syndrome
161. Distal femoral epiphyseal fractures are uncommon but have a high incidence of complications. In the treatment of these injuries, all of the following variables are associated with an increased incidence of complications EXCEPT:
 (A) Exactness of fracture reduction (B) Presence of fracture displacement
 (C) Direction of fracture displacement (D) Surgical treatment
162. What is the preferred treatment for newly diagnosed irreducible congenital vertical talus in a toddler?
 (A) Casting followed by open reduction and achillies lengthening
 (B) Serial Ponseti method casting
 (C) Percutaneous achillies lengthening
 (D) Talectomy with tendon interposition

163. What is the cellular mechanism responsible for osteopetrosis (Albers-Schönberg Disease)?
(A) Inactive osteoclast Gs alpha subunit of the G-protein coupled receptor
 (B) Inactive osteoclast carbonic anhydrase
(C) Inactive osteoclast mitochondria
(D) Overactive osteoblast ruffled border
164. A child with a defect in the DTDST gene would have which of the following classic phenotypes?
(A) Blue sclera and bowing deformities
(B) Mental retardation and cardiac malformations
 (C) Cauliflower ears and hitchhiker's thumb
(D) Craniosynostosis and complex syndactyly
165. Hematogenous osteomyelitis caused by Salmonella is most common in which of the following patient populations?
(A) Neonates
(B) Intravenous drug abusers
 (C) Patients with sickle cell disease
(D) Patients with chronic kidney failure requiring dialysis
166. All of the following are true regarding treatment of scoliosis in patients with Marfan's syndrome EXCEPT?
 (A) Bracing is often effective if started early enough
(B) The cardiopulmonary condition of patients with Marfan syndrome should be evaluated and planned for before surgery
(C) Preoperative computed tomograph should be performed to assess bony adequacy for fixation
(D) Preoperative magnetic resonance imaging should be performed to evaluate for dural ectasia
167. In the treatment of Blount's disease, how do plates or staples help correct the genu varum deformity?
 (A) Increasing compression forces across the physis to slow longitudinal growth
(B) Decreasing compression forces across the physis to slow longitudinal growth
(C) Increasing tension forces across the physis to slow longitudinal growth
(D) Decreasing tension forces across the physis to slow longitudinal growth
168. What is the inheritance pattern for Duchenne's muscular dystrophy?
(A) autosomal recessive (B) autosomal dominant
 (C) X-linked recessive (D) X-linked dominant
169. All of the following are findings associated with Ehlers-Danlos syndrome EXCEPT:
 (A) Superior lens dislocation of the eye (B) Joint hypermobility
(C) Skin hyperelasticity (D) Pathologic defect of collagen
170. The Evans lateral calcaneal lengthening osteotomy is the surgical procedure most appropriate for which pediatric foot deformity?
(A) Talipes equinovarus (B) Cavus foot
 (C) Flexible pes planovalgus (D) Juvenile hallux valgus

179. A 65-year-old female has severe knee arthritis with a significant flexion contracture and valgus deformity. In the recovery room following her total knee replacement, she is unable to dorsiflex her ankle. Management should include?
- (A) Application of an AFO to prevent an equinus contracture
 (B) Unwrap any compressive dressings and flex the knee
 (C) Immediate EMG
 (D) Open exploration of the peroneal nerve
180. Risk factors for a motor nerve palsy following primary total hip arthroplasty include all of the following EXCEPT?
- (A) Limb lengthening (B) Posttraumatic arthritis
 (C) Obesity (D) Posterior approach
181. Which of the following total hip arthroplasty patients appropriately meets the criteria for a surgical debridement with isolated femoral head and polyethylene liner exchange?
- (A) Prosthesis infection of 4 months duration
 (B) Prosthesis infection 8 weeks following implantation
 (C) Prosthesis infection 5 days following a systemic infection
 (D) Acetabular component loosening due to osteolysis
182. A 66-year-old woman with genu valgum osteoarthritis undergoes total knee replacement. What technical error could lead to post-operative lateral patellar instability?
- (A) External rotation of the tibial component
 (B) External rotation of the femoral component
 (C) Internal rotation of the femoral component
 (D) Lateralization of the femoral component
183. A 40-year-old man has moderate lateral compartment arthritis several years after undergoing a partial lateral meniscectomy. He has a correctable 5 degree valgus knee deformity compared to his other limb. His patellofemoral and medial compartments do not show any radiographic signs of degenerative changes. His knee has full range of motion and is stable on exam. After failing nonoperative treatments, which surgical option is most likely to give him the best outcome?
- (A) Valgus producing high tibial osteotomy (B) Varus producing distal femoral osteotomy
 (C) Total knee replacement (D) Arthroscopic debridement and chondroplasty
184. Which of the following is a characteristic change in cartilage involved in moderate osteoarthritis-
- (A) Decreased chondrocyte activity (B) Increased proteoglycan quantity
 (C) Increased water content (D) Increased collagen quantity
185. Osteopenia has what effect on the strength of the bone-cement interface in comparison to normal bone?
- (A) improved mechanical integrity (higher fracture resistance)
 (B) diminished mechanical integrity (low fracture resistance)
 (C) reduced depth of cement penetration into bone
 (D) less affected by cement pressurization

186. All of the following are absolute or relative contraindication to hip resurfacing arthroplasty EXCEPT?
- (A) Acetabular dysplasia (B) Coxa vara
(C) Femoral neck bone stock deficiency (D) Age less than 50-years-old
187. Patella baja is a known problem commonly encountered intraoperatively when converting which of the following patients to a total knee arthroplasty-
- (A) Previous medial compartment unicompartmental arthroplasty
(B) Previous medial proximal tibial opening wedge osteotomy
(C) Previous lateral distal femoral closing wedge osteotomy
(D) Previous patello-femoral unicompartmental arthroplasty
188. Performing an isolated release of the popliteus tendon during a total knee arthroplasty is most appropriate in which of the following scenarios?
- (A) Valgus deformity that is tight in extension
(B) Varus deformity that is tight in extension
(C) Valgus deformity that is tight in flexion
(D) Valgus deformity that is tight in both flexion and extension
189. All of the following are known steps in the development of a malignant tumor with the ability to metastasize EXCEPT?
- (A) Sustained angiogenesis (B) Tumor cell intravasation
(C) Avoidance of immune surveillance (D) Increased apoptosis
190. Metastatic bony lesions that occur distal to the elbows or knees are most likely to originate from which one of the following primary organs?
- (A) Lung (B) Thyroid
(C) Gastrointestinal (D) Prostate
191. A 59-year-old female presents with a metastatic spinal tumor and has a lytic lesion in the T12 vertebral body. The process of bone resorption in her lytic lesion is mediated by-
- (A) Direct resorption of bone by tumor cells (B) Neoangiogenesis of the vertebral body
(C) Macrophage-mediated bony destruction (D) Tumor induced activation of osteoclasts
192. In patients with an extremity-based osteosarcoma without metastasis, all of the following are risk factors for disease progression and poor outcomes EXCEPT?
- (A) High histologic grade
(B) Low serum level of alkaline phosphatase at diagnosis
(C) Large tumor volume
(D) Inadequate surgical margins following resection
193. All of the following are true of multiple hereditary exostoses (MHE) EXCEPT?
- (A) Autosomal dominant inheritance
(B) Caused by mutation(s) in the EXT1/EXT2/EXT3 genes
(C) Exostoses grow towards the joint in MHE but away from the joint in solitary osteochondromas
(D) The most common joint affected is the knee

