Basic science quiz!

All answers are correct. Anyone who queries any of these answers will be asked to do the next end of term quiz and will be made to do a year of foot and ankle surgery.
All these questions have been asked in vivas or on paper within the last two years. Most of this is easy.

There is nothing here that you will not know by the time the exam comes around (if you want to pass!)—and almost everything here starts a discussion that would become more detailed during your vivas.
1) Name the main collagen in

- a) Bone - Type 1
- b) Cartilage - Type 2
2) Label this drawing of cartilage

- A- Superficial
- B- Middle
- C-Deep
- D-Tidemark
  - (calcified cartilage)
3) Label this proteoglycan (aggrecan)

CS- chondroitin sulphate

KS- Keratan sulphate

HA – hyaluronic acid
4) Name 2 general health related scoring systems, 2 related to arthritis and 2 joint specific questionnaires

- SF-12, 20, 36, nottingham health questionnaire
- WOMAC, AIMS
- HOOS, Oxford hip/knee score, harris hip score
5) Name 3 genes or proteins associated with cartilage cell apoptosis?

- **blc-2** protein - in growth plate may indicate cells are targetted for apoptosis
- **Bax** protein expression
- **P-53** protein expression

- All seem to be linked and has been asked in vivas.
6) In the Sillence classification for Osteogenesis imperfecta

- How many main subtypes are there? 4
- Which subtype is fatal at/before birth? 2
- Which subtypes are associated with blue sclera? 1 always, type 3 at birth, type 4 normal.

<table>
<thead>
<tr>
<th>Type</th>
<th>Inheritance</th>
<th>Teeth</th>
<th>Bone fragility</th>
<th>Deformity of long knees</th>
<th>Sclera</th>
<th>Spine</th>
<th>Skull</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>AD</td>
<td>Normal</td>
<td>Variable but less severe than other types</td>
<td>Moderate</td>
<td>Blue</td>
<td>20% scoliosis and kyphosis</td>
<td>Wormian bones</td>
<td>Fair</td>
</tr>
<tr>
<td>IB</td>
<td>AD</td>
<td>Dentinogenesis imperfecta</td>
<td>Unknown</td>
<td>Very severe</td>
<td>Crumbled bone</td>
<td>Blue</td>
<td>Wormian bones with absence of ossification</td>
<td>Perinatal death</td>
</tr>
<tr>
<td>II</td>
<td>AD</td>
<td>Osteogenesis imperfecta</td>
<td>Unknown</td>
<td>Severe</td>
<td>Progressive bowing of long bones and spine</td>
<td>Bluish at birth but white in adults</td>
<td>Kyphoscoliosis</td>
<td>Wheelchair bound and nonambulatory</td>
</tr>
<tr>
<td>III</td>
<td>AD</td>
<td>Osteogenesis imperfecta</td>
<td>Unknown</td>
<td>Severe</td>
<td>Progressive bowing of long bones and spine</td>
<td>Bluish at birth but white in adults</td>
<td>Kyphoscoliosis</td>
<td>Hypoplastic Wormian bones</td>
</tr>
<tr>
<td>IVA</td>
<td>AD</td>
<td>Normal</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Normal</td>
<td>Kyphoscoliosis</td>
<td>Hypoplastic Wormian bones</td>
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<td>Normal</td>
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</tr>
</tbody>
</table>

AD — autosomal dominant.
7) Label this cutting cone (direct primary bone healing)

- 1 – osteoclast
- 2 – osteocyte
- 3 – osteoblast
- 4 – osteoid seem
- 5 mineralised osteoid.

- This is a favourite in the vivas!
8) Describe movement in terms of load and stiffness?

- Movement = load/stiffness
9) Name these three traction systems

- A – Dunlop
- B – Hamilton-Russell
- C – Gallows

(Be able to draw, be aware of variations and weights for age etc)
10) Roughly compare in terms of a standard CXR, how much radiation is produced by:

- A) CT Spine = 3.6 mSv or 72 CXR
- B) Isotope bone scan = 5.0 mSv or 100 CXR

(1 CXR = 0.05 mSV)
11) Draw and label the trabeculae of the femoral neck.

- A common question in trauma and basic science. Can then progress to femoral neck fractures, osteoporosis, ageing changes within bone, other bone architecture etc.
12) Definitions

- Define stress! **Force per unit area**

- Define strain! **Change in length/Original length**
13) Stress strain curve

What regions are depicted by:

a) The blue line – elastic region

b) The green line – plastic region
14) Stress strain curve

- A) What is represented by the gradient?
  Gradient equals Youngs modulus or stiffness of the material

- B) What does the shaded area under line represent. **Shaded area represents energy**
15) Put the following in order (1-11)

1. Al₂O₃ (ceramic)
2. Co-Cr-Mo (Alloy)
3. Stainless steel
4. Titanium
5. Cortical bone
6. Matrix polymers
7. PMMA
8. Polyethylene
9. Cancellous bone
10. Tendon/ligament
11. Cartilage
16) Please classify the following joints in terms of lever classes:

- Elbow joint
- Tibiotalar (ankle) joint
- Atlanto-occipital joint
17) Name 4 types of lubrication

- Boundary
- Mixed
- Hydrodynamic
- Elastohydrodynamic
18) Name at least 5 types of wear

- Adhesive
- Abrasive
- Third Body wear
- Mechanical
- Chemical
- Fatigue
- Fretting
- Corrossive
19) Draw a free body diagram for a hip

Body weight is considered 5/6 of total weight.
20) Give 6 techniques used third generation cementing of THRs

- Distal cement plug
- Retrograde femoral filling (+/- vent)
- Femoral brush
- Proximal femoral pressurizer
- Pulse lavage
- Vacuum mixing
21) In a THR draw the relationship between wear volume and impingement with increasing head size.
22) Name three epiphyseal primary bone tumours

- Chondroblastoma
- Giant cell tumour
- Epiphyseal chondrosarcoma

You must have your version of this diagram in your head and be able to reproduce it.
23) In modern theatre air flow

- What does CFU stand for? Colony forming unit

- How many changes of air per hour are there in a clean air laminar flow theatre. Up to 400/hour
24) Label this osteoclast

- A – ruffled border of resorptive lacunae
- B - Tight or sealing zone
- C - Multiple nuclei
25) According to the last UK National Joint Registry

- Which is the most popular cemented THR (femoral and acetabular component)? **Exeter stem and cup**
- What is the most popular uncemented THR? **Furlong HAC (JRI)**
- What is the most used cement? **Palacos (+abx)**
26) What is the relationship between bone strength and bone mineral density.

- Bone strength \sim (BMD) squared
27) Statistics

- Define sensitivity. True positives who test positive over all those who test positive.

- Define specificity. True negatives who test negative over all those who test negative.
This table shows study results where MRI results were confirmed by arthroscopy:

<table>
<thead>
<tr>
<th>MRI</th>
<th>Arthroscopic</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>Positive</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Negative</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>
28) In terms of this table (A, B, C, and D) please define sensitivity, specificity, PPV and NPV.

<table>
<thead>
<tr>
<th>Arthroscopic</th>
<th>True</th>
<th>False</th>
<th>PPV = A/A+B</th>
<th>NPV = C/C=D</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>A</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>C</td>
<td>D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Sensitivity**: $\frac{A}{A+C}$
- **Specificity**: $\frac{D}{D+B}$
- **Positive Predictive Value (PPV)**: $\frac{A}{A+B}$
- **Negative Predictive Value (NPV)**: $\frac{C}{C+D}$

Be able to draw this table and talk examiner through it as you go leaving no room for confusing double negatives.