Anatomy and Physiology - Division C Condensed Key

University of Georgia Science Olympiad Invitational 2019

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Team Number: x
Team Name: x
Total Points: x **Rank:** x

THIS KEY IS MEANT TO FACILITATE THE GRADING PROCESS.

Instructions and Clarifications:

- You have **50** minutes to finish this exam.
- You **may** split the exam but you are responsible for placing the pages back in order. The page numbers are located in the lower right corner of each page for your convenience.
- Tiebreakers are labeled as **TB#**. There are **5** tiebreakers in this exam.
- Write your **team number** on every page of the answer sheet.
- Anything written on the exam will **not** be graded. Only the **answer sheet** will be graded.
- If you have any questions or comments about the exam, feel free to email me at velasco.scienceolympiad@gmail.com. **Happy testing!**

I. Integumentary System

Multiple Choice: Each is worth **one** point.

1. A B C D
2. D
3. A B
4. B
5. A
6. B C
7. D
8. C
9. B
10. C
11. C
12. C
13. B
14. D
15. A
16. B
17. C
18. C
19. A
20. C

Classification: Each is worth **one** point.

1. Thick
2. Thin
3. Thick
4. Thick
5. Thin
6. Thin
7. Thick
8. Thick
9. Thick
10. Thick

Short Answer: Each is worth **one** point.

1. Mechanoreceptor
2. Tactile corpuscles/Meissner corpuscles
3. Lamellar corpuscles/Pacinian corpuscles
4. Bulbous corpuscles/Ruffini endings
5. Merkel nerve endings/Merkel discs
6. Thermoreceptor
7. nociceptor/pain receptor
8. Neural-crest
9. silent/sleeping
10. chemoreceptor/chemosensor

Labeling: Each is letter is one point.

1.
    A. Stratum corneum
    B. Stratum lucidum
    C. Stratum granulosum
    D. Stratum spinosum
    E. Stratum germinativum/basale
    F. Mitosis
    G. Dermis
    H. Meissner's corpuscle

2.
    A. Epidermis
    B. Dermis
    C. Sebaceous gland
    D. Hair
    E. Internal radicular sheath
    F. External radicular sheath
    G. Dermic sheath of connective tissue
    H. Sweat glands
    I. Pilous bulb

Image-Based Questions: Each is one point unless stated otherwise.

1. Keratinocyte/Epidermal cells
2. 90%
3. Barrier formation
4. Accept any of the following: filaggrin, keratin
5. True
6. True
7. True
8. (2) it would promote it
9. (2) vitamin D_3 (1 point for vitamin D)
10. pyknotic nucleus (2) and eosinophilic cytoplasm (2)

Pathology

1.
    a. Second (1)
    b. Epidermis and dermis (0.5 credit for epidermis or dermis only)

2.
    a. Impetigo (give 0.5 for infection)
    b. Infants and children (0.5 for one group only)

3.
    a. Carbuncle (1) (give 0.5 for infection)
    b. Back of the neck, shoulders, thighs (give one point for any of the above) (1)

4.
    a. Allergy (1)
    b. Nickel (metal) (1)

II. Skeletal System

Multiple Choice: Each is worth one point.

1. D
2. A
3. B
4. A
5. D
6. C
7. C
8. B
9. B D
10. D
11. C
12. C
13. A C D
14. B
15. D
16. B
17. C
18. A
19. A
20. A B C D

Labeling: Each letter is worth **one** point.

1.

A. Articulating bone (1)
B. Articular cartilage (1)
C. Articulating bone (1)
D. Periosteum (1)
E. Fibrous membrane (1)
F. Synovial membrane (1)
G. Synovial (joint) cavity (1)
H. Fibrous membrane (1)
I. Synovial membrane (1)
J. Articulating bone (1)
K. Periosteum (1)
L. Synovial (joint) cavity (1)
M. Articular cartilage (1)
N. Articulating bone (1)

2.

A. Crest (1)
B. Fossa (1)
C. Anterior superior spine (1)
D. Anterior inferior spine (1)
E. Spine (1)
F. Body (1)
G. Ramus (1)
H. Superior ramus (1)
I. Inferior ramus (1)
J. Body (1)
K. Base of sacrum (1)
L. Sacroiliac joint (1)
M. Pelvic surface of sacrum (1)
N. Pelvic inlet (1)
O. Coccyx (1)
P. Acetabulum (1)
Q. Obturator foramen (1)
R. Ilium (1)
S. Ischium (1)
T. Pubis (1)

3. Each one is worth **one** point

A. Humerus
B. Radial fossa
C. Capitulum
D. Head of radius
E. Neck of radius
F. Styloid process of radius (0.5 if radius not specified)
G. Coronoid fossa
H. Trochlea
I. Coronoid process
J. Ulnar tuberosity
K. Radial tuberosity
L. Radius
M. Ulna
N. Interosseous membrane
O. Head of ulna
P. Styloid process of ulna (0.5 if ulna not specified)
Q. Carpals
R. Olecranon fossa
S. Olecranon
T. Head of radius
U. Neck of radius
V. Styloid process of radius (0.5 if radius not specified)

Image-based Questions: Each is worth one point unless stated otherwise.

1. (2) **endochondral ossification (1 point for ossification)**
2. (2) **perichondrium**
3. **Epiphysis**
4. (2) **in the primary center of ossification (1) located in the middle of diaphysis/shaft (1)**
5. (2) **zone of proliferation/cell columns**
6. **Callus**
7. (2) **osteoclasts**
8. **Epiphyseal line**
9. (2) **osteoclasts**
10. **False**

Pathology: Each is worth **one** point unless stated otherwise.

1.
    A. Medial collateral ligament (MCL) damage (1)
    B. Grade 2 (1)
    C. medial/inner side of the knee joint (accept knee or knee joint) (1)
    D. Valgus stress (1)
    E. Therapy, controlling inflammation, bracing, arthroscopic surgery if severe, replacement or suturing of MCL, prolotherapy. (give one point for any one of the listed)

2.
    A. Osteoarthritis (1)
    B. Pain, stiffness, tenderness, loss of flexibility, grating sensation, bone spurs, swelling. (give two points for any of the two listed) (2)
    C. False
    D. True
    E. False

III. Muscular System

Each of the following is worth one point for MC and T/F.

Multiple Choice

1. B
2. B
3. D
4. C
5. A
6. C
7. B
8. B
9. D
10. C D

True or False

1. False
2. True
3. True
4. True
5. False
6. False
7. False
8. True
9. True
10. True

Diagram-based Question: Each is worth **one** point.

1. C
2. C
3. B
4. B
5. A
6. B
7. A
8. B
9. B
10. C

Origin, Insertion and Function

A. Deltoid (2)
B. Deltoid tuberosity of humerus (2)
C. Serratus anterior (2)
D. Ribs 1-8 or 1-9 (2)
E. Ulnar tuberosity and coronoid process of ulna (2)
F. Flexes the forearm at the elbow joint (2)
G. Gluteus medius (2)
H. Flexes and adducts thigh at hip joint (2)
I. Biceps femoris (2)
J. Head of fibula and lateral condyle of tibia (2)

Diagram-based Part 2

Note: If the competitors **did not** include write the bolded words but included other details, give them **one** point instead of two. If the competitors did not include the bolded words and the other details, **DO NOT** give them credit.

A. Nerve impulse arrives at the axon terminal of motor neuron and releases **acetylcholine** (ACh).
B. ACh diffuses and binds to the receptors in the **motor end plate**, and causes a start of an action potential (AP).
C. **Acetylcholinesterase** destroys ACh, so there is no muscle action potential that arises unless there is more ACh released.
D. The muscle action potential leads to Ca^{2+} release channels opening in the **sarcoplasmic reticulum (SR) membrane**, which allows Ca^{2+} to flow into the sarcoplasm.
E. Ca^{2+} binds to **troponin** located on the thin filament, **exposing** the **binding sites** for myosin.
F. Contraction: ATP is used for **power strokes**; **myosin heads bind to actin**, swivel, and release; **thin filaments are pulled toward the center** of the sarcomere.
G. Ca^{2+} release channels in SR close and **Ca^{2+} active transport pumps** use ATP to restore the low Ca^{2+} levels in the sarcoplasm.
H. **Troponin-tropomyosin complex** slides back into position, blocking the myosin-binding sites on actin.
I. Muscle **relaxes.**

1. Nerve impulse
2. Ca^{2+} (calcium ion)
3. Synaptic vesicle filled with ACh
4. ACh receptor
5. Transverse tubule
6. Muscle action potential
7. Elevated (higher levels) of Ca^{2+} / calcium ions
8. Ca^{2+} active transport pumps
9. Sarcoplasmic reticulum/SR

Labeling: Each letter is worth **one** point.

1.

A. Bone (1)
B. Fascicle (1)
C. Periosteum (1)
D. Tendon (1)
E. Belly of skeletal muscle (accept skeletal muscle) (1)
F. Perimysium (1)
G. Epimysium (1)
H. Fascicle (1)
I. Perimysium (1)
J. Muscle fiber (cell) (1)
K. Myofibril (1)
L. Endomysium (1)
M. Perimysium (1)
N. Somatic motor neuron (1)
O. Blood capillary (1)
P. Endomysium (1)
Q. Nucleus (1)
R. Muscle fiber (1)
S. Striations (1)
T. Sarcoplasm (1)
U. Sarcolemma (1)
V. Myofibril (1)
W. Filament (1)

2.

A. H-band (1)
B. M-line (1)
C. A-band (1)
D. Z-line (1)
E. T-Tubule (1)
F. Sarcoplasmic reticulum (1)
G. I-band (1)

Pathology: Each is worth **one** point unless stated otherwise.

1.
    A. Poliomyelitis or polio (1)
    B. Poliomyelitis, polio or Heine-Medin disease (grant one point for any of the one listed) (1)
    C. *Enterovirus* (1)
    D. <1% or about 0.5% (1)
    E. 2 (1)
2.
    A. Myasthenia gravis (MG) (1)
    B. Muscle weakness, double vision, drooping eyelids, trouble talking, trouble walking, large thymus, thymoma (give two points for any of the two listed) (2)
    C. 50-200 (1)
    D. 66.67% (⅔) (1)
    E. False (1)