AMREF INTERNATIONAL UNIVERSITY

SCHOOL OF MEDICAL SCIENCES

DEPARTMENT OF REHABILIATION MEDICINE

BACHELOR OF SCIENCE IN PHYSIOTHERAPY

END OF TRIMESTER EXAMINATIONS JANUARY to APRIL 2026

UNIT CODE: PHT 221

UNIT NAME: ELECTROPHYSICAL AGENTS II (MAIN EXAM)

DATE: 7TH APRIL 2026

TIME: START: 9:00AM STOP: 11:00AM

INSTRUCTIONS

1. **All students will have two (2) hours to complete the examination**
2. **This is an online exam, Attempt all questions as per the instruction**
3. **It is the student's responsibility to report any page and number missing in this paper.**
4. **Check that the paper is complete**
5. **Total number of pages is 6 including the cover.**
6. **Read through the paper quickly before you start.**

SECTION A: MULTIPLE CHOICE QUESTIONS. CHOOSE THE BEST RESPONSE. EACH CORRECT ANSWER IS ONE MARK 30 MARKS

1. A patient's plan of care includes use of iontophoresis for the management of calcific bursitis of the shoulder. To administer this treatment using the acetate ion, what current characteristics and polarity should be used?
    A. Monophasic twin-peaked pulses using the positive pole.
    B. Monophasic twin-peaked pulses using the negative pole.
    C. Direct current using the positive pole.
    D. Direct current using the negative pole.
2. A patient with diabetes mellitus has had a stage III decubitus ulcer over the right ischial tuberosity for the past 5 months. The ulcer is infected with Staphylococcus aureus, and necrotic tissue covers much of the wound. What therapeutic modality is CONTRAINDICATED in this situation?
    A. Low-voltage, constant microamperage direct current.
    B. High-voltage monophasic pulsed current.
    C. Alternating/biphasic current.
    D. Moist hot packs.
3. When using continuous ultrasound in treating the hip of an obese patient, the GREATEST benefit might occur if the ultrasound frequency and dosage are set at which parameters?
    A. 1 MHz and 1.5 watts/cm2
    B. 1 MHz and 0.5 watts/cm2
    C. 3 MHz and 1.5 watts/cm2
    D. 3 MHz.and 0.5 watts/cm2
4. A patient with flaccid hemiplegia exhibits pain in the shoulder region seconda1y to inferior glenohumeral subluxation. Using electrical stimulation as orthotic substitution, where would it be BEST to place the electrodes?
    A. Posterior deltoid.
    B. Supraspinatus.
    C. Middle deltoid.
    D. Anterior, middle, and posterior deltoid.
5. A patient strained the lower back muscles 3 weeks ago and now complains of pain (6/10). Upon examination, the therapist identifies bilateral muscle spasm from T10-L4. The therapist elects to apply interferential current to help reduce pain and spasm. What is the BEST electrode configuration in this case?
    A. Four electrodes, with current flow perpendicular to the spinal column.
    B. Two electrodes, with current flow perpendicular to the spinal column.
    C. Four electrodes, with current flow diagonal to the spinal column.
    D. Two electrodes, with current flow parallel to the spinal column.
6. A patient sprained the left ankle 4 days ago. The patient complains of pain (4/10), and there is moderate swelling that is getting worse. At this time, which intervention would be BEST to use?

A. Cold/intermittent compression combination with the limb elevated.
B. Cold whirlpool followed by massage.
C. Contrast baths followed by limb elevation
D. Intermittent compression followed by elevation.

7. During an ultrasound (US) treatment, the patient flinches and states that a strong ache was felt in the treatment area. What is the therapist's BEST course of action?
   A. Decrease the US frequency
   B. Add more transmission medium.
   C. Decrease the US intensity.
   D. Increase the size of the treatment area.
8. A patient complains of pain (7 /10) in the shoulder region secondary to acute subdeltoid bursitis. As part of the plan of care during the acute phase, the therapist elects to use conventional TENS. Which of the following BEST identifies the modulating properties of this biophysical device?
   A. Stimulation of endorphins.
   B. Gate control mechanisms.
   C. Descending inhibition.
   D. Ascending inhibition.
9. A patient is referred for outpatient care after a tendon transfer of the extensor carpi radialis longus. The muscle strength tests poor (2/5) in spite of previous intensive therapy. The therapist elects to apply biofeedback to assist in progressively increasing active motor recruitment. What is the BEST choice for the initial EMG protocol?
   A. High-detection sensitivity with recording electrodes placed far apart.
   B. Low-detection sensitivity with recording electrodes placed close together.
   C. High-detection sensitivity with recording electrodes placed close together.
   D. Low-detection sensitivity with recording electrodes placed far apart.
10. A patient presents with partial- and full-thickness burns on the chest and neck regions. The therapist decides to apply transcutaneous electrical nerve stimulation (TENS) before debridement to modulate pain. Which TENS mode should provide the BEST relief?
    A. Acupuncture-like (low-rate) TENS.
    B. Brief intense TENS.
    C. Modulated TENS.
    D. Conventional (high rate) TENS.
11. An elderly patient presents with a stage Ill decubitus ulcer on the plantar surface of the right foot. After a series of conservative interventions with limited success, the therapist chooses to apply electrical stimulation for tissue repair. What is the BEST electrical current to administer in this case?
    A. Medium frequency burst current.
    B. High-volt monophasic pulsed current.
    C. Medium frequency beat current.
    D. Low-volt biphasic pulsed current.

12. A patient presents with pain radiating down the posterior hip and thigh as a result of a herniated disc in the lumbar spine. The therapist decides to apply mechanical traction. If the patient can tolerate it, what is the preferred patient position?
    A. Supine with one knee flexed.
    B. Prone with pillow under the abdomen.
    C. Supine with both knees flexed.
    D. Prone with no pillow.
13. A therapist is applying a symmetrical biphasic pulsed current to the vastus medialis to improve patellar tracking during knee extension. The patient complains that the current is uncomfortable. To make the current more tolerable to the patient, yet maintain a good therapeutic effect, what should the therapist adjust?
    A. Current polarity.
    B. Pulse duration.
    C. Current intensity.
    D. Pulse rate.
14. A patient with a traumatic brain injury presents with hemiparesis. The examination reveals slight cutaneous and proprioceptive impairment, fair (3/5) strength of the shoulder muscles and triceps, and slight spasticity of the biceps. Voluntary control of the patient's left arm has not progressed since admission. The therapist decides to use functional electrical stimulation (FES), placing the active electrode on the triceps to facilitate active extension of the elbow. Which of the following is the BEST choice of timing sequence for FES in this case?
    A. No ramp up, 10-second stimulation, 2-second ramp down.
    B. 2-second ramp up, 10-second stimulation, no ramp down.
    C. 2-second ramp up, 5-second stimulation, 2-second ramp down.
    D. 5-second ramp up, 5-second stimulation, 5-second ramp down.
15. _____ uses ultrasound to drive molecules of medication into the skin.
    A. Combo therapy”
    B. Iontophoresis
    C. Phonophoresis
    D. None of the above
16. Which of the following is NOT a property of lasers?
    A. Monochromaticity
    B. Coherence
    C. Divergence
    D. Collimation
17. Microwave diathermy is more suited for use in areas with little subcutaneous fat.
    A. True
    B. False
18. Which of the following is a contraindication for cryotherapy?
    A. acute pain
    B. skin anesthesia
    C. muscle spasm

D. acute ligament sprain

19. The decrease in energy intensity of the ultrasound wave as it is scattered and dispersed while traveling through various tissues is known as which of the following?

A. Acoustic impedance
B. Attenuation
C. Rarefaction
D. Compression

20. Shortwave capacitor electrodes are called which of the following?
    A. air space plates
    B. pad electrodes
    C. both a and b
    D. neither a nor b
21. Excessive sun exposure can roughen the skin and even cause skin cancer because sunlight contains
    A. Infrared
    B. Ultraviolet
    C. Ultrasound
    D. Infrasound
22. Ultraviolet radiation lies between
    A. Visible light and X- ray
    B. Radio waves and microwaves
    C. Infrared and visible light
    D. X- rays and gamma rays
23. Which of the following is NOT a negative effect of ultraviolet radiation?
    A. Damages DNA, causing skin cancer
    B. Damages collagen causing aging
    C. Irritation and watering of eyes
    D. Production of vitamin D
24. The wavelength of Ultraviolet C radiation (UVC) is
    A. 280- 315 nm
    B. 315- 400 nm
    C. Below 280 nm
    D. None of the above
25. Following are the physiological effects of Ultraviolet Rays except
    A. Carcinogenesis
    B. Erythema
    C. Aging
    D. Pressure sores
26. Sudden cessation of current can also cause a shock when the current used is
    A. Constant DC
    B. Modified DC

C. Alternating Current
D. All of the above

27. Intensity is inversely proportional to square of distance is called

A. Attenuation
B. Cosine law
C. Inverse square law
D. Ohm's law

28. When the charges on a body do not flow, then it is called as

A. Static electricity
B. Current electricity
C. All of the above
D. None of the above

29. One of the major effects of cold therapy is on

A. Muscle power
B. Muscle tone
C. Muscle girth
D. None of the above

30. When an ultrasonic beam is applied to a cell membrane it causes unidirectional flow of tissue components this is termed as

A. Cavitation
B. Attenuation
C. Adsorption
D. Acoustic streaming

SECTION B: SHORT ANSWER QUESTIONS. ANSWER ALL QUESTIONS. EACH QUESTION IS 5 MARKS (20 MARKS)

1. Explain the application of the Gate Control Theory of Pain in pain management using TENS
2. Differentiate between Galvanic and Faradic current (5 marks)
3. Classify TENS and its role in the modulation of pain (5 marks)
4. Analyze the physical effects and therapeutic value of traction on bone, muscle, ligaments, joint structures, nerve, blood vessels, and intervertebral disks (5 marks)

SECTION C: LONG ANSWER QUESTIONS (20 MARKS)

ANSWER ALL QUESTIONS. EACH QUESTIONIS 10 MARKS

1. An 18-year-old college freshman sustained a fracture of the fifth metacarpal of the left hand during a prank in the dormitory. The fracture required gauntlet cast immobilization for 6 weeks. At the time of cast removal, the patient noted significant restriction of motion and weakness in the left wrist. A referral was initiated. Physical examination revealed flexion 0–45 degrees, extension 0–30 degrees with radial and ulnar deviation unaffected. There was point tenderness at the callus site on the shaft of

the fifth metacarpal. Finger motion was grossly within normal limits at all constituent joints. A course of therapeutic ultrasound was initiated to decrease joint stiffness through increased collagen-connective tissue extensibility.

i What phase of the injury healing continuum did the patient present for care in (2 marks)

ii Giving reason for your answer, describe the parameters (method of application, dosage, frequency) of the therapeutic agent used (6 marks)

iii What other therapeutic agent modalities could be utilized to treat this injury or condition? Why? (2 marks)

2. A 45-year-old male presenting with chronic low back pain (VAS 7/10) following a lifting injury 3 months ago. Imaging shows degenerative disc changes but no nerve root compression. He reports diffuse, aching pain, worse with prolonged sitting and standing. His primary goal is pain reduction and improved function.

i Identify the most appropriate type of electrical stimulation. Justify your choice based on the patient's condition and the desired physiological effects (3 marks).

ii Propose specific treatment parameters for your chosen modality. Include: Waveform, Pulse duration (or phase duration), Frequency (pulse rate/carrier frequency), Intensity (amplitude) (4 marks)

iii Explain the rationale behind your parameter choices (3 marks)