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 231

UNIT NAME: ELECTROPHYSICAL AGENTS II (MAIN EXAM)

DATE: 14th April 2026
TIME: 9AM-11AM
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 9 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 has chronic lateral epicondylitis that has failed conservative management including exercise and US. Which modality offers an alternative mechanism for stimulating tissue repair?
   a) Extracorporeal Shockwave Therapy (ESWT)
   b) Continuous Ultrasound at a higher intensity
   c) NMES for muscle strengthening
   d) Cryokinetics

2. A patient has a delayed forearm fracture healing. Which electrophysical agent is MOST indicated for non-union fractures?
   a) Pulsed Shortwave Diathermy (PSWD)
   b) Continuous Ultrasound for deep heating
   c) Pulsed Electromagnetic Field (PEMF) therapy
   d) High Voltage Pulsed Current (HVPC)

3. A patient with plantar fasciitis complains of heel pain that is most severe in the morning. The therapist chooses therapeutic ultrasound. What is the PRIMARY rationale for this choice?
   a) To reduce acute inflammation in the heel pad
   b) To provide deep heating to the plantar fascia to improve its extensibility
   c) To stimulate a motor response in the intrinsic foot muscles
   d) To desensitize the calcaneal nerve

4. A patient with persistent shoulder tendinopathy has not improved with exercise and traditional ultrasound. Which advanced electrophysical agent might be considered to promote tendon healing?
   a) Pulsed Shortwave Diathermy (PSWD)
   b) High-voltage galvanic stimulation for edema
   c) TENS for chronic pain
   d) Iontophoresis with acetic acid

5. A post-surgical patient has a wound with delayed healing, showing minimal granulation tissue. Which parameter is MOST critical when using HVPC for wound healing?
   a) Using a high frequency (over 200 Hz) to stimulate sensory nerves
   b) Using the negative polarity during the early stages of healing to attract neutrophils and macrophages
   c) Using a continuous (direct) current mode to maximize tissue penetration
   d) Using the positive polarity to create an acidic environment for bacterial control

6. A patient with hand osteoarthritis has morning stiffness. Which superficial heating agent is MOST appropriate for treating the small joints of the hand?
   a) Continuous Ultrasound
   b) Paraffin wax bath
   c) Shortwave Diathermy
   d) Cryotherapy

7. A patient with rheumatoid arthritis complains of hand stiffness and pain. What is a CRITICAL contraindication to using a superficial heat agent like a paraffin wax bath?
   a) The patient is taking disease-modifying anti-rheumatic drugs (DMARDs).
   b) The patient has a history of Raynaud's phenomenon.
   c) There is an acute inflammatory flare-up in the hands.
   d) The patient is over 65 years old.

8. A patient has chronic finger stiffness post-fracture. The goal is to remodel scar tissue and improve tendon glide. What is the MOST appropriate electrophysical agent?
   a) Continuous Ultrasound to heat and stretch the adhesions
   b) Pulsed Ultrasound to reduce inflammation
   c) NMES to the finger flexors to strengthen them
   d) Cryotherapy to reduce post-exercise soreness

9. A patient with scleroderma has hand stiffness and cold intolerance. Which physical agent is CONTRAINDICATED due to the potential for worsening their condition?
   a) Paraffin wax bath for heat
   b) Contrast baths for vascular stimulation
   c) Cryotherapy for pain management
   d) Active range of motion exercises

10. A patient has chronic muscle spasms in the lumbar region. The therapist decides to use continuous ultrasound. What is the PRIMARY mechanism by which this modality reduces muscle spasm?
    a) Decreasing the conduction velocity of Type Ia afferent fibers
    b) Increasing the firing rate of the Golgi tendon organ
    c) Inducing a sedative effect on the muscle spindle via thermal and non-thermal mechanisms
    d) Directly fatiguing the muscle fibers to the point of relaxation

11. A patient presents with a painful shoulder. The therapist suspects a deep infection. What should be the therapist's FIRST action regarding the use of electrophysical agents?
    a) Apply continuous ultrasound to the area to resolve the infection.
    b) Use TENS to manage the pain while awaiting a diagnosis.
    c) Defer all electrophysical agents and refer the patient for medical evaluation.
    d) Apply cryotherapy to reduce the local inflammatory response.

12. A patient with a total knee replacement (6 weeks post-op) has swelling, pain, and significant quadriceps weakness. What is the MOST comprehensive electrophysical approach to address multiple impairments?
    a) Continuous ultrasound followed by NMES
    b) HVPC for edema control followed by NMES for muscle strengthening
    c) TENS alone for pain control
    d) Pulsed Shortwave Diathermy for deep healing

13. A patient with chronic low back pain is also taking anticoagulant medication (Warfarin). Which modality poses the HIGHEST risk for deep tissue bleeding and is relatively contraindicated?
    a) TENS
    b) Pulsed Shortwave Diathermy
    c) Continuous Ultrasound
    d) NMES

14. A patient has an implanted cardiac pacemaker. Which electrophysical agent is ABSOLUTELY CONTRAINDICATED?
    a) TENS applied to the lower back
    b) NMES applied to the quadriceps
    c) Shortwave or Microwave Diathermy
    d) Therapeutic Ultrasound applied to the shoulder

15. A patient has a metal plate and screws in their tibia from a previous fracture. They now have a soft tissue injury over the same area. Which modality can be used safely, provided the metal is not in the direct field of application?
    a) Shortwave Diathermy
    b) Microwave Diathermy
    c) Therapeutic Ultrasound, with caution
    d) Magnetic field therapy

16. A patient with a history of malignancy is now presenting with a new, benign musculoskeletal condition. What is the general guideline for using electrophysical agents?
    a) All electrophysical agents are contraindicated for life.
    b) Thermal modalities (e.g., continuous US, diathermy) are contraindicated in the area of the previous malignancy.
    c) Electrical modalities (e.g., TENS, NMES) are absolutely contraindicated.
    d) No electrophysical agents can be used if the patient has had cancer.

17. A pregnant patient in her second trimester presents with chronic low back pain. Which modality is MOST appropriate to use?
    a) Shortwave Diathermy to the lumbar spine
    b) TENS applied to the lower back, avoiding the abdomen and pelvis
    c) Continuous Ultrasound applied directly over the uterus
    d) NMES applied to the paraspinal muscles using a large current density

18. A patient has a deep vein thrombosis (DVT) in the calf. Which electrophysical agent is CONTRAINDICATED due to the risk of embolism?
    a) TENS applied to the foot for pain
    b) Continuous Ultrasound applied to the calf muscles
    c) NMES applied to the quadriceps
    d) Cryotherapy applied to the calf

19. A patient complains of a burning sensation during a TENS treatment. What is the therapist's BEST immediate action?
    a) Tell the patient that a slight burning sensation is normal.
    b) Gradually increase the intensity to overcome the sensation.
    c) Stop the treatment and check the electrode placement and skin integrity.
    d) Apply a conductive gel to the electrodes to improve conductivity.

20. During an ultrasound treatment, the patient reports a deep, aching pain. The therapist should FIRST:
    a) Increase the intensity to overcome the pain.
    b) Decrease the intensity or move the sound head to a different location.
    c) Reassure the patient that this is an expected therapeutic effect.
    d) Continue the treatment but reduce the time.

21. A therapist is using IFC for a patient with chronic knee pain. The goal is sensory-level pain modulation. What beat frequency should be selected?
    a) 0-10 Hz
    b) 10-50 Hz
    c) 80-150 Hz
    d) 200-250 Hz

22. A therapist is using Russian stimulation for quadriceps strengthening. What is the unique parameter set that defines this form of NMES?
    a) A low frequency (10-20 Hz) delivered in long, continuous trains
    b) A medium frequency (2500 Hz) that is amplitude-modulated at 50 Hz bursts
    c) A high voltage (up to 500V) monophasic pulsed current
    d) A direct current (galvanic) waveform

23. A therapist is using HVPC for acute edema control after a shoulder injury. Which polarity and mechanism are MOST appropriate?
    a) Positive polarity to repel positively charged serum proteins
    b) Negative polarity to attract negatively charged blood cells
    c) Alternating polarity to create a pumping effect
    d) Positive polarity to create an acidic environment

24. A therapist is using low-level laser therapy (LLLT) for a patient with a chronic tendinopathy. What is the critical parameter for achieving a biostimulative effect?
    a) High power to generate significant heat
    b) Appropriate wavelength and dose (energy density) to trigger cellular respiration
    c) Continuous output mode to achieve thermal effects
    d) A focused beam to cut or ablate tissue

25. A patient with a large, superficial, non-healing wound is being treated with HVPC. The wound has a moderate amount of exudate and is in the proliferation phase. What polarity is MOST appropriate for this stage of healing?
    a) Positive polarity to promote fibroblast and endothelial cell proliferation
    b) Negative polarity to attract neutrophils and macrophages
    c) Alternating polarity to disrupt bacterial biofilm
    d) Polarity is irrelevant for wound healing.

26. A therapist is applying pulsed shortwave diathermy (PSWD) to a patient with a subacute knee injury. What is the primary physiological effect of PSWD in this context?
    a) Deep, continuous heating of the joint capsule
    b) Non-thermal effects such as increased cell membrane permeability and fibroblast activity
    c) Superficial heating of the skin and subcutaneous tissues
    d) Motor-level stimulation of the quadriceps muscle

27. When using therapeutic ultrasound for a patient with a chronic tendinopathy, what is the MOST important technique to ensure effective energy delivery?
    a) Keeping the sound head perfectly still to concentrate the energy
    b) Moving the sound head slowly and continuously in a small circular pattern
    c) Using a very high intensity to ensure deep penetration
    d) Applying the sound head with minimal coupling gel to avoid reflection

28. For a patient with a 5 cm x 5 cm area of acute inflammation, what is the MOST appropriate ultrasound treatment area and time?
    a) 1 ERA (Effective Radiating Area) for 10 minutes
    b) An area twice the size of the lesion for 2-3 times the ERA in minutes
    c) The exact size of the lesion for 5 minutes
    d) A small area over the most tender point for 15 minutes

29. A patient with a fresh hamstring strain is being treated with cryotherapy. What is the primary neurophysiological reason for using ice to reduce pain?
    a) It increases the release of endorphins.
    b) It decreases nerve conduction velocity and acts as a counterirritant.
    c) It stimulates the Golgi tendon organ to cause muscle relaxation.
    d) It increases the firing rate of A-beta fibers to close the pain gate.

30. A therapist is considering using iontophoresis for a patient with a superficial, inflammatory condition. What is the primary limitation of iontophoresis compared to phonophoresis?
    a) Iontophoresis can only deliver positively charged medications.
    b) Iontophoresis cannot deliver anti-inflammatory medications.
    c) Iontophoresis has a more limited depth of penetration (often only into the dermis).
    d) Iontophoresis requires a coupling medium that is often allergenic

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

1. A 45-year-old patient presents with subacute lateral epicondylitis (onset 3 weeks ago) with persistent pain during gripping activities and mild tenderness over the common extensor origin. There is no significant swelling or heat (5 MARKS)

a) Identify the MOST appropriate electrophysical agent for this condition and stage. (1 mark)
b) Justify your selection by explaining the physiological rationale, including the stage of healing and desired tissue effect. (2 marks)
c) Describe the step-by-step procedure for applying this modality, including patient positioning, parameter selection (frequency, intensity/dosage, duration), and electrode/transducer placement. (2 marks)

2. A 28-year-old athlete presents immediately after an acute ankle inversion sprain. The lateral ankle is swollen, warm to touch, and painful on palpation. The athlete is unable to bear weight (5 MARKS)

a) Identify the MOST appropriate electrophysical agent for this acute presentation. (1 mark)

b) Explain the physiological effects you aim to achieve with this modality, linking them to the pathophysiology of acute inflammation. (2 marks)

c) Describe the procedure for application, including duration, frequency, and any specific precautions or contraindications relevant to this acute stage. (2 marks)

3. A 55-year-old patient with chronic low back pain and paraspinal muscle spasm has been referred for electrotherapy. The physiotherapist decides to use continuous therapeutic ultrasound (5 MARKS)

a) Critically evaluate the rationale for using continuous ultrasound over pulsed ultrasound in this chronic condition. (2 marks)

b) Describe the correct technique for applying continuous ultrasound to the lumbar paraspinal region, including patient positioning, coupling medium, sound head movement, and parameter selection (frequency, intensity, duration). (2 marks)

c) Identify TWO absolute or relative contraindications that must be screened for before applying this modality to the lumbar spine. (1 mark)

4. A 65-year-old patient with knee osteoarthritis reports significant morning stiffness lasting more than 30 minutes, which improves with gentle movement. The goal is to improve range of motion before an exercise program (5 MARKS)

a. Compare and contrast the use of a superficial heating agent (e.g., paraffin wax or hot pack) versus a deep heating agent (e.g., continuous ultrasound or shortwave diathermy) for this patient. Include considerations of tissue depth, safety, and efficacy. (3 marks)
b. If you choose a deep heating agent, describe the parameter settings and application technique you would use to achieve the desired thermal effect. (2 marks)

SECTION C: LONG ANSWER QUESTIONS (20 MARKS)

ANSWER ALL QUESTIONS. EACH QUESTIONIS 10 MARKS

1 A 52-year-old female patient presents with chronic low back pain (LBP) of 8 months' duration. She reports constant dull aching in the lumbosacral region, with intermittent sharp pain radiating to the right buttock and posterior thigh (no symptoms below the knee). Pain is aggravated by prolonged sitting, forward bending, and standing for more than 20 minutes. Morning stiffness lasts approximately 30 minutes and improves with gentle movement. She has significant paraspinal muscle spasm bilaterally, with tenderness over the L4-L5 and L5-S1 facets. There is no evidence of acute inflammation or neurological deficit. Previous conservative management included analgesic medication and a home exercise program with minimal improvement. You are the physiotherapist managing this patient. You decide to use an electrophysical agent as part of your treatment plan.

a) Identify the MOST appropriate electrophysical agent(s) for this patient, providing a comprehensive rationale that considers (4 MARKS)

i. The stage and nature of the condition
ii. The desired physiological effects
iii. Why alternative modalities would be less appropriate

b) Describe in detail the step-by-step application procedure for your chosen modality, including (3 MARKS)

i. Patient positioning
ii. Equipment setup
iii. Parameter selection (frequency, intensity, duration, mode)
iv. Electrode/transducer placement with anatomical landmarks
v. Technique of application

c) Identify THREE specific contraindications or precautions that must be screened for before applying this modality to the lumbar spine (1 MARK)
d) Explain how you would modify the treatment if any of these were present (1 MARK)
e) Describe how you would evaluate the effectiveness of this treatment session (1 Mark)

2 A 19-year-old male university student sustained a grade II lateral ankle sprain during a soccer match 4 days ago. He was initially treated with RICE (Rest, Ice, Compression, Elevation) by the athletic trainer. Currently, he presents with moderate swelling over the anterolateral ankle, ecchymosis extending into the lateral foot, and pain during weight-bearing (5/10). He is able to walk with a limp but cannot perform single-leg stance or hop. There is no evidence of fracture. The ankle is warm to touch, with tenderness over the anterior talofibular ligament (ATFL). Range of motion is limited to 50% of the unaffected side due to pain and swelling. You are managing this patient in the subacute phase of injury. Your goals are to reduce residual edema, manage pain, and begin tissue repair to facilitate early return to sport.

a) Identify the MOST appropriate electrophysical agent(s) for this patient in the subacute stage. Justify your selection by explaining the physiological effects required at this stage of healing (4 MARKS)
b) Describe the detailed application procedure for your chosen modality, including patient positioning, Electrode/transducer placement with anatomical landmarks, Specific parameter selection (waveform, frequency, intensity, polarity if applicable, duration), technique of application (3 marks)
c) Explain the specific physiological mechanisms by which your chosen modality achieves edema reduction, pain modulation (2 marks)
d) Describe how you would progress the electrophysical agent parameters or modalities over the next 1-2 weeks as the patient moves into the chronic stage of healing (1 mark)