AMREF INTERNATIONAL UNIVERSITY

SCHOOL OF MEDICAL SCIENCES

DEPARTMENT OF REHABILIATION MEDICINE

BACHELOR OF SCIENCE IN PHYSIOTHERAPY

END OF TERM EXAMINATIONS JANUARY TO APRIL 2026

UNIT CODE: PHT 126

UNIT NAME: Medical Physics (Main Exam)

DATE: 10th APRIL 2026

TIME: 11.15AM-1.15PM

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 8 including the cover.**
6. **Read through the paper quickly before you start.**

Section A: Multiple choice questions. Answer all the questions. (30 Marks)

1. Where is the location of center of mass in a body

A. Posterior to PSIS at 55% of body height when body is in anatomical position
B. Anterior to PSIS at 55% of body height when body is in anatomical position
C. Anterior to ASIS at 50% of body height when body is in anatomical position
D. Posterior to PSIS at 50% of body height when body is in anatomical position

2.Measuring knee ROM with a goniometer focuses on:
A. Linear velocity
B. Angular displacement
C. Resistance arm
D. Force arm

3. Measuring walking speed (m/s) in rehab is measuring:
A. Acceleration only
B. Rate of motion
C. Force
D. Torque

4. A tall patient standing upright is less stable mainly due to:
A. Larger BOS
B. Lower COM
C. Higher COM
D. Less gravity

5. A therapist asks a patient to widen stance before throwing a ball to improve:
A. Mobility
B. Stability
C. Velocity
D. Acceleration

6. A patient kicks a ball during rehab. This is:
A. Closed chain
B. Open chain
C. Static loading
D. Compression dominant

7. The Achilles tendon provides the effort force during:
A. Tiptoe standing
B. Elbow flexion
C. Neck nodding
D. Wrist flexion

8. A patient with knee osteoarthritis and lumber spondylolisthesis have been referred to the physiotherapy department for hydrotherapy. What are the benefits of exercising in the water

A. It improves range of motion and reduces pain due to low water temperature
B. Water's properties enable pain management, enhanced joint mobility, strength restoration, and functional recovery.
C. Water has electrolytes which facilitates osteoarthritis and spondylolisthesis healing
D. Buoyancy creates upward force reducing gravity effects, easing movement during aquatic therapy for injury recovery
9 Longer moment arm of load makes exercise:
A. Easier
B. Harder
C. Static
D. Closed chain

10. Which of the following statement is true about mobility

A. A mass with a low COM is more stable
B. A large mass is more mobile
C. A mass with a high COM is more mobile
D. A mass with a larger BOS is more mobile
11. Which of the following statement is true about stability

A. A mass with a LOG near edge of BOS is more stable
B. A mass with a high COM is more stable
C. A mass with a smaller BOS is more stable
D. A mass with a larger BOS is more stable

12. A patient is performing elbow flexion exercises during physiotherapy using a dumbbell to strengthen the biceps muscle. The physiotherapist asks the patient to hold the dumbbell farther away from the elbow joint. The patient reports that the exercise feels more difficult.

What is the most likely biomechanical explanation for this increased difficulty?

A. The muscle force required decreases
B. The lever arm length decreases
C. The torque at the elbow joint increases
D. The elbow joint becomes more stable

13. A patient is undergoing physiotherapy following a shoulder injury. During the session, the physiotherapist asks the patient to move their arm from an outstretched position at the side back toward the body.

This movement is known as:

A. Flexion
B. Abduction
C. Rotation
D. Adduction

14. A patient recovering from knee surgery is participating in physiotherapy. The physiotherapist includes closed kinetic chain (CKC) exercises such as squats and step-ups instead of only seated knee extensions. The physiotherapist explains that these exercises are more functional.

Why are CKC exercises considered more functional?

A. They isolate a single muscle group
B. They eliminate weight-bearing on the limb
C. They involve multiple joints and promote joint stability
D. They reduce muscle activation

15. Why do wrestlers lower their stance during matches

A. To increase COM to make them more mobile and flexible
B. To decrease COM to make them more mobile and flexible
C. To increase COM to make them more stable
D. To decrease COM to make them more stable

16. The line of gravity passes through the following points in the body except?

A. Anterior to mastoid process
B. Center of the cervical vertebrae
C. Anterior to shoulder joint
D. Center of the rib cage

17. Nodding the head at the neck is a:
A. First class lever
B. Second class lever
C. Third class lever
D. No lever

18. The Achilles tendon provides the effort force during:
A. Tiptoe standing
B. Elbow flexion
C. Neck nodding
D. Wrist flexion

19. Which one of the following is not an intensive property of matter

A. Temperature
B. Density
C. Colour
D. Energy content

Use the question below to answer number 20, 21, 22 and 23 questions.

A 67 years old patient doing incremental shuttle walk test as part of her initial assessment for pulmonary rehabilitation walked about 480m in 8minutes

20. Calculate her speed in (m/s)

A. 60m/s
B. 10m/s
C. 60km/hr
D. 10km/hr

21. During pulmonary rehabilitation, you notice that a patient's mobility has declined. She reports difficulty lifting her left leg while walking, suggesting reduced hip flexion. As a physiotherapist, you decide to assess her hip flexion range of motion using a goniometer. Which of the following is NOT a correct anatomical landmark used when measuring hip flexion?

A. Left lateral epicondyle of femur

B. Left lateral malleolus

C. Middle of the trunk

D. Greater trochanter of femur

22. As part of discharge planning following pulmonary rehabilitation, a physiotherapist evaluates a patient's performance during the Incremental Shuttle Walk Test. The patient's initial velocity was 4 m/s and her final velocity was 16 m/s after 6 seconds. What is the patient's acceleration?

A. 2.7m/s
B. 2.7 m/s^2
C. 2m/s
D. 2m/s^2

23. During discharge following physiotherapy rehabilitation, a patient tells you that she finds it difficult to continue her exercises at home due to lack of motivation.

What is the MOST appropriate advice for the physiotherapist to provide?

A. Tell the patient that exercise is mandatory and she must follow the program strictly
B. Advise the patient to stop exercising if she does not feel motivated
C. Explore the patient's barriers, set realistic goals, and encourage a structured and achievable home exercise program
D. Inform the patient that physiotherapy is no longer beneficial after discharge

24. Which one of the following is not a property of ultrasound waves

A. Have a frequency greater than 20KHz; beyond human hearing.
B. Have shorter wavelengths hence they have higher penetrating power.
C. They travel at the speed of sound
D. Travel through a vacuum

25. A 62-year-old patient is undergoing physiotherapy rehabilitation one month after a hemorrhagic stroke. During sitting balance training, you observe that the patient consistently loses balance when leaning forward to reach for an object placed in front of him. What is the MOST likely explanation for this loss of balance?

A. The patient's line of gravity remains within the base of support
B. The patient's line of gravity shifts outside the base of support
C. The patient's center of mass becomes lower
D. The patient's base of support becomes wider

26. A patient following ACL reconstruction undergoes knee flexion ROM assessment in supine. The physiotherapist places the goniometer axis over the lateral epicondyle. Where should the moving arm be aligned?

A. Greater trochanter
B. Fibular head
C. Lateral malleolus
D. Tibial tuberosity

27. A physiotherapist is assessing hip flexion ROM in a patient recovering from hip surgery. The patient is positioned supine, and the therapist aligns the goniometer axis over the greater trochanter. Where should the stationary arm be aligned?

A. Midline of femur
B. Midline of trunk
C. Lateral epicondyle
D. ASIS

28. A patient recovering from rotator cuff repair is assessed for shoulder abduction ROM in supine. The physiotherapist stabilizes the scapula. What is the normal ROM for shoulder abduction?

A. 90°
B. 120°
C. 150°
D. 184°

29. A patient following total hip replacement is assessed for hip abduction ROM in supine. Where should the goniometer axis be placed?

A. Greater trochanter
B. ASIS
C. Center of patella
D. Lateral epicondyle

30. A 75-year-old male patient with right shoulder subluxation attends your clinic for assessment. During the examination, you observe bruising on his shoulder and back. The patient confides that the injury occurred during a recent family altercation at home.

As a responsible physiotherapist, what is the MOST appropriate next action?

A. Ignore the disclosure and continue with the physiotherapy assessment
B. Advise the patient to resolve the issue privately with the family
C. Document the findings and follow local safeguarding procedures, including reporting concerns to the appropriate authority
D. Immediately discharge the patient from physiotherapy

Section B. Short structured questions. Answer all the questions in this section (20 Marks).

31. Name three applications of physics in physiotherapy (3 marks)

32. (a) State and explain 3 types of sound (6marks)

(b). State 4 clinical application of ultrasound in physiotherapy (4marks)

33. (a). State and explain four properties of laser light (4marks)

(b). State three conditions that can be treated with a laser light in physiotherapy (3marks)

Section C: Long structured questions. Answer all questions below (20 Marks)

34. (a). Name four planes of motion (4marks)

(b). State seven motions in frontal plane (7marks)

(c). Name three muscles in each of the following classes of lever first, second and third (9marks)

35. A person weighing 80 kg stands up from a sitting position. Assuming that the mass above the knee joint accounts for 60% of the whole-body weight and the gravitational force acting on the body is 9.8N

(a). Calculate the weight above the knee joint (3marks)

(c). Calculate the gravitational force acting on the body (3 marks)

(d). The patient walks 450m in 6 minutes during gait training exercise, calculate the speed of the patient in m/s (4marks)