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Federal State Budget Educational Institution
of Higher Education
Pacific State Medical University
of the Ministry of Health of the Russian Federation

APPROVED BY
Director of the Institute of
Fundamentals and Information
Technologies in Medicine
_____ / Bagryantsev V.N./
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COLLECTION OF ASSESSMENT TOOLS
Б1.О.45 Medical physics
of the basic educational program
of Higher Education

Specialty	**31.05.03 Dentistry** **for international students (in English)** (code, name)
Degree	Specialist's degree
Profile	02 "Healthcare" (in the field of providing primary health care to the population in medical organizations: polyclinics, outpatient clinics, inpatient/outpatient facilities of the municipal health care system)
Mode of study	**Full-time**
Period of mastering the BEP	**6 years** (nominal length of study)
Institute	of Fundamentals and Information Technologies in Medicine

Vladivostok, 2025

1. INTRODUCTION

1.1. Collection of Assessment Tools is a document that regulates the format, content, and types of assessment tools for continuous assessment, interim examination and final (state final) examination, and graded criteria for each type of assessment tools.

1.2. Assessment tools allows to evaluate the development of universal, general professional, and professional competencies (UCs, GPCs and PCs respectively) outlined in Federal State Educational Standard of Higher Education and defined in the basic educational program of higher education for the specialty 31.05.01 General Medicine for international students (in English), profile 02 "Healthcare" (in the field of providing primary health care to the population in medical organizations: polyclinics, outpatient clinics, inpatient/outpatient facilities of the municipal health care system).

(BEP HE for the 31.05.01 General Medicine for international students (in English) specialty, section 3 Learning Outcomes Requirements of the Basic Educational Program of Higher Education)

2. DOCUMENT BODY

2.1. Types of Assessment, Formats of Assessment Tools

No.	Types of assessment	Assessment Tools Format
1	Continuous assessment	Tests
		Practice problems
2	Interim assessment	Interview Questions

3. The contents of assessment tools for continuous and interim examination are prepared by the teacher of the course

Tests for continuous and interim assessment

	Code	Competence description / name of labor function / name of work activity / text
S	31.05.03	Dentistry for international students (in English)
C	GPC-8	Is able to use basic concepts and methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activities
C	GPC-12	Is able to implement and monitor medical rehabilitation of a dental patient
F	A/01.7	Examination of the patient in order to make a diagnosis
I		**ANSWER LEVEL 1 TEST QUESTIONS (ONE CORRECT ANSWER)**
		1. Viscosity of a Newtonian liquid depends on the +1) intermolecular forces 2) surface pressure 3) fluid velocity 4) volume of the liquid 2. As the diameter of a vessel increases, the velocity of a frictionless (ideal) liquid +1) decreases quadratically 2) increases proportionately 3) doesn’t change 4) decreases proportionately

3. Such unit of measurement as a “Volt” is used to describe
1) action potential amplitude
2) resistance
+3) electromotive force
4) intensity of electric current

4. Such unit of measurement as a “Ampere” is used to describe
+1) intensity of electric current
2) action potential amplitude
3) resistance

5. Oscillations that are driven by internal forces are called
1) free
2) forced
+3) self-oscillations

6. Oscillations that are driven by external forces are called
1) free
+2) forced
3) self-oscillations

7. If free oscillations are sustained in undampened state by an external energy source, such system is called
1) resonant
+2) forced
3) self-oscillations

8. Resonance is observed in oscillating systems if the oscillations are
1) natural
2) self-oscillations
+3) forced
4) decaying (damped)

9. Relative to the equilibrium position, the maximum speed (in absolute value) of an oscillating body is observed
1) in a moment of arbitrary displacement
2) when displacement is equal to half of the amplitude
+3) when the body passes through its equilibrium position
4) in the moment of maximum displacement

10. Cardiac output of an adult at-rest is usually
1) 1-2 L/min
2) 2-2.5 L/min
3) 7-8 L/min
+4) 4.5-5 L/min

11. Work performed by the right ventricle equals to
+1) 25% of the work of the left ventricle
2) 5% of the work of the left ventricle
3) 50% of the work of the left ventricle
4) 55% of the work of the left ventricle

12. Average stagnation (total) pressure in the circulatory system _____ as the blood flows from aorta to the vena cava

1) increases and exceeds atmospheric pressure

+2) exceeds atmospheric pressure in the arteries and falls below it in the vena cava

3) is consistent in all segments of the circulatory system

4) is equal to atmospheric pressure in the arteries and falls below it in the vena cava

13. Normal systolic pressure equal to 120 mm Hg is observed in the _____ of the human circulatory system

1) arterioles

+2) major arteries

3) capillaries

4) veins

14. Negative pressure is observed in the _____ of the human circulatory system

+1) veins

2) aorta

3) arterioles

4) arteries

15. Electric dipole can exist indefinitely in

+1) dielectric medium

2) conductive medium

3) semiconductive medium

16. Current dipole can exist indefinitely in

+1) dielectric medium

2) conductive medium

3) a vacuum

17. Total force affecting an electric dipole in a uniform electric field

+1) equals 0

2) is directed along electric force lines

3) is directed against electric force lines

4) depends on the spatial orientation of the dipole

18. Electric dipoles in a uniform electric field are positioned

1) along the equipotential lines of the electric field

+2) along the electric lines of force

3) perpendicular to the electric lines of force

4) at an angle to the electric lines of force

20. Electric dipoles in a non-uniform electric field

1) are drawn into the area of weaker intensity

2) are positioned along the equipotential lines of the electric field

3) are positioned along the electric lines of force

+4) are positioned along the electric lines of force and are drawn into the area of stronger intensity

Assessment criteria
"Pass" – over 75% correct answers
"Fail" – 74% and less correct answers

Practice problems

	Code	Competence description / name of labor function / name of work activity / text
S	31.05.03	Dentistry for international students (in English)
C	GPC-8	Is able to use basic concepts and methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activities
C	GPC-12	Is able to implement and monitor medical rehabilitation of a dental patient
F	A/01.7	Examination of the patient in order to make a diagnosis
I		1. Plague causes an artery to narrow to half of its original diameter; this leads to changes in blood flow rate, impaired blood supply, and blood vessel deformation. 2. An ultrasound wave with frequency 0.5 MHz and amplitude 0.01 mm propagates in an elastic medium. Determine the wavelength of the ultrasonic wave if the sound speed of the medium is 1500 m/s. 3. Determine the difference in phase between an ultrasonic source in a liquid and a point at 0.3 meters away from the source. Frequency of the source is 5 MHz; the sound speed of the medium is 1500 m/s m. 4. Elasticity modulus of protoplasmic filaments in some cell types is about 9×10^3 Pascals at room temperature. Determine the stress upon the filament if its strain deformation is less than 20% from its initial length. 5. During a bone fracture, a metal wire is used to stretch the bone by suspending a 3 kg. How much will the metal wire will stretch if its modulus is equal to 100 kN/m?. 6. Determine the stress in a cylindrical metal wire used in traumatology to stretch bones in fractures when a 5 kg weight is suspended from it. The wire diameter is 1 mm, with stiffness module is 140 kN/m. 7. Determine the stiffness module of the vertebral bone if, when exposed to a force of 4 kN, its absolute deformation is 1.2 mm. the length of the bone plate is 2.7 cm, the thickness is 4 cm, and the width is 2.5 cm. 8. Dental examination chair is designed with a lift operated on the principle of a hydraulic press. How much force should a dentist apply to the pedal of the chair to lift a patient of weight 78 kg, if the small piston of the lifter has an area of $s_1 = 5cm^2$ and the large piston $s_2 = 500cm^2$.

		9. The small piston of a hydraulic lift in a dental chair, when pressed with a force on the pedal of 160 N, dropped to about 10 cm. At the same time, the chair rose by 2 cm. Determine the combined mass of the chair and the patient. 10. The cross-sectional area of the medical syringe is 1 cm^2. The area of the outlet 0.2 mm^2. The syringe is positioned horizontally. A constant horizontal force of $F = 0.5\ N$ acts on the plunger of the syringe. Moving the seal about 4 cm, Find the time for the liquid to flow out of the syringe if its liquid density is 900 kg/m^3

Assessment criteria

"Pass" – explanation of the solution is detailed, logical, and grammatically correct; the student is fluent in terminology; answers to additional questions are correct and clear.

"Fail" – explanation of the solution is not logical; there are mistakes in the detail; answers to additional questions are incorrect.

Interview questions

	Code	**Competence description / name of labor function / name of work activity / text**
S	31.05.03	Dentistry for international students (in English)
C	GPC-8	Is able to use basic concepts and methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activities
C	GPC-12	Is able to implement and monitor medical rehabilitation of a dental patient
F	A/01.7	Examination of the patient in order to make a diagnosis
I		**ANSWER THE QUESTIONS** 1. Harmonic oscillations in the human body and their characteristics. 2. Spring and mathematical pendulum as models of biological systems. 3. Resonance. 4. Wave processes. 5. Longitudinal and transverse waves in an actively elastic medium. 6. Application of elastic mechanical waves in medicine. 7. Sound waves. 8. Application of the Doppler effect in medicine. 9. Ultrasound and its application in medicine. 10. The biophysical nature of sound. 11. Mechanical properties of polymer materials and biological tissues. 12. Rheological properties of bone and muscles. 13. Viscosity of biological fluids. 14. Aggregation of red blood cells. 15. Methods for determining blood viscosity. 16. Models of blood circulation. 17.Basic concepts of electrical circuits.

		18. Electrical properties of DC tissues. 19.Properties of alternating current tissues. 20. The use of alternating currents in medicine. 21. Impedance. 22.Total resistance of biological tissues. 23. Dispersion of electrical conductivity. 24. Properties of a biological tissues on direct current.

4. Assessment criteria for learning outcomes

"Pass" is given to a student who has shown a sufficiently strong knowledge of the basic concepts of the subject; is able to complete specific practical tasks outlined in the program with no outside help, use recommended reference material, and correctly evaluate the results.

"Fail" is given to a student who has significant gaps in knowledge of the basic concepts of the subject, is not able reach the correct solution to a specific practical task outlined in the curriculum even with outside help.

Appendix 1

Practical Skills Assessment Checklist

Practical Skill Name "Determining the viscosity of a fluid using the rotational viscometry"

C	GPC-8	Is able to use basic concepts and methods of physics, chemistry, mathematics and natural sciences when working to achieve objectives of professional activities		
C	GPC-12	Is able to implement and monitor medical rehabilitation of a dental patient		
F	A/01.7	Examination of the patient in order to make a diagnosis		
WA	Work activities as part of the function Formulation of a preliminary diagnosis and preparation of a plan for laboratory and instrumental examinations of the patient			
	Action		Performed	Not Performed
1.	Prepare the equipment: make sure the viscometer is in operable condition and calibration and accuracy are acceptable; prepare the measuring flask		1 point	-1 point
2.	Prepare the sample: make sure the sample meets the requirements of this experiment.		1 point	-1 point
3.	Prepare the solution: make sure that the solution is ready and meets the requirements of this experiment.		1 point	-1 point
4.	Perform the measurement: determine the viscosity of the fluid; record all measurements.		1 point	-1 point
5.	Analyze the results. Make a graph reflecting the dependence between the viscosity of the examined solution and its concentration.		1 point	-1 point
	Total		5 points	

Assessment criteria:

"Pass" –75% or more of actions performed correctly

"Fail" – 74% and less