

Name of applicant:

1. Which group of units involves only base SI units?

- a) N, cd, kg b) s, A, mol c) kg, V, W d) K, W, dB
e) no answer is correct

2. Which quantity has units $[N \cdot m^{-2}]$?

- a) liquid surface tension b) power c) acceleration d) pressure
e) no answer is correct

3. 10 m^3 of water is spread out on a square area of side 1 km. The resulting thickness of water layer is:

- a) 1 mm b) 0.1 mm c) 1 μm d) 10 μm
e) no answer is correct

4. A freely falling object of mass 100 kg drops through a height of 500 m. What was the duration of its free fall? Assume zero air friction and a free-fall acceleration of $10 \text{ m} \cdot \text{s}^{-2}$.

- a) 5 s b) 10 s c) 15 s d) 100 s
e) no answer is correct

5. What work is done when slowly letting down a 20 kg object into a hole 5 m deep? Assume a free-fall acceleration of $10 \text{ m} \cdot \text{s}^{-2}$.

- a) 2000 J b) 2000 W c) 1000 J d) 1000 W
e) no answer is correct

6. A piston is driven by an engine of power 1 kW. The piston exerts a force of 10 kN for 10 s. What is the displacement of the piston during this time?

- a) 100 m b) 10 m c) 1 m d) 0.1 m
e) no answer is correct

7. A wheel with radius of 100 cm does 120 revolutions per minute. What is the instantaneous velocity of a point lying on the circumference of the wheel?

- a) $2 \text{ m} \cdot \text{s}^{-1}$ b) $4\pi \text{ m} \cdot \text{s}^{-1}$ c) $200 \text{ m} \cdot \text{s}^{-1}$ d) $200\pi \text{ m} \cdot \text{s}^{-1}$
e) no answer is correct

8. The positions of two particles initially at a distance r from one another were changed so that the gravitational force between them increased 25-times. What is the new distance between them?

- a) $25r$ b) $625r$ c) $r/5$ d) $r/25$
e) no answer is correct

9. The force buoying up an object in a liquid (buoyant force acting upward) depends on:

- a) the mass of the immersed object
- b) the air pressure
- c) the density of the liquid
- d) the total volume of the liquid
- e) no answer is correct

10. The force due to liquid pressure acting on the bottom of a water-filled vessel is proportional to only:

- a) the bottom area and depth, liquid density and free-fall acceleration.
- b) the depth of water and liquid density.
- c) the liquid density and free-fall acceleration.
- d) the depth of water, liquid density and free-fall acceleration..
- e) no answer is correct

11. Water flows through a pipe at speed of 10 m.s^{-1} . What is the new flow speed in a section of the pipe where the radius is half the original radius? Consider water an ideal liquid with density of 1000 kg.m^{-3} .

- a) 5 m.s^{-1}
- b) 2.5 m.s^{-1}
- c) 20 m.s^{-1}
- d) 40 m.s^{-1}
- e) no answer is correct

12. The magnitude of the acceleration of a body doing simple harmonic oscillations is:

- a) maximum when reaching maximum displacement
- b) constant
- c) maximum when reaching zero displacement
- d) maximum when reaching a displacement equal to half of the amplitude
- e) no answer is correct

13. What is the main difference between sound and ultrasound?

- a) the speed of ultrasound is higher than the speed of sound
- b) sound waves are of mechanical character while the ultrasound ones are of electromagnetic character
- c) sound waves are transverse whilst the ultrasound ones are longitudinal
- d) the frequency of ultrasound is higher than the frequency of sound
- e) no answer is correct

14. The First law of thermodynamics represents:

- a) a rule describing spontaneous increase of disorder in an isolated system
- b) a rule describing transformation of heat in free energy
- c) a rule describing spontaneous decrease of disorder in an isolated system
- d) a special application of the law of conservation of energy
- e) no answer is correct

15. Which of the following equations is false for an ideal gas during an isobaric process?

- a) $pV = \text{const.}$
- b) $V_1/T_1 = V_2/T_2$
- c) $p = \text{const.}$
- d) $V/T = \text{const.}$
- e) no answer is correct

16. The magnitude of the work done by an ideal gas when pushing a piston is given by the formula (assume an isobaric process):

- a) $W = p.V$
- b) $W = p/V$
- c) $W = p.(V_2 - V_1)$
- d) $W = Q/S$
- e) no answer is correct

17. Which of the following processes can be considered to be melting?

- a) evaporation of olive oil
- b) setting (hardening) of concrete
- c) drying of frozen laundry
- d) action of soap on fats
- e) no answer is correct

18. The pressure inside a bubble:

- a) increases as the bubble radius decreases
- b) does not depend on bubble radius
- c) decreases as the bubble radius decreases
- d) reaches its maximum when the bubble bursts
- e) no answer is correct

19. The work done during the transfer of unit electric charge between two points in an electric field equals to:

- a) the electric voltage
- b) the electric field strength
- c) the dielectric constant of the medium
- d) the value of the electric dipole
- e) no answer is correct

20. A constant direct electric current of 10 μA passes through a conductor. What is the time necessary for the passage of an electric charge of 5 C?

- a) 20 s
- b) 500 s
- c) $5 \cdot 10^{-8}$ s
- d) more than 10 hours
- e) no answer is correct

21. What electric current must pass through a heating coil of resistance 200 Ω , if the boiler power output is to be 800 W?

- a) 1/4 A
- b) 1/2 A
- c) 2 A
- d) 4A
- e) no answer is correct

22. Which formula can be used for the calculation of the capacitance of a capacitor?

- a) $X_C = C/\omega$
- b) $X_C = \omega/C$
- c) $X_C = \omega C$
- d) $X_C = U/Q$
- e) no answer is correct

23. Alternating electric current of very high frequency passes through a coil (a solenoid), but:

- a) poorly
- b) only its positive half-waves
- c) only its negative half-waves
- d) only if high-quality dielectric is used in the space between the plates
- e) no answer is correct

24. Light patterns seen on a cathode-ray tube (CRT, screen) are formed by:

- a) a thin beam of light moving across the screen.
- b) the projection of an image produced by a photomultiplier located in the back part of the screen.
- c) a thin beam of electrons moving across the screen.
- d) a so-called brush discharge.
- e) no answer is correct

25. A converging lens has focal distance of +10 cm. What is its optical power?

- a) +10 N
- b) +10 W
- c) +10 D
- d) +0,1 D

e) no answer is correct

26. If a light ray passes from glass into vacuum:

- a) refraction towards the normal occurs. b) refraction away from the normal occurs.
c) no refraction occurs. d) total internal reflection occurs.
e) no answer is correct

27. The wavelength of violet light:

- a) is shorter than about 380 nm b) ranges between about 600 and 800 nm
c) is longer than about 380 nm d) ranges between about 600 and 800 μm
e) no answer is correct

28. Which of the following particles change easily their trajectory when it passes through an electric field?

- a) electron, proton, alpha-particle b) proton, electron, photon
c) electron, photon, meson d) neutron, proton, electron
e) no answer is correct

29. The number of neutrons in an atomic nucleus increased by one, without changing the total number of nucleons. It was caused by the:

- a) capture of a neutron b) emission of an electron
c) emission of a positron d) emission of an alpha-particle
e) no answer is correct

30. Gamma rays originate mainly:

- a) in the atomic nucleus
b) by the acceleration of electrically charged particles
c) by fast deceleration of electrons in matter
d) by the impacts of electrons on the cathode of an X-ray tube
e) no answer is correct

