

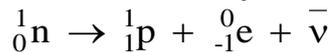
PHYSICS

Instruction: You are offered the test tasks with one correct answer from five proposed. The selected answer should be marked on the answer sheet by painting the appropriate circle.

1. A spring accelerates a 500 g cart from rest in 0.4 s giving it $6 \text{ kg} \cdot \frac{\text{m}}{\text{s}}$ momentum. The maximum velocity the cart can achieve is
 - A) 15 m/s
 - B) 2 m/s
 - C) 6 m/s
 - D) 10 m/s
 - E) 12 m/s
2. A car skids 22.5 m distance on a wet road. If the coefficient of friction between the tires and the road is 0.5, then the initial velocity of the car just before skidding is ($g=10 \text{ m/s}^2$)
 - A) 21 m/s
 - B) 5 m/s
 - C) 15 m/s
 - D) 8 m/s
 - E) 10 m/s
3. According to Kepler's laws orbits of the planets rotating around the Sun are
 - A) elliptical
 - B) parabolic
 - C) sinusoidal
 - D) circular
 - E) straight lines
4. Archimedes' Law is
 - A) pressure applied to the liquid or gas is transmitted in all directions without change
 - B) force of attraction between all bodies
 - C) module of elastic force of body is directly proportional to the change in body's length
 - D) body immersed in a liquid experiences a pushing force equal to the weight of the displaced liquid
 - E) force of gravity between the Earth and an object

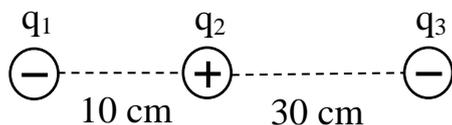
5. A Carnot heat engine receives heat from a high temperature heat source at 727°C and releases heat to a low temperature heat sink (cold reservoir) at 27°C . If it receives 800 kJ of heat from the hot reservoir in one cycle, the mechanical work output of the engine in one cycle is
- 400 kJ
 - 27 kJ
 - 727 kJ
 - 560 kJ
 - 800 kJ
6. A heat engine with efficiency $\eta = 40\%$, loses 6000 J heat during one cycle. The work done by the engine in one cycle is
- 3 kJ
 - 4 kJ
 - 2 kJ
 - 6 kJ
 - 5 kJ
7. A heat engine receives 5000 J of heat from the fuel and then releases 2000 J of heat from its exhaust. Efficiency of this engine is
- 40%
 - 60%
 - 50%
 - 70%
 - 30%
8. A 9 V battery supplies a total electric current of 0.5 A to the circuit. Power the battery supplies to the circuit is equal to
- 36 W
 - 4.5 W
 - 2.25 W
 - 18 W
 - 9.5 W
9. Period of electromagnetic oscillation can be expressed as
- $T = 2\pi\sqrt{LC}$
 - $\omega_0 = \sqrt{\frac{g}{\ell}}$
 - $T = 2\pi\sqrt{\frac{\ell}{g}}$
 - $\omega_0 = \frac{1}{\sqrt{LC}}$
 - $T = 2\pi\sqrt{\frac{m}{k}}$

10. A neutron decays into a proton as shown in the equation below.



The ${}^1_1\text{p}$ in the equation corresponds to

- A) antineutrino
 - B) proton
 - C) neutron
 - D) neutrino
 - E) electron
11. Definition of Pascal's law
- A) force of attraction between all bodies
 - B) module of elastic force of the body is directly proportional to the change in body's length
 - C) force of gravity between the Earth and the object
 - D) liquids and gases transmits pressure equally in all directions
 - E) upthrust force acting on the object immersed in liquid
12. The wavelength of a 10 Hz wave that travels with a 30 m/s speed is
- A) 3 m
 - B) 5 m
 - C) 2 m
 - D) 4 m
 - E) 6 m
13. A heat engine receives 4000 J of heat from the fuel and then releases 2000 J of heat from its exhaust. Efficiency of this engine is
- A) 50%
 - B) 60%
 - C) 30%
 - D) 40%
 - E) 70%
14. Three charges $q_1 = -5 \mu\text{C}$, $q_2 = 2 \mu\text{C}$ and $q_3 = -3 \mu\text{C}$ are placed along a line, as shown in the figure. The distance between q_1 and q_2 is 10 cm, and between q_2 and q_3 is 30 cm. The magnitude of the resultant force acting on charge q_2 is ($k = 9 \cdot 10^9 \text{ N} \cdot \text{m}^2 / \text{C}^2$)



- A) 6,5 N
- B) 5,8 N
- C) 9,5 N
- D) 7,8 N
- E) 8,4 N

15. The electric force between charges $q_1 = 2 \cdot 10^{-6} \text{ C}$ and $q_2 = -0,5 \cdot 10^{-6} \text{ C}$ is $2,5 \cdot 10^{-4} \text{ N}$. The distance between charges is equal to ($k = 9 \cdot 10^9 \text{ N} \cdot \text{m}^2 / \text{C}^2$)
- A) 4 m
 - B) 6 m
 - C) 5,2 m
 - D) 3,5 m
 - E) 5 m
16. Wave characteristics that equals to the product of the frequency and the wavelength
- A) wavelength of wave
 - B) speed of wave
 - C) period of wave
 - D) frequency of wave
 - E) amplitude of wave
17. The wavelength of a X-ray with the frequency of $0,5 \cdot 10^{20} \text{ Hz}$ ($c = 3 \cdot 10^8 \text{ m/s}$)
- A) $2 \cdot 10^{-18} \text{ m}$
 - B) $4 \cdot 10^{-9} \text{ m}$
 - C) $5 \cdot 10^{-22} \text{ m}$
 - D) $6 \cdot 10^{-12} \text{ m}$
 - E) $3 \cdot 10^{-15} \text{ m}$
18. A Carnot heat engine receives heat from a high temperature heat source at 727°C and releases heat to a low temperature heat sink (cold reservoir) at 27°C . Efficiency of this engine is
- A) 50%
 - B) 30%
 - C) 70%
 - D) 40%
 - E) 60%
19. The tuning circuit of a radio receiver has an inductance of $10 \mu\text{H}$. If the radio receives a signal from a radio station broadcasting at a wavelength of 120 m, the capacitance of the circuit is ($c = 3 \cdot 10^8 \text{ m/s}$, take $\pi^2 = 10$)
- A) 300 pF
 - B) 500 pF
 - C) 350 pF
 - D) 200 pF
 - E) 400 pF

20. Human eye sometimes is called as

- A) cornea
- B) pupil
- C) eyeball
- D) retina
- E) iris

Instruction: You are offered the test items on the base of context with one correct answer from five proposed ones. Read the context attentively and do the items. The selected answer should be marked on the answer sheet by full painting the appropriate circle.

Weight suspended on a thread

An object with mass 0.02 kg is suspended on the rope and makes simple harmonic oscillations with a period of 2 s. The total energy of the oscillation is $2 \cdot 10^{-4}$ J

21. The angular frequency of the object is

- A) 6,28 rad/s
- B) 12,56 rad/s
- C) 2 rad/s
- D) π rad/s
- E) 0,3 rad/s

22. The frequency of oscillation

- A) 3 Hz
- B) 1 Hz
- C) 0,5 Hz
- D) 2 Hz
- E) 4 Hz

23. If the same weight is suspended on a spring, to have the same period of the oscillation the spring constant should be

- A) $\approx 3,6$ N/m
- B) $\approx 0,2$ N/m
- C) $\approx 0,06$ N/m
- D) $\approx 5,12$ N/m
- E) $\approx 0,12$ N/m

24. The amplitude of the oscillation is

- A) ≈ 2 m
- B) ≈ 8.234 m
- C) ≈ 0.090 m
- D) ≈ 0.045 m
- E) ≈ 22.19 m

25. The same object started to move along a circle with a radius of 20 cm with a constant tangential acceleration. By the end of the 80th revolution, the kinetic energy of the object was $4 \cdot 10^{-2}$ J. Calculate the tangential acceleration of the object

- A) ≈ 25 mm/s²
- B) ≈ 10 mm/s²
- C) ≈ 20 mm/s²
- D) ≈ 16 mm/s²
- E) ≈ 17 mm/s²

Instruction: You are offered the test tasks with one or more correct answers from multiple choices. The selected answer should be marked on the answer sheet by painting the appropriate circle.

In the test tasks with one or more correct answers there can be up to three correct answers.

26. A man weighs 700 N on Earth. Find his weight and mass on Jupiter where $g = 26 \text{ N/kg}$ (on Earth $g = 10 \text{ N/kg}$)
- A) 1820 N
 - B) 70 kg
 - C) 80 kg
 - D) 1,82 kN
 - E) 1690 N
 - F) 1,69 kN
 - G) 2080 N
 - H) 65 kg
27. The best description of the condition of a thermodynamic system during isothermal process
- A) energy given to the system is spent for work done and change of internal energy of the system
 - B) temperature of the gas remains constant
 - C) energy given to the system is completely transferred to its internal energy
 - D) pressure of the gas remains constant
 - E) volume of the gas remains constant
 - F) no work done
 - G) energy given to the system is spent totally to perform the work
 - H) no change in internal energy takes place
28. The wavelength of 1,5 MHz radio wave is ($c = 3 \cdot 10^8 \text{ m/s}$)
- A) 0,02 km
 - B) 100 m
 - C) 200 m
 - D) 300 m
 - E) 0,01 m
 - F) 1 m
 - G) 0,03 km
 - H) 0,2 km

29. An inductor of $L=0,1$ H is connected to an AC source of voltage $U = 60\sin 100\pi t$. Maximum current in the inductor is (Take $\pi = 3$)
- A) 0,002 kA
 - B) 1 A
 - C) 0,01 A
 - D) 2 A
 - E) 10 A
 - F) 0,2 A
 - G) 0,03 kA
 - H) 30 A
30. The lens camera (which is used to take a photo) produces an image with the following properties
- A) no image
 - B) smaller than the object (diminished)
 - C) real
 - D) virtual
 - E) upright
 - F) inverted
 - G) the same size
 - H) larger than the object (magnified)
31. The point where the total pressure is 4 times greater the atmospheric pressure is located under the surface of water at the depth of ($P_{\text{atm}} = 10^5$ Pa, $D = 1000\text{kg}/\text{m}^3$)
- A) 35 m
 - B) 30 m
 - C) 60 m
 - D) 50 m
 - E) 15 m
 - F) 40 m
 - G) 80 m
 - H) 55 m
32. Heat engine receives 500 J of energy from hot reservoir and then releases 200 J as exhaust. The efficiency of this engine is
- A) 0,4
 - B) 0,2
 - C) 20%
 - D) 40%
 - E) 0,6
 - F) 50%
 - G) 60%
 - H) 0,5

33. An inductor of $L=0,1$ H is connected to an AC source of voltage $U = 60\sin 100\pi t$. Inductive reactance is (Take $\pi = 3$)
- A) 10 Ohm
 - B) 1 Ohm
 - C) 0,02 kOhm
 - D) 0,01 kOhm
 - E) 30 Ohm
 - F) 20 Ohm
 - G) 0,03 kOhm
 - H) 0,2 kOhm
34. Efficiency of heat engine is 30%. During the cycle it receives 200J from hot reservoir. The work done this engine is
- A) 75 J
 - B) 200000 mJ
 - C) 60000 mJ
 - D) 70 J
 - E) 100 J
 - F) 85 J
 - G) 60 J
 - H) 20 J
35. The number of neutrons produced during the following nuclear reaction is
- $${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{56}^{144}\text{Ba} + {}_{36}^{89}\text{Kr} + ?{}_0^1\text{n}$$
- A) 1
 - B) 3
 - C) 7
 - D) 0
 - E) 5
 - F) 4
 - G) 6
 - H) 2

PHYSICS TEST IS COMPLETED