FACULTY OF MEDICINE, MASARYK UNIVERSITY, BRNO

Admission test : PHYSICS A Year : 2009

1. Which group of units contains only base SI units?
a) second, joule, candela, mole b) second, ampere, newton, mole
c) second, mole, kilogram, candela d) candela, second, radian, gram
e) no answer is correct

2. Which group of quantities contains only scalars?
a) surface tension, pressure, work b) energy, work, density of magnetic flux
c) magnetic permeability, acceleration, momentum
d) momentum, energy, amount of substance e) no answer is correct

3. What is the unit of angular velocity?
a) Ns^{-1} b) s^{-1} c) $rads^{-1}$ d) rad^{-1} e) no answer is correct

4. Which unit is correctly expressed by means of the other units?
a) watt $[VA^{-1}]$ b) joule $[kgms^{-2}]$ c) kelvin [Js]
d) becquerel $[s^{-1}]$ e) no answer is correct

5. Which of the following units is used for a dimensionless quantity?
a) farad b) becquerel c) light year d) decibel e) no answer is correct

6. On a small planet without atmosphere, a body is thrown vertically upwards. What should be its initial velocity to reach the height of 10 m? (homogeneous gravitational field, $a_g = 2.00\ ms^{-2}$ is assumed.)
a) 40.0 ms^{-1} b) 20.0 ms^{-1} c) 10.0 ms^{-1} d) 6.32 ms^{-1}
e) no answer is correct

7. A 500-g arrow had thrust into a freely hanging bag full of hay with a velocity of 40 ms^{-1}. It caused the bag (including the arrow) to start moving with a velocity of 1 $m.s^{-1}$. What was the original mass of the bag? (Energy loss by friction is ignored.)
a) 20 kg b) 19.5 kg c) 19 kg d) 1 kg e) no answer is correct

8. A body with a volume of 400 ml and a mass of 800 g moves down in water (ρ=1000 kgm^{-3}) at a constant velocity of 6 cms^{-1}. What is the total force exerted on the body *against* the direction of its motion? ($a_g = 10\ ms^{-2}$)
a) 8.00 N b) 4.00 N c) 400 N
d) cannot be calculated without knowing the friction force e) no answer is correct

9. A worker pulls up a body by means of a light system of pulleys (a tackle). What is his mechanical power compared to a worker doing the same task without any tool and during the same time? (Friction can be ignored.)
a) bigger b) smaller c) the same d) cannot be solved e) no answer is correct

10. A 1.00-kg body is moving in circle with a frequency of 1Hz. It is held in its trajectory by a 10-m long thin iron wire. What is the value of force stretching the wire? (Friction and gravity are ignored.)
a) 40 N b) 20 N c) about 197 N d) about 395 N e) no answer is correct

11. After position change of two particles which were originally at a distance of *r*, the gravitational force acting between these particles increased 900-times. What is the new distance of these particles?

a) r/900 b) r/30 c) 900r d) 30r e) no answer is correct

12. In case of collision of two air bubbles of the same size in water, the bubbles join (coalesce) easily. The air pressure inside the resulting bubble is:

a) The sum of the pressures in original bubbles b) slightly bigger than in original bubbles
c) smaller than in original bubbles d) the same like in the original bubbles
e) no answer is correct

13. Objects placed at the bottom of a water-filled vessel are made of the same material and of the same mass but of different shape. Which statement is true?

a) Buoyant force acting on them is different in all cases.
b) All the bodies act on the bottom with different force.
c) Buoyant force acting on a sphere and a lying disc is the same.
d) Buoyant force acting on a sphere is smaller than the force acting on a lying disc.
e) no statement is true

14. Water flows through a pipe. If the ratio of radii of a narrower and a wider section of the pipe is 1:3, than the ratio of water flow-rates in these two sections is:

a) 9:1 b) 3:1 c) 2:1 d) 1:3 e) no answer is correct

15. A body doing simple harmonic oscillations has the minimum kinetic energy in the moment when:

a) reaching maximum acceleration b) travelling through its equilibrium position
c) its displacement is just $0.5y_{max}$ (half of the amplitude)
d) its displacement is just zero e) no answer is correct

16. In the equation of motion of simple harmonic oscillator, the phase of the motion is changed so that the instantaneous displacement *y* of the oscillator reaches the opposite value of the same magnitude (-*y*). This change of phase for *any (arbitrary) y* equals:

a) $\pi/2$ b) π c) $3\pi/2$ d) 2π e) no answer is correct

17. The original intensity of a sound was just (exactly) 1.00 W.m^{-2}. Sound level of this sound decreased by 50 dB. What is intensity of the sound now?

a) -5 Wm^{-2} b) 0.50 Wm^{-2} c) 1×10^{-5} Wm^{-2} d) problem has no solution
e) no answer is correct

18. Which statement is false?

a) Ultrasound intensity can be the same like intensity of audible sound.
b) A supersonic aircraft can exceed the speed of ultrasound.
c) In a given medium, sound differs from ultrasound by longer wavelength.
d) In a given medium, sound differs from ultrasound by lower frequency.
e) No statement is false.

19. In thermodynamics, the term *kT* (*k* is Boltzmann constant and *T* temperature) has the physical dimension of

a) volume b) pressure c) energy d) Avogadro constant e) no answer is correct

20. The mechanical (volumetric) work can be done by perfect gas during:
a) isothermal process b) isobaric process c) adiabatic process
d) all of the three previous cases e) no answer is correct

21. In a process in which the volume remains constant, after increasing the temperature of the perfect gas 4-times:
a) pressure increased 2-times b) pressure increased 4-times
c) pressure did not change d) pressure decreased to one half e) no answer is correct

22. Sea water changed to ice (froze) at -3 ºC. This phenomenon was caused probably by:
a) the presence of dissolved salt b) increased evaporation c) increased ambient pressure
d) the presence of air bubbles e) no answer is correct

23. In the phenomenon of capillary elevation, narrowing of the capillary causes:
a) bigger elevation of the liquid surface in capillary
b) smaller elevation of the liquid surface in capillary
c) no change of the liquid surface position
d) change of elevation into depression in some cases e) no answer is correct

24. A steel wire with a cross-section area of 1 cm^2 has the modulus of elasticity equal to 220 GPa. What is the force necessary for its relative elongation by 0.1%?
a) 220 N b) 2.2 kN c) 22 kN d) 220 kN e) no answer is correct

25. Intensity of electric field in dielectrics is:
a) directly proportional to its relative permittivity
b) indirectly proportional to its relative permittivity
c) indirectly proportional to its potential d) independent of its relative permittivity
e) no answer is correct

26. How should three 3-pF capacitors be connected to substitute (replace) a 1-pF capacitor?
a) in series b) in parallel c) two in series and one in parallel to them
d) it is not possible e) no answer is correct

27. A 100-μA constant direct current passes through a wire. What is the time necessary to transfer the electric charge of 1 C?
a) 20 s b) 500 s c) $5x10^{-8}$ s d) 10 000 s e) no answer is correct

28. What is the mutual force exerted in vacuum by two 1-m long parallel wires with a distance of 10 cm with electric current of 1 A?
a) $2x10^{-7}$ N b) $2x10^{-6}$ N c) $2x10^{-4}$ N d) $2x10^{-3}$ N e) no answer is correct

29. Meaning of the equation $\omega.C - \frac{1}{\omega.L} = 0$ is (resistance of the coil is neglected):
a) impedance of the circuit with a coil and a capacitor in series
b) impedance of the circuit with a coil and a capacitor in parallel
c) condition for maximum value of a coil and a capacitor impedance in series
d) condition for resonance in a circuit with a coil and a capacitor e) no answer is correct

30. In electronics, the common meaning of the abbreviation LED is
a) laser energised device b) light electric device c) light emitting diode
b) low-energy drone e) no answer is correct

31. Light rays coming from infinity fall on a thin converging lens (parallel to its principal axis) and intersect 25 cm behind it. The optical power of the lens is:
a) – 0.25 D b) +0.25 D c) +4 D d) - 4 D e) no answer is correct

32. Light rays passing through a thin converging lens intersect in a point which distance from the lens centre is double the focal length *f*. The source of light rays is:
a) between the front focus and the lens b) in distance of f in front of the lens
c) in distance of $2f$ in front of the lens
d) there is not enough information to provide the answer e) no answer is correct

33. A part of the energy of a violet light photon turned to another form of energy when travelling through a medium.
a) The resulting photon can be a photon of yellow light
b) The resulting photon can be a photon of ultraviolet light
c) There is no reason for colour change.
d) The photon energy cannot turn to another form of energy. e) no answer is correct

34. The illuminance unit is:
a) lumen b) candela c) Wm^{-2} d) lux e) no answer is correct

35. It is possible to obtain energy from synthesis of helium from two deuterium nuclei because
a) the mass defect per one nucleon in helium is smaller than in deuterium
b) the mass defect per one nucleon in helium is bigger than in deuterium
c) helium produced is radioactive d) deuterium is radioactive e) no answer is correct

36. A β^+-particle was emitted from atom nucleus. It resulted in:
a) increase of neutron number of the nuclide b) decrease of proton number by 1
c) decrease of nucleon number by 2 d) decrease of neutron number by 1
e) no answer is correct

37. What is the true meaning of the symbol N_t in the Law of radioactive decay, $N_t = N_0 x e^{-\lambda t}$).
a) number of atoms decayed during time *t* b) number of particles emitted during time t
c) it should be I (i.e. intensity of radiation)
d) number of nucleons in the atom nucleus at the end of decay e) no answer is correct

38. Which of the following particles is not influenced (deflected from the original direction of movement) by magnetic field? (Spin of the particles is not considered.)
a) helium atom b) β^--particle c) any nucleon d) α-particle
e) no answer is correct

39. Particle wavelength given by the de Broglie relation is:
a) a quotient of the Planck constant and momentum of the particle
b) a quotient of the momentum and mass of the particle
c) a quotient of the Planck constant and mass of the particle
d) a quotient of the mass and momentum of the particle e) no answer is correct

40. A significant diffraction and consequent interference of X-rays takes place in:
a) magnetic field b) crystals c) glass/vacuum interface d) electric field
e) no answer is correct