FACULTY OF MEDICINE, MASARYK UNIVERSITY, BRNO

Admission test**:** **BIOLOGY A** Year: 2022

Name of applicant: .....

1. Cranially from the first lumbar vertebra are located
a) 19 vertebrae b) 8 cervical vertebrae c) 24 presacral vertebrae d) 15 vertebrae
e) none of the answers is correct

2. Which of the following is the largest organ of our body?
a) liver b) brain c) muscle d) skin e) none of the answers is correct

3. During the histology seminar of the first-year General medicine programme at the Faculty of Medicine, Masaryk University in Brno, a student observes the epithelium of human skin and sees that the cells are layered, flat and scaly. The sample is an example of:
a) simple squamous epithelium b) stratified squamous epithelium c) stratified cuboidal epithelium
d) stratified columnar epithelium e) none of the answers is correct

4. A 47-year-old man comes to the ambulance with the pain in his left knee appearing most often during skiing, walking down the stairs or hills or while squatting. What type of joint is the knee joint?
a) simple b) compound c) ball and socket d) plane e) none of the answers is correct

5. When examining the musculoskeletal system, physiotherapists can check the strength of the muscle acting on a joint. If one muscle contracts, the other relaxes. The biceps brachii muscle is a skeletal muscle lying on the anterior side of the arm, it functions (between others) as a flexor of the elbow joint. What is the general type of this muscle in relation to the triceps brachii muscle, which lies on the other (posterior) side of the arm and functions as an elbow joint extensor?
a) agonist b) antagonist c) synergist d) relaxer e) none of the answers is correct

6. Which of the following has the lowest pH optimum?
a) gastric secretion b) saliva c) pancreatic secretion d) bile e) none of the answers is correct

7. The vital capacity of the lungs expresses
a) the amount of inhaled and exhaled air at rest
b) the maximum amount of exhaled air after the maximum inhalation
c) the volume of air which, when inhaled, remains in the airways and does not reach the lungs
d) the maximum amount of exhaled air after a normal inhalation at a rest
e) none of the answers is correct

8. Indicate the correct sequence of organs or tissues in which sperm can pass in a healthy person
a) testis - epididymis - vas deferens - male urethra - female vagina - uterus - Fallopian tube
b) testis - epididymis - prostate - vas deferens - female urethra - female vagina - Fallopian tube - ovary
c) testis - vas deferens - epididymis - prostate - male urethra - female vagina - uterus - Fallopian tube
d) testis - epididymis - Fallopian tube - urethra - female uterus - female vagina - Fallopian tube - ovary
e) none of the answers is correct

9. Which hormone is produced by the placenta?
a) progesteron b) insulin c) melatonin d) glucagon e) none of the answers is correct

10. The tricuspid valve in the heart opens
a) at the beginning of systole b) during systole c) at the beginning of diastole
d) when the ventricles contract e) none of the answers is correct

11. Choose a correct statement about the blood
a) we count granulocytes to the blood (cellular) elements
b) the largest proportion of blood elements in the blood are leukocytes and platelets
c) platelet viability is about 120 days
d) an important component of blood plasma is, in addition to proteins, also glucose, the concentration of which in a healthy person is about 9% of the total volume e) none of the answers is correct

12. The posterior roots of the spinal nerves contain fibres
a) mixed, i.e. motor and sensory b) sensory, i.e. afferent c) motor, i.e. efferent
d) motor, i.e. centripetal e) none of the answers is correct

13. Choose a correct statement about the sympathetic nervous system
a) strengthens intestinal peristalsis b) causes secretion of saliva and digestive juices c) narrows the bronchi d) reduces blood flow in the skin and abdominal organs e) none of the answers is correct

14. Which scientists work contributed to our understanding of the causes of infectious diseases?
a) Thomas Hunt Morgan b) Louis Pasteur c) James Watson
d) Johan Gregor Mendel e) none of the answers is correct

15. The concentration of solutes in a red blood cell corresponds to 0.9 % NaCl. In which of the following solutions will red blood cells shrink most due to osmosis?
a) physiological saline solution b) 0.5% NaCl solution c) 1.5 % NaCl solution
d) pure water e) none of the answers is correct

16. Which of the following <u>IS NOT</u> part of a virus?
a) capsid b) centrosome c) nucleic acid d) envelope e) none of the answers is correct

17. In the following three columns, cell constituents, biochemical components and functions are listed. Which of the triads has a meaning?

a) Golgi apparatus	valin	synthesis of proteins
b) Endoplasmic reticulum	saccharose	synthesis of polysaccharides
c) microtubules	tubulin	muscle contraction
d) microfilaments	actin	cell movement

e) none of the triads is meaningful

18. Alpha cells in the pancreas produce peptide hormone glucagon. By using radioactively labelled amino acids, one can track the path of glucagon through the cytoplasm. Which of the following could be the path of the glucagon? (ER-endoplasmic reticulum)
a) rough ER → Golgi → vesicle → plasma membrane b) Golgi → rough ER → plasma membrane c) rough ER → lysosome → Golgi d) smooth ER →lysosome → plasma membrane
e) none of the answers is correct

19. Which of the following possesses a structure similar to a basal body?
a) centriole b) nucleosome c) centrosome d) ribosome e) none of the answers is correct

20. The process of capturing a substance or particle from outside the cell by engulfing it with the cell membrane is
a) osmosis b) endocytosis c) facilitated diffusion d) exocytosis e) none of the answers is correct

21. Picture shows chromosomes in eucaryotic cell. Recognise and name the phases of the cell cycle.



a) prophase b) metaphase c) anaphase d) telophase e) none of the answers is correct

22. Which of the following statements about the eukaryotic chromosome is correct?
a) It is composed of single-stranded linear molecule of DNA and histones.
b) It consists of a single circular molecule of double-stranded DNA.
c) It consists of a single circular molecule of double-stranded DNA and histones.
d) It consists of a single linear molecule of double-stranded DNA and histones.
e) none of the answers is correct

23. Fill in the correct term/s. After replication, one strand of the new DNA is from the old DNA, and one strand has been newly synthesized. This is known as _____.
a) transcription b) translation c) semi-conservative replication d) conservative replication
e) none of the answers is correct

24. Which one of the following statements is the most close to reality?
a) All codons code for amino acids. b) Ribosomes are composed of 3 different subunits.
c) The same genetic code is found in all organisms. d) Ribosomal RNA brings amino acids to the ribosome.
e) all the statements are correct

25. The main significance of mitosis is that
a) it causes genetic variation b) it causes transcription of DNA to RNA c) it reduces the number of chromosomes d) it ensures genetic identity of mother and daughter cells e) none of the answers is correct

26. Select the statement that most correctly describes meiosis.
a) During the prophase I crossing over takes place.
b) During anaphase I the chromatids separate and migrate to opposite poles of the spindle.
c) Telophase I results in the formation of two genetically identical haploid cells.
d) During the second division, the chromatids separate in metaphase II.
e) none of the answers is correct

27. Independent assortment of chromosomes occurs
a) during mitosis only b) during meiosis I only c) during meiosis II only
d) during all mitosis, meiosis I and meiosis II e) none of the answers is correct

28. Fill in the correct terms. Genes occur as alleles on chromosomes. If both alleles are the same, the organism is _____ for that allele. When one of a pair of alleles produces functional protein, and the other does not, the allele producing functional protein is called the _____ allele.
a) heterozygous, dominant b) heterozygous, recessive c) homozygous, dominant
d) homozygous, recessive e) none of the answers is correct

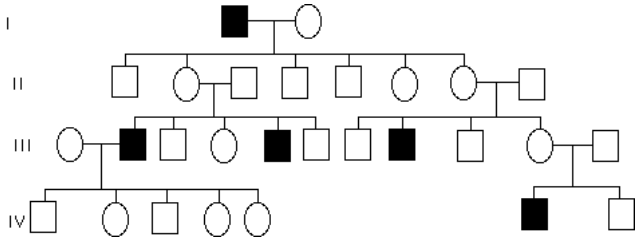
29. In sickle-cell disease, a single substitution of an 'A' by 'T' on the β-globin gene causes the resultant protein to have altered properties, but to be of normal size. Select the term that most accurately describes this type of mutation.
a) silent mutation b) missense mutation c) nonsense mutation d) frameshift mutation
e) none of the answers is correct

30. What is the function of exons?
a) regulation of gene expression b) initiation of replication c) coding for proteins
d) their function is not yet known e) none of the answers is correct

31. How many Barr bodies would you expect to find in cells of female with Turner´s syndrome?
a) none b) one c) two d) three e) none of the answers is correct

32. Cell has 2n chromosomes. If a pair of homologous chromosomes fails to separate during anaphase of meiosis I, what will be the chromosome number of the four resulting gametes?
a) n+1; n+1; n; n b) n+1; n+1; n-1; n-1 c) n+1; n-1; n; n d) n+1; n+1; n-1; n
e) none of the answers is correct

33. Inheritance of what genetic disorder does most probably show the pedigree chart given bellow?



a) X-linked recessive b) of X-linked dominant c) autosomal recessive d) autosomal dominant e) none of the answers is correct

34. An achondroplastic dwarf man with normal vision marries a colour-blind woman of normal height. The man´s father was 6 feet tall, and both woman´s parents were of average height. Achondroplastic dwarfism is autosomal dominant, blindness is X-linked recessive. What proportion of their male children would be colour-blind and normal height?

a) all b) none c) 1/4 d) 1/2 e) none of the answers is correct

35. In cats, black colour is caused by an X-linked allele; the other allele at this locus cases orange colour. The heterozygote is tortoise-shell. What kinds of offspring would you expect from the cross of black female and orange male?

a) tortoise-shell female; tortoise-shell male b) black female; orange male c) tortoise-shell female; black male
d) orange female; black male e) none of the answers is correct

36. In a cross of individuals with genotypes AaBbCc x AaBbCc, what is the probability of producing offspring with the genotype AABBCC?

a) 1/128 b) 1/64 c) 1/14 d) 1/8 e) none of the answers is correct

37. Sometimes, DNA of virus becomes part of the host DNA and remains in the host cell for a long period of time. This process is called the

a) cell cycle b) lysogenic cycle c) lytic cycle d) nitrogen cycle e) none of the answers is correct

38. Which one of the following statements is the most probable?

a) Antibiotics are used for treatment of both viral and bacterial infections.
b) *Claviceps purpurea* is pathogenic fungus in humans.
c) *Treponema pallidum* is a spirochete that causes syphilis.
d) Tse tse fly transmits leishmaniosis. e) none of the answers is correct

39. The causative agent of tuberculosis is

a) a protist b) a yeast c) a bacterium d) a virus e) none of the answers is correct

40. Human genome project (1990-2003) revealed that the human genome includes approximately following number of genes:

a) 13 000 b) 20 000 – 25 000 c) 30 000 – 40 000 d) 50 000 -100 000
e) none of the answers is correct

FACULTY OF MEDICINE, MASARYK UNIVERSITY BRNO

Admission test: **CHEMISTRY A** Year: 2022

1) Select the formula of magnesium disulfite:

a) $Mg_2S_2O_4$ b) MgS_2O_7 c) MgS_2O_6 d) MgS_2O_5
e) no answer is correct

2) Calculate the mass percentage of oxygen in sodium peroxide, A_r(Na) = 23, A_r(O) = 16.

a) 41.0% b) 30.1% c) 20.5% d) 18.9%
e) no answer is correct

3) Calculate the theoretical volume of water that, upon decomposition, yields one litre of oxygen. Consider the properties of ideal gas, 0 °C and 101.3 kPa. A_r(H) = 1, A_r(O) = 16, density of water = 1.0 g/ml.

a) 89.7 cm^3 b) 22.4 dm^3 c) 1.6 cm^3 d) 44.8 dm^3
e) no answer is correct

4) Calculate the mass of one selenium atom. A_r(Se) = 79

a) 1.3×10^{-22} g b) 4.7×10^{-25} g c) 1.5×10^{-20} g d) 3.2×10^{-22} g
e) no answer is correct

5) Radioactive fluorine isotope ^{18}F contains:

a) 10 protons + 8 neutrons b) 7 protons + 11 neutrons c) 9 protons + 9 neutrons
d) 18 neutrons e) no answer is correct

6) Consider a general equilibrium reaction in gaseous phase [A (g) + 2 B (g) ⇄ C (g) + heat] and select the correct statement:

a) removing A supports reaction progress from the left to the right
b) adding B supports reaction progress from the right to the left
c) increasing pressure will support the right-to-left reaction
d) decreasing temperature will drive the left-to right reaction course
e) no answer is correct

7) Select the compound that can form hydrogen bonds with water molecules:

a) trichloromethane b) dimethyl sulfide c) ethylamine d) potassium bromide
e) no answer is correct

8) A mouthwash contains 600 ppm of fluoride anion. Calculate the molarity of fluoride. A_r(F) = 19, density of mouthwash = 1.0 g/ml, ppm = parts per million

a) 31.6 mmol/l b) 31.6 μmol/l c) 0.32 mmol/l d) 0.03 μmol/l
e) no answer is correct

9) A solution of hydrochloric acid (20%, M = 36.5 g/mol) has the density 1.1 g/ml. Determine the molarity of HCl.

a) 6.0 mol/l b) 1.3 mol/l c) 3.0 mol/l d) 12.0 mol/l
e) no answer is correct

10) The solution of sulfuric acid (50 ml; 0.1 mol/l) was added to the NaOH solution (40 ml; 0.1 mol/l). How many per cents of acid was neutralized? Assume an ideal solution and complete dissociation of both electrolytes.

a) 80% b) 30% c) 45% d) 60%
e) no answer is correct

11) In a sodium phosphate solution, the concentration of cations is 400 mmol/l. Calculate the concentration of anions. Assume complete dissociation and ideal conditions, do not consider the hydrolysis of ions.

a) 100 mmol/l b) 200 mmol/l c) 400 mmol/l d) 1200 mmol/l
e) no answer is correct

12) Select a weak electrolyte (R = alkyl):

a) R-CO-R b) R-NH_2 c) R-NH_3^+ Cl^- d) R-CH_2-R
e) no answer is correct

13) A solution of nitric acid (*M* = 63 g/mol) has pH = 2.0 (25 °C). Calculate the mass concentration of HNO_3.

a) 1.8 g/l b) 3.1 g/l c) 2.5 g/l d) 0.63 g/l
e) no answer is correct

14) Select the salt whose aqueous solution is acidic:

a) KNO_2 b) $MgCl_2$ c) $Al_2(SO_4)_3$ d) $NaHCO_3$
e) no answer is correct

15) Select the true statement on alkali metals:

a) potassium ions (K^+) are the major cations of intracellular fluid
b) hydrated sodium ion $[Na(H_2O)_n]^+$ exhibits typical properties of a Brønsted acid
c) rubidium ion (Rb^+) has very strong reducing properties
d) natural caesium (Cs) is a radioactive element
e) no answer is correct

16) Select the poorly soluble salt:

a) $Ca(HCO_3)_2$ b) $MgCO_3$ c) $KHSO_4$ d) $NaClO_3$ e) no answer is correct

17) Select the redox reaction:

a) $CaCO_3 \rightarrow CaO + CO_2$
b) $PCl_5 + H_2O \rightarrow POCl_3 + 2\ HCl$
c) $2\ CH_3\text{-}SH + ½\ O_2 \rightarrow CH_3\text{-}S\text{-}S\text{-}CH_3 + H_2O$
d) $[Cu(H_2O)_4]^{2+} + H_2O \rightarrow [Cu(H_2O)_3OH]^+ + H_3O^+$
e) no answer is correct

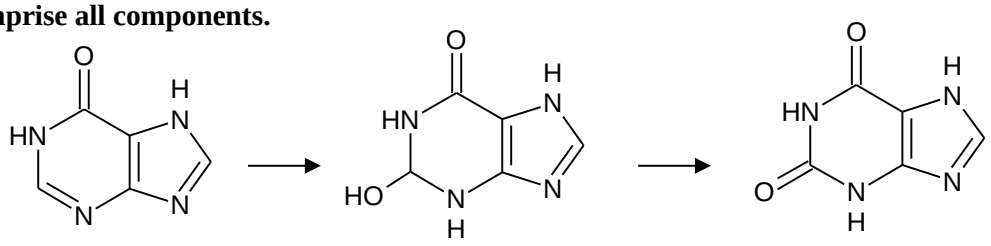
18) Find the acyl of a five-carbon carboxylic acid:

a) malonyl b) succinyl c) caproyl d) acetoacetyl e) no answer is correct

19) Select the redox pair (A_{red}/A_{ox}) corresponding to dehydrogenation ($A_{red} \rightarrow A_{ox} + 2\ H$):

a) acetate/acetaldehyde b) propanal/propanone c) glycerol/glyceraldehyde
d) asparagine/aspartate e) no answer is correct

20) Determine the reactions during conversion of compounds A → B → C. The scheme is simplified, does not comprise all components.



A B C

a) dehydrogenation of A is followed by hydration of B
b) the A → B conversion is dehydration, the second reaction is isomerization
c) the first reaction is oxidation, the second conversion is reduction
d) upon hydration of A, the intermediate B undergoes dehydrogenation
e) no answer is correct

21) The compound R-CO-CH_2-CO-NR_2 (R = alkyl) is formed by the reaction of:

a) keto acid + amine b) ketone + amino acid
c) diketone + amine d) keto acid + amino acid
e) no answer is correct

22) Select the correct set of general names for R-CH(OR)OH, R-CO-NH-R, R-S-S-R (R = alkyl):

a) acetal, dipeptide, disulfane b) hemiacetal, amide, disulfide c) ester, aldimine, dithiol
d) ester, azide, disulfate e) no answer is correct

23) Select the compound possessing a centre of chirality:

a) cyclohexylamine b) malic acid c) diethyl succinate d) 2-bromopropane
e) no answer is correct

24) Select the compound corresponding to molecular formula $C_6H_{14}N_2O_2$:

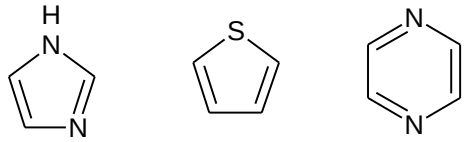
a) thymine b) alanyl-serine c) lysine d) *N*,*N*-dimethylbutanamide e) no answer is correct

25) Select the monocarboxylic acid:

a) maleic b) glutaric c) oxalic d) ascorbic e) no answer is correct

26) Select the correct set of names for the compounds depicted:

a) imidazole, thiolane, pyridine
b) pyrrole, furan, pteridine
c) pyrrolidine, oxolane, pyrimidine
d) pyridine, thiophene, purine
e) no answer is correct

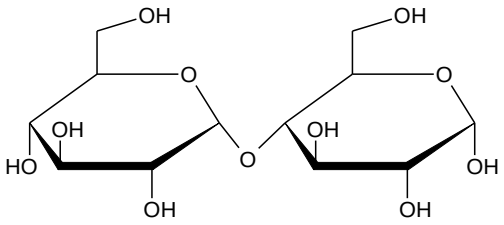


27) Select the compound containing a nitrogen heterocycle:

a) hydroquinone b) aniline c) catechol d) hydroxyproline
e) no answer is correct

28) The compound depicted is:

a) mannose
b) maltose
c) sucrose
d) galactose
e) no answer is correct



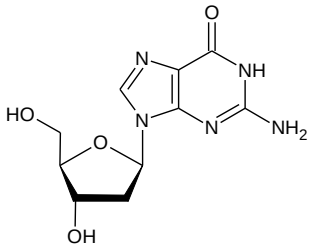
29) Select the isomer of glucose:

a) ribose
b) fructose
c) maltose
d) amylose
e) no answer is correct

30) Select the fatty acid that is essential for humans:

a) *cis*,*cis*-octadeca-6,9-dienoic acid b) *cis*,*cis*-octadeca-9,12-dienoic acid
c) *cis*,*cis*-octadeca-15,18-dienoic acid d) *cis*,*cis*,*cis*-octadeca-6,9,12-trienoic acid
e) no answer is correct

31) Determine the name of the compound depicted:

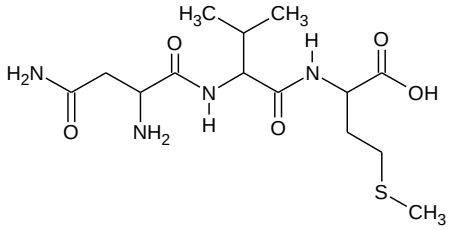


a) deoxyadenosine b) deoxycytidine
c) deoxyguanosine d) deoxythymidine
e) no answer is correct

32) In replication, deoxynucleotides are attached to a newly synthesized DNA strand. Select the equation that correctly expresses elongation of the dCdG sequence by dT (P_i = phosphate, PP_i = diphosphate):

a) dCdG + dTMP → dCdGdT + H_2O
b) dCdG + dTDP → dCdGdT + P_i
c) dCdG + dTTP → dCdGdT + PP_i
d) dCdG + dTMP + ATP → dCdGdT + ADP + P_i
e) no answer is correct

33) The compound depicted is formed from:



a) asparagine, valine, methionine
b) glutamine, histidine, threonine
c) lysine, glutamine, isoleucine
d) glutamine, tyrosine, isoleucine
e) no answer is correct

34) Which amino acid has the highest number of positive charges under physiological pH (6.8 – 7.4)?

a) glutamine b) tryptophan c) lysine d) glutamate e) cannot decide unambiguously

35) Select the amino acid with the highest number of carbon atoms:

a) histidine b) tyrosine c) threonine d) arginine e) cannot decide unambiguously

36) The conversion of malate to fumarate is catalysed by:

a) oxidoreductase b) hydrolase c) transferase d) lyase
e) no answer is correct

37) Select the intermediate of glycolysis that undergoes isomerization:

a) phosphoenolpyruvate b) fructose-1,6-bisP c) glyceraldehyde-3-P d) glycerol-3-P
e) no answer is correct

38) R-CO-CH_2-CO-S-CoA is an intermediate of β-oxidation of fatty acids. Its further conversion requires:

a) H_2O b) NAD^+ c) FAD d) CoA-SH e) no answer is correct

39) Identify the vitamin from the following data: molecular formula $C_{12}H_{17}N_4OS$, water soluble, contained in meat, beans, yeast, whole-meal cereals, derivative of pyrimidine and thiazole, needed for aerobic catabolism of all nutrients, especially glucose. Its deficit is manifested mainly by various neurological problems, e. g. irritability and confusion.

a) ascorbate b) thiamine c) phylloquinone d) folate
e) no answer is correct

40) Select the intermediate of citrate cycle that releases carbon dioxide:

a) 2-oxoglutarate b) malate c) citrate d) succinyl-CoA
e) no answer is correct

Admission test - Physics A – 2022

Note: In the test questions any relativistic effects are not considered unless otherwise stated. The frame of reference (co-ordinate system), in case one is needed, is inertial and connected with the observer. In the questions oriented on mechanics we consider incompressible solid bodies and liquids unless otherwise stated. The gravitational field is homogeneous (except for question Nr. 10). In optics-oriented questions all lenses are considered thin, and the light rays are paraxial. Use 3.14 as the value of π. Express the results as round numbers with three significant digits (figures).

1. Which of the following physical units is dimensionless (i.e., it is only a number)?
a) hertz b) decibel c) electron volt d) lumen e) No answer is correct.

2. Which of the following units can be substituted by a product of a time unit and a power unit?
a) joule b) farad c) volt d) coulomb e) No answer is correct.

3. Find the quantity which unit can be substituted by the term [J·s].
a) power b) surface tension c) impulse of force d) torque e) No answer is correct.

4. Find the group, which consists only of vector quantities?
a) luminous flux, force, acoustic power b) electric voltage, inductance, speed
c) torque, velocity, magnetic flux density
d) activity, angular frequency, magnetic flux density e) No answer is correct.

5. A sphere moved 100 m without friction down a constant angle slope. It was at rest before starting to roll down and then moved at a constant acceleration of a = 1.00 m·s^{-2}. What time was necessary to travel the whole distance?
a) 10 s b) 12 s c) 14.1 s d) 20 s e) No answer is correct.

6. A particle performs a uniform circular motion (r = 50 cm) at a speed of 40 m·s^{-1}. What is the frequency of this motion?
a) 0.159 Hz b) 6.37 Hz c) 12.7 Hz d) 40 Hz e) No answer is correct.

7. A body with a mass of 100 tons moving in vacuum at a constant velocity is stopped by a force which impulse is 1000 N.s during deceleration of the body. What was the original speed of the body?
a) The instructions given are not sufficient to calculate it. b) 1 cm·s^{-1} c) 10 cm·s^{-1}
d) 1 m·s^{-1} e) No answer is correct.

8. A small agricultural machine driven by a motor with the mechanical power of 250 W moves on a horizontal field with a constant speed of 2 m·s^{-1}. What is the force exerted against the friction which brakes the machine movement?
a) 50 N b) 125 N c) 250 N d) The instructions given are not sufficient to calculate it.
e) No answer is correct.

9. Children are playing on a seesaw (see the picture). Peter (45 kg) sits 1 m from the pivot, Paul sits on the opposite side 1.5 m from the pivot. The seesaw is balanced now. However, somebody gave to Paul a 15 kg backpack. How much must Peter move away from the pivot to restore the balance of the seesaw? (The children and the backpack are considered particles!)
a) 50 cm b) Peter need not to move. c) 100 cm
d) The instructions given are not sufficient to calculate it. e) No answer is correct.



10. A lift is going down through a very deep shaft aiming at the centre of Earth. During its movement
a) the size of gravitational force acting on the objects inside the lift is growing.
b) the size of gravitational force acting on the objects inside the lift is decreasing.
c) the size of gravitational force acting on the objects inside the lift does not change.
d) no forces are acting on the objects inside the lift. e) No statement is correct.

11. A body is thrown upwards perpendicularly to the Earth's surface (air friction is neglected). As a result of it
a) its potential energy decreases, and its kinetic energy remains constant.
b) its potential energy remains constant, and its kinetic energy is growing.
c) its kinetic energy and potential energy are decreasing.
d) the sum of its kinetic and potential energy is constant. e) No answer is correct.

12. Which of the following values of the atmospheric pressure can be expected at the seashore?
a) 760 hPa b) 1000 hPa c) 1000 Pa d) 1000 mm of mercury
e) No answer is correct.

13. Find the sentence giving the best „definition" of the Archimedes principle.
a) The hydrostatic force is directly proportional to the density of immersed body and depth of the liquid.
b) The hydrostatic pressure is the same in all places of the liquid body.
c) The buoyant force acting on totally immersed bodies of the same volume is the same in the whole volume of the liquid.
d) The hydrostatic pressure is directly proportional to the depth of the liquid. e) No answer is correct.

14. The buoyant force acting on totally immersed bodies of the same volume in the same liquid is
a) always greater in a sphere than in a cube. b) always greater in the cube than in the sphere.
c) smaller in a sphere compared with body of irregular shape.
d) independent of the immersed body shape. e) No answer is correct.

15. What was the depth of the ideal liquid in an open vessel, if the liquid started to escape from the vessel trough an outlet very near the bottom at a speed of 8 $m \cdot s^{-1}$? (Acceleration of gravity is 10 $m \cdot s^{-2}$, density of the liquid is 1000 $kg \cdot m^{-3}$, viscosity of the liquid is not considered.)
a) 16.0 m b) 8.00 m c) 3.20 m d) The instructions given are not sufficient to find it.
e) No answer is correct.

16. If the diameters of different parts of a pipe are in ratio of 5:2, the speeds of the liquid streaming inside the pipe are in ratio of:
a) 5:2 b) 25:4 c) 4:25 d) 2:5 e) No answer is correct.

17. What is approximate number of molecules in one litre of the oxygen gas (under normal temperature and pressure)? ($N_A = 6.022 \cdot 10^{23}$ mol^{-1})
a) $2.7 \cdot 10^{22}$ b) $9 \cdot 10^{27}$ c) $6.022 \cdot 10^{23}$ d) $1 \cdot 10^{10}$ e) No answer is correct.

18. The Avogadro constant is:
a) a dimensionless quantity (i.e., a number). b) proportional to the mass of atoms.
c) given by the ratio of the universal gas constant and Boltzmann constant.
d) a product of the universal gas constant and the Boltzmann constant. e) No answer is correct.

19. It is well known that in high mountains meat must be cooked longer than at the seashore. Choose right explanation of this fact.
a) Due to lower atmospheric pressure water boils at lower temperature than at the normal pressure. Therefore, the meat cooks slower.
b) In the mountains, the pot with meat is cooled due to thinner air so that the cooking takes longer time.
c) The above statement about duration of cooking is false. The high humidity of the air at the seashore increases the

boiling point so that the meat is cooked faster.
d) If the pot is covered by a lid the boiling water cannot be cooled by evaporation which leads to lower boiling temperature in the pot. The duration of cooking is not influenced. e) No statement is correct.

20. The pressure of a perfect gas is lowered to one third of initial value by a reversible adiabatic process, thus
a) gas temperature is lowered. b) the volume must remain constant. c) the temperature remains constant.
d) the gas volume increases three times e) No answer is correct.

21. A reversible isobaric compression of a perfect gas can be described by the equation:
a) $p_1 \cdot V_1 = p_2 \cdot V_2$ b) $V_1/T_1 = V_2/T_2$ c) $p_1 \cdot T_2/V_1 = p_2 \cdot T_1/V_2$ d) $V_1 \cdot T_1 = V_2 \cdot T_2$
e) No answer is correct.

22. A droplet of some sort of oil is floating in water. After addition of a small amount of a detergent, the surface tension of the droplet decreased. Therefore, this droplet
a) can be easier divided into smaller droplets. b) can be divided in smaller droplets only with difficulties.
c) surface becomes rainbow coloured. d) will rapidly grow and consequently forms a foam
e) No answer is correct.

23. A small body of a mass *m* is hanging on a vertically oscillating spring. The oscillations of angular frequency ω are harmonic. The body displacement is *y*, velocity is *v*, and *T* is the oscillation period. We can write the following equation for its acceleration *a*:
a) $a = y \cdot \omega$ b) $a = m \cdot y$ c) $a = 2\pi \cdot T$ d) $a = \omega/v$ e) No answer is correct.

24. The sound power level increases by 40 dB. It means that the sound power increases:
a) 40000-times b) 200-times c) 40-times d) by 4 $W \cdot m^{-2}$ e) No answer is correct.

25. Which of the following phenomena is caused by mechanical oscillations of a solid body?
a) Newton rings b) Sound of a bell c) sound of a pipe organ d) Seebeck effect
e) No answer is correct.

26. Intensity of an electric field in a defined place near a charged particle (with charge Q) can be explained/described as
a) the ratio of electric potentials in given place and in infinity. b) electric voltage in given place.
c) the work done by electric forces to moves a charge of unit size from given place to the Earth's surface.
d) the electric force acting in given place on a positive electric charge of unit size.
e) No answer is correct.

27. A capacitor is in a circuit with alternating voltage. As a result of it, force acting on its plates
a) is equal to zero (no attraction or repulsion). b) is only attractive. c) is only repulsive.
d) is alternatively attractive and repulsive. e) No answer is correct.

28. An electric heater power is 690 W. If alternating current at effective voltage of 230 V passes through the heater, what will be the effective value of the alternating current?
a) 0.3 A b) 1 A c) 3 A d) 4 A e) No answer is correct.

29. The cathode rays studied by W.C. Roentgen in a discharge tube filled by a gas under low pressure were actually
a) identical with electrons attracted to the anode. b) the x-rays.
c) photons of electromagnetic radiation produced in the cathode.
d) the radioactivity discovered later in the uranium ore. e) No answer is correct.

30. The vector B value inside a very long solenoid (coil) passed by a constant direct current (we do not consider places close to the ends of the solenoid)
a) has the maximum size in the axis of the solenoid.

b) has the same size in any place inside the solenoid. c) has maximum size in the middle of the solenoid.
d) has zero value. e) No answer is correct.

31. How to increase the impedance of a circuit consisting only of a capacitor and a source of alternating voltage?
a) by increasing the capacitance of the capacitor. b) by decreasing the capacitance of the capacitor.
c) by increasing the current frequency. d) by adding a resistor in parallel. e) No answer is correct.

32. To produce one gram of arbitrary substance in one second by an electrochemical process we *always* need an electric charge equal to
a) Faraday constant b) the charge of one mole of electrons. c) one coulomb.
d) the product of Faraday and Avogadro constant. e) No answer is correct.

33. The total reflection of light can occur when
a) light rays propagate from the medium in which they propagate slower to the medium in which they propagate faster.
b) the water surface is illuminated from above. c) the angle of incidence equals the angle of reflection.
d) it is possible that the angle of incidence is greater than the angle of reflection.
e) No answer is correct.

34. The focus of a converging lens is
a) a point where all rays going through the lens are intersecting.
b) a point on the principal axis of the lens which is the centre of the lens curvature.
c) a point in which all rays entering the lens in parallel with the principal axis are intersecting.
d) its centre. e) No answer is correct.

35. Dioptric power of a converging lens is 0.2 D. What is the focal length of the lens?
a) 1/5 m b) 0.5 m c) 50 cm d) 500 cm e) No answer is correct.

36. The objective of a common light microscope produces the image
a) as a converging lens with an object placed between the lens focus and a point lying in double the focal distance.
b) like magnifying glass. c) which is magnified and virtual. d) in the focal plane.
e) No answer is correct.

37. The x-rays differ from the ultraviolet light
a) by their higher frequency. b) the fact that they are radioactive. c) the fact they are accelerated electrons.
d) by their longer wavelength. e) No answer is correct.

38. We can irradiate a metallic surface by a light with increasing frequency. It is possible that this light
a) starts to provoke the photoelectric effect. b) stops to provoke the photoelectric effect.
c) will enable emission of the so-called „bremsstrahlung".
d) will evoke some diffraction patterns on the metallic surface. e) No answer is correct.

39. Which of the following particles does not change its trajectory and/or velocity in a homogeneous electric field?
a) hydrogen atom b) electron c) α particle d) Fe^{2+} ion e) No answer is correct.

40. If the half-life of a radionuclide is 30 seconds, what time is necessary to reduce original number of nuclei to one sixteenth?
a) 30/16 s b) 16/30 s c) 480 s d) 2 min e) No answer is correct.