

---

**1. Essential elements of virus particles (the structure of virus) are:**

- A) capsid and envelope
  - B) nucleic acid and capsid
  - C) capsid and capsomere
  - D) nucleic acid and envelope
- 

**2. Peptidoglycan is:**

- A) polymer of peptides cross-linked by sugars
  - B) polymer of sugars cross-linked by peptides
  - C) polymer of sugars cross-linked by lipids
  - D) polymer of peptides cross-linked by lipids
- 

**3. Danish physician Hans Christian Gram classified bacterial species into two groups (Gram stain) based on differences in:**

- A) DNA composition
  - B) ribosome composition
  - C) cell wall composition
  - D) plasma membrane composition
- 

**4. Nucleolus contains:**

- A) genes for synthesis of ribosomal components
  - B) genes for synthesis of tRNA
  - C) genes for the enzyme telomerase
  - D) undefined DNA molecules
- 

**5. Which intercellular junction is NOT present in animal cells, but only in plant ones:**

- A) tight junction
  - B) desmosome
  - C) plasmodesma
  - D) gap junction
- 

**6. Synthesis (replication) of nuclear DNA runs in:**

- A) G2 phase of cell cycle
  - B) G1 phase of cell cycle
  - C) M phase of cell cycle
  - D) S phase of cell cycle
- 

**7. Reverse transcriptase (enzyme) is:**

- A) DNA-dependent DNA polymerase
  - B) DNA-dependent RNA polymerase
  - C) RNA-dependent RNA polymerase
  - D) RNA-dependent DNA polymerase
- 

**8. Nucleotide is:**

- A) nitrogenous base joined to a pentose and a phosphate group
  - B) nitrogenous base joined to a pentose
  - C) nitrogenous base joined to a hexose and a phosphate group
  - D) nitrogenous base joined to a hexose
- 

---

**9. In Mendel's experiments the genotype of the first filial generation:**

- A) AA
  - B) aa
  - C) Aa
  - D) AA x aa
- 

**10. Sex determination by the haplo-diploid system:**

- A) exists in humans
  - B) exists in birds
  - C) exists in bees and ants
  - D) does not exist
- 

**11. Fetal testing (prenatal screening) includes:**

- A) biopsy and arteriography
  - B) amniocentesis and chorionic villus sampling
  - C) amniocentesis and biopsy
  - D) arteriography and chorionic villus sampling
- 

**12. A special human cell, gamete, has:**

- A) 23 chromosomes
  - B) 22 chromosomes
  - C) 44 chromosomes
  - D) 46 chromosomes
- 

**13. Huntington's chorea is an autosomal dominant disease manifested by dementia. Calculate the risk for a child of a healthy mother and a sick father.**

- A) 0%
  - B) 25%
  - C) 50%
  - D) 100%
- 

**14. Karyotype 45,0Y:**

- A) is manifested as Turner syndrome
  - B) is manifested as Klinefelter syndrome
  - C) is manifested as missing X syndrome
  - D) is not viable
- 

**15. The most frequent disorders in population:**

- A) single-gene disorders
  - B) chromosome disorders
  - C) multifactorial disorders
  - D) mitochondrial disorders
- 

**16. The dominant allele R results in Rh-positive individuals, whereas the homozygous recessive condition (rr) results in Rh-negative individuals. Consider a population at equilibrium in which 84% of the people are Rh-positive, what is the frequency of R allele?**

- A) 0.6
- B) 0.4
- C) 0.36
- D) 0.16

---

**17. pH level in human body is:**

- A) range of 7.30 to 7.34
  - B) range of 7.24 to 7.30
  - C) range of 7.36 to 7.44
  - D) range of 7.44 to 7.48
- 

**18. Skin is formed by multiple layers of:**

- A) endodermal tissue
  - B) mesodermal tissue
  - C) entodermal tissue
  - D) ectodermal tissue
- 

**19. The Eustachian (auditory) tube opens in:**

- A) larynx
  - B) pharynx
  - C) nasal cavity
  - D) mouth cavity
- 

**20. Hepatopancreatic ampulla (common duct) drains into:**

- A) duodenum
  - B) jejunum
  - C) stomach
  - D) ileum
- 

**21. Detoxification (drug metabolism) takes place primarily in:**

- A) kidneys
  - B) stomach
  - C) intestines
  - D) liver
- 

**22. Secretion of foreign substances (e.g. antibiotics) in kidney takes place in:**

- A) loop of Henle
  - B) collecting duct system
  - C) distal tubule
  - D) proximal tubule
- 

**23. Cells producing testosterone in testes are:**

- A) Sertoli cells
  - B) Cowper's cells
  - C) Follicular cells
  - D) Leydig cells
- 

**24. Hormones released from the posterior pituitary gland that are made in hypothalamus (neurohormones):**

- A) antidiuretic hormone and oxytocin
  - B) adrenalin (epinephrine) and noradrenalin (norepinephrine)
  - C) growth hormone and prolactin
  - D) catechol and dopamine
- 

---

**25. In the central nervous system, bodies of neurons form:**

- A) gray matter
  - B) pink matter
  - C) yellow matter
  - D) white matter
- 

**26. Action potentials are:**

- A) signal conducted inside each cell
  - B) signal conducted by axons of neurons
  - C) signal conducted in blood
  - D) signal conducted in cerebrospinal fluid
- 

**27. Sweat glands are located in:**

- A) lower dermis of the skin
  - B) hypodermis of the skin
  - C) dermis of the skin
  - D) epidermis of the skin
- 

**28. The visual pigments consisting of retinal and the protein opsin are part of:**

- A) ganglion cells
  - B) bipolar cells
  - C) rods and cones
  - D) pigmented epithelium
- 

**29. Connective tissue does NOT include:**

- A) bone
  - B) muscle tissue
  - C) adipose tissue
  - D) blood
- 

**30. The main cells of the immune defense of the organism:**

- A) erythrocytes
  - B) leucocytes
  - C) fibrocytes
  - D) immunocytes
-

---

**1. Propanal and acetone are**

- A) two names for the same molecule
- B) structural isomers
- C) water insoluble molecules
- D) both formed by reduction of propanoic acid

---

**2. Choose the molecule that exists in a form of two stereoisomers:**

- A) butyne
- B) 1,2-dimethylbenzene
- C) cyclohexan-1,4-diol
- D) ethene

---

**3. In the human body, building blocks of macromolecules exist as specific enantiomers (other enantiomers cannot be used in human metabolism). Choose from the following molecules the one, which is commonly metabolised by human cells:**

- A) L-glucose
- B) D-alanine
- C) L-cysteine
- D) D-glycine

---

**4. In organic chemistry, common (trivial) names are commonly in use in addition to systematic names. Which of the following trivial names denotes chloroethene?**

- A) chloroform
- B) isoprene
- C) vinyl chloride
- D) xylene

---

**5. Choose the reaction that is classified as an elimination:**

- A)  $\text{CH}_3\text{-CO-O-CH}_2\text{-CH}_3 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{-COOH} + \text{CH}_3\text{-CH}_2\text{-OH}$
- B)  $\text{CH}_2=\text{CH}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{-CH}_3$
- C)  $\text{CH}_3\text{-OH} + \text{CH}_3\text{-CH}_2\text{-COOH} \rightarrow \text{CH}_3\text{-O-CO-CH}_2\text{-CH}_3 + \text{H}_2\text{O}$
- D)  $\text{CH}_3\text{-CH}_2\text{-CH}_3 \rightarrow \text{CH}_3\text{-CH}=\text{CH}_2 + \text{H}_2$

---

**6. Methylbutanoate is a product of the reaction whose reactants are:**

- A) butanoic acid and methanol
- B) methanoic acid and butanol
- C) butanoic acid and methyl amine
- D) methanoic acid and butanone

---

**7. Choose the molecule that contains a chiral carbon:**

- A) 2-aminopropanoic acid
- B) propanone
- C) trifluoroacetic acid
- D) cyclohexanol

---

**8. Which of the following molecules is classified as a phenol?**

- A) benzaldehyde

- B) benzene-1,2-diol
- C) benzyl alcohol
- D) cyclohexanol

---

**9. Choose the molecule whose oxidation can result in a formation of an organic disulfide:**

- A) methanesulfonic acid
- B) dimethyl ether
- C) dimethyl sulfide
- D) methanethiol

---

**10. Monocarboxylic acids containing less than four carbons are:**

- A) gaseous molecules under the room temperature
- B) stronger acids than their halogeno- derivatives
- C) diprotic acids that strongly acidify their solutions
- D) partially ionized in aqueous solutions

---

**11. The molecule with the structural formula  $\text{HOOC-CH}_2\text{-CH}_2\text{-CH}_2\text{-COOH}$** 

- A) is named pentanoic acid by systematic nomenclature
- B) can be converted to a cyclic anhydride
- C) can be classified as an unsaturated carboxylic acid
- D) is an example of so called fatty acids found in lipids

---

**12. Choose molecules that are NOT reactants of the reaction called neutralization:**

- A)  $\text{HNO}_3 + \text{KOH}$
- B)  $\text{CH}_3\text{COOH} + \text{NaOH}$
- C)  $\text{H}_3\text{PO}_4 + \text{Ca(OH)}_2$
- D)  $\text{HCOOH} + \text{CH}_3\text{OH}$

---

**13. Which of the following reactions produces the ION called acetate?**

- A) ethanoic acid + water  $\rightarrow$
- B) acetone + water  $\rightarrow$
- C) acetic acid + ethanol  $\rightarrow$
- D) acetylene + hydrogen molecule  $\rightarrow$

---

**14. Choose the correct description of this molecule:  $\text{H}_2\text{N-CH}_2\text{-(CH}_2\text{)}_3\text{-CH(NH}_2\text{)-COOH}$** 

- A) it is an amide of hexanoic acid
- B) it is an amino acid
- C) it is called 5-carboxypentane-1,5-diamine
- D) it has branched carbon chain and contains one primary and one secondary amino group

---

**15. What of the following is true?**

- A) elements that should be included in a human diet include lead, mercury and cadmium
- B) hydroxides mostly contain oxygen, hydrogen and some nonmetal
- C) oxoacids are mostly made from alkali or alkali earth metals (groups I and II)
- D) trace elements found in a human body include iron, zinc and copper

**16. Choose the correct pair of a name of a common substance and its molecular formula:**

- A) calcium phosphate is  $\text{Ca}_3\text{PO}_4$
- B) zinc sulfate is  $\text{Zn}(\text{SO}_4)_2$
- C) copper(II) nitrate is  $\text{CuNO}_3$
- D) sodium carbonate is  $\text{Na}_2\text{CO}_3$

**17. At room temperature (25°C),  $\text{H}_2\text{O}$  is a liquid but  $\text{H}_2\text{S}$  is a gas. THE BEST explanation of this fact is the following statement:**

- A) oxygen and sulfur differ in the number of valence electrons
- B) oxygen atom is larger than sulfur atom
- C) oxygen has a higher electronegativity than sulfur
- D) oxygen atom has more protons than sulfur atom

**18. Choose the weakest acid:**

- A) phosphoric acid ( $\text{pK}_{\text{a}1} = 2.12$ )
- B) hydrofluoric acid ( $\text{pK}_{\text{a}} = 3.18$ )
- C) carbonic acid ( $\text{pK}_{\text{a}1} = 6.35$ )
- D) hydrocyanic acid ( $\text{pK}_{\text{a}} = 9.21$ )

**19. Choose the INCORRECT pair of the name and molecular formula:**

- A) sodium oxide  $\text{Na}_2\text{O}$
- B) magnesium oxide  $\text{MgO}_2$
- C) nitrogen dioxide  $\text{NO}_2$
- D) calcium oxide  $\text{CaO}$

**20. Which pair of the molecules can be bound together by a peptide bond?**

- A) cytosine and guanine
- B) succinic acid and oxalic acid
- C) pyruvic acid and lactic acid
- D) serine and methionine

**21. To which of the following molecules can phosphoric acid attach by an ester bond?**

- A) ribose
- B) phenylalanine
- C) pyrrole
- D) aspartic acid

**22. Choose the pair of molecules that BOTH can undergo a hydrolytic cleavage:**

- A) palmitic acid and stearic acid
- B) glucose and sucrose
- C) mannose and galactose
- D) triacylglycerol and lactose

**23. The molecule of adenosine triphosphate (ATP) consists of:**

- A) glycerol, arachidonic acid and three phosphoric acid residues
- B) alanine, thymine and phosphoric acid
- C) adenine, ribose and three phosphoric acid residues
- D) glycerol, adenosine and one phosphoric acid residue

**24. If the reaction  $(\text{H}_2\text{PO}_4)^- + \text{H}_2\text{O} \rightleftharpoons (\text{HPO}_4)^{2-} + \text{H}_3\text{O}^+$  is at an equilibrium and then we add a strong acid to the solution, the result will be this change in concentrations:**

- A)  $(\text{H}_2\text{PO}_4)^-$  decreases and  $(\text{HPO}_4)^{2-}$  increases
- B)  $(\text{HPO}_4)^{2-}$  decreases, but  $(\text{H}_2\text{PO}_4)^-$  does not change
- C)  $(\text{H}_2\text{PO}_4)^-$  decreases, but  $(\text{HPO}_4)^{2-}$  does not change
- D)  $(\text{HPO}_4)^{2-}$  decreases and  $(\text{H}_2\text{PO}_4)^-$  increases

**25. The concentration of calcium ions in the cytosol of cells is  $10^{-7}$  mol/l but in the extracellular fluid it is ten thousand times higher. It follows from this that the concentration in cytosol is:**

- A) 100 nmol/l and outside the cell it is millimolar
- B) 10 nmol/l and outside the cell it is millimolar
- C) 100 pmol/l and outside the cell it is micromolar
- D) 10 pmol/l and outside the cell it is micromolar

**26. If the concentration of fully ionised sulfuric acid in a solution is 0.0005 mol/l, the concentration of hydroxide ions in this solution is:**

- A)  $10^{-5}$  mol/l
- B)  $10^{-9}$  mol/l
- C)  $10^{-3}$  mol/l
- D)  $10^{-11}$  mol/l

**27. Calculate the pH of 0.004% (mass/volume) sodium hydroxide solution. Relative atomic masses: Ar(sodium) = 23, Ar(oxygen) = 16, Ar(hydrogen) = 1.**

- A) pH = 13
- B) pH = 12
- C) pH = 11
- D) pH = 10

**28. What is the molar concentration of a glucose solution if it contains 0.18 g of glucose in 1 ml? Relative molecular mass of glucose (Mr) is 180.**

- A) 1 mmol/l
- B) 10 mmol/l
- C) 1 mol/l
- D) 0.1 mol/l

**29. If an aqueous solution contains  $10^{-9}$  mol/l of hydroxonium ions, it follows from this that the solution:**

- A) contains  $10^{-9}$  mol/l of a hydroxide
- B) contains  $10^{-5}$  mol/l of a strong acid
- C) contains  $10^{-5}$  mol/l of hydroxide ions
- D) contains also  $10^{-9}$  mol/l of hydroxide ions

**30. What is the molar concentration of a solution prepared by mixing 1 ml of 0.1 mmol/l HCl with 99 ml of water?**

- A) 0.01 micromol/l
- B) 0.1 micromol/l
- C) 1 micromol/l
- D) 10 micromol/l

**1. A research submarine is completely submerged in the sea. The hydrostatic pressure of sea water acting on the outer surface of the submarine does NOT depend on:**

- A) the surface area of the submarine
- B) density of the sea water
- C) submerged depth of the submarine
- D) gravitational acceleration

**2. What is the total charge of the nucleus of one iodine atom whose atomic number is 53 and atomic mass number is 131?**

- A) +78 C
- B)  $+84.9 \times 10^{-19} \text{ e}$
- C) +131 C
- D) +53 e

**3. If the pressure of a perfect gas is reduced by one third in a reversible isothermal process then:**

- A) the volume drops to two thirds of the original volume
- B) the volume increases by 50%
- C) the volume drops to one third of the original volume
- D) the temperature drops to one half of the original value

**4. If a proton moves in a homogeneous magnetic field from its north pole to its south pole (i.e. in the direction of **B** vector),**

- A) the magnetic field does not influence its motion
- B) it is decelerated uniformly
- C) it is accelerated towards the south pole
- D) it turns in the direction of the thumb of the right hand whose fingers are oriented like **B**

**5. If we compare UV (ultraviolet) and IR (infrared) radiations, UV has:**

- A) higher frequency
- B) longer wavelength
- C) faster speed of propagation in vacuum
- D) greater linear polarization

**6. What is the correct statement for the image formed by a concave mirror?**

- A) the image is always inverted
- B) the image is always real
- C) that type of mirror forms different image types depending on the distance between the object and the mirror
- D) the image is always magnified

**7. A device used to heat water has a power of 420 W. How many liters of water can be heated by 20 °C in one hour?**

( $c_{\text{water}} = 4200 \text{ J K}^{-1} \text{ kg}^{-1}$ )

- A) 0.5 l
- B) 50 l
- C) 200 l
- D) 18 l

**8. An object is placed 50 cm in front of a thin converging lens, whose optical power is 5 D. The image formed by the lens is:**

- A) real, inverted, reduced
- B) real, inverted, same size
- C) virtual, upright, magnified
- D) real, inverted, magnified

**9. A resistor with resistance R is used as a heating filament to produce heat and has a power of 100 W when connected to an AC voltage source of 100 V/50 Hz. What is its power when connected to a 100 V DC source?**

- A) the same as before
- B) significantly greater than 100 W
- C) significantly less than 100 W
- D) the resistor will not produce any heat at all if connected to DC

**10. Which of the following is NOT an electromagnetic wave?**

- A) beta ray
- B) microwave
- C) soft X-ray
- D) orange light

**11. Which of the following quantities is dimensionless (i.e. only number)?**

- A) luminous flux
- B) optical power
- C) moment of force
- D) index of refraction

**12. Which of the following combinations of distance travelled and duration of movement corresponds to the highest speed of movement?**

- A) 8 cm in 0.2 s
- B) 0.8 km in 0.2 h
- C) 8 m in 0.2 min
- D) 8 dm in 20 s

**13. The Space Shuttle *Discovery* (mission STS-133) launched on 24th February 2011 had a liftoff mass of about 2000 t. What was the thrust (force) of the rocket engines during vertical launch, when the shuttle was moving vertically upward with an (upward) acceleration of  $5.25 \text{ m/s}^2$  (the air resistance is negligible shortly after launch)?**

- A) 30.5 MN
- B) 20 MN
- C) 10.5 MN
- D) 10.5 kN

**14. A 6 kg parcel slid down a ramp from a height of 2 m and reached the ground at a speed of 2 m/s. How much heat was produced due to friction during the slide?**

- A) 108 J
- B) 0 J
- C) 48 J
- D) 12 J

15. The diameters of two different parts of the pipe are in the ratio 2:3. The ratio of the volume flow rates [ $\text{m}^3/\text{s}$ ] of an incompressible liquid in those different parts of the pipe is therefore:

- A) 1:1
- B) 3:2
- C) 4:9
- D) 9:4

16. Medical ultrasound probes can emit 2 MHz ultrasound waves. What would be the wavelength of such a 2 MHz wave in water? (The speed of sound in water is approximately 1500 m/s).

- A) 30 cm
- B) 3 mm
- C) 0.8 mm
- D) 1.5 mm

17. What is the maximum voltage that can be applied to a 100  $\Omega$  resistor if the maximal allowed power is 16 W?

- A) 40 V
- B) 16 V
- C) 1.6 kV
- D) 6.2 V

18. What is the electric current through a 24 W bulb when connected to a 120 V DC source?

- A) 5.0 A
- B) 0.2 A
- C) 0.5 A
- D) 2.880 A

19. What is the increase in velocity of a falling body during the fourth second of its free fall?

- A) 10 m/s
- B) 40 m/s
- C) 20 m/s
- D) 50 m/s

20. What unit can be expressed as a joule per coulomb?

- A) ampere A
- B) ohm  $\Omega$
- C) volt V
- D) newton N

21. An object rotates with a frequency of 2 Hz. What is its (tangential) speed if its turning radius is 25 cm?

- A) 4.0 m/s
- B) 5.0 m/s
- C) 6.3 m/s
- D) 3.1 m/s

22. In a strong electrical discharge, 5 C of charge is transferred across a potential difference of 50 kV. How much energy is released?

- A) 0.25 MJ
- B) 25 kJ
- C) 10 kJ
- D) 50 kJ

23. What is the force exerted by a hydraulic jack with an output piston area of 20  $\text{cm}^2$  and a pressure of 1 MPa?

- A) 2 kN
- B) 200 kN
- C) 50 kN
- D) 500 N

24. At the bottom of the pool lies a completely submerged piece of silver weighing 105 kg. How much force is required to lift it from the bottom of the pool if it remains completely submerged in fresh water when handled? ( $\rho_{\text{silver}} = 10\,500 \text{ kg/m}^3$ )

- A) 950 N
- B) 1050 N
- C) 1150 N
- D) 100 N

25. What is the half-life of a radionuclide if its activity has decreased to one sixteenth of the original value after 16 years?

- A) 1 year
- B) 4 years
- C) 2 years
- D) 8 years

26. How long does it take to fill a pool measuring 2 x 2 m and 50 cm deep if water is supplied through a hose with a cross section of 5  $\text{cm}^2$  at a speed of 1 m/s ?

- A) 1h 7 min
- B) 17 min
- C) 11.7 h
- D) 7.1 h

27. What is the speed of light in water?

- A) significantly more than  $3 \times 10^8 \text{ m/s}$
- B)  $3 \times 10^8 \text{ m/s}$
- C) significantly less than  $3 \times 10^8 \text{ m/s}$
- D) 1500 m/s

28. The direction of wave propagation changes as the wave propagates from one environment to another. What is the term for this phenomenon?

- A) refraction
- B) convection
- C) distortion
- D) cohesion

29. What is the reduction in potential energy during the first 2 s of free fall for an object whose mass is 250g?

- A) 15 J
- B) 250 J
- C) 125 J
- D) 50 J

30. What nucleus is produced when a nucleus of thorium  $^{234}\text{Th}$  undergoes two beta-minus decays and two alpha decays?

- A)  $^{226}\text{Ra}$
- B)  $^{234}\text{U}$
- C)  $^{230}\text{Th}$
- D)  $^{222}\text{Rn}$

**1. Select the expression representing the greatest numerical value:**

- A)  $0.10^{-2}$
- B)  $2^6$
- C)  $\log_{10}(62)$
- D) 62

**2. The teacher must select 17 team members from a total of 20 candidates. How many possible combinations are there?**

- A) more than 5000, but less than 15000
- B) more than 15000
- C) less than 500
- D) more than 500, but less than 5000

**3. Marbles are randomly picked from a box containing 2 black, 1 yellow, 3 red, 4 blue and 5 green balls. What is the minimum number of marbles that must be picked to be sure that at least 2 of the selected marbles are the same color?**

- A) 5
- B) 6
- C) 3
- D) 2

**4. Choose the coordinates of the point that has the greatest distance from the reference point  $R = [0, 2, 2]$ .**

- A)  $[2, -2, 0]$
- B)  $[-2, 0, 2]$
- C)  $[-2, 2, 0]$
- D)  $[0, -2, 2]$

**5. Last year, the surgical team performed on average 11 surgical procedures of a particular type per month. There were 4 surgeries in January, none in November and 2 in December. In the other 9 months the same number of surgeries each month were performed. How many surgeries were performed in May?**

- A) 14
- B) 18
- C) 12
- D) 13

**6. Let  $a = (1, 0, 2)$  and  $b = (2, 3, 0)$  be two vectors in the space. Find the vector  $c$ , which is perpendicular to both vectors  $a$  and  $b$ .**

- A)  $c = (4, 2, -3)$
- B)  $c = (3, -2, 4)$
- C)  $c = (-6, 4, 3)$
- D)  $c = (0, 0, 6)$

**7. A circle has the equation  $3x^2 + 6x + 3y^2 - 18y - 10 = 0$ . What are the coordinates of its center  $C$ ?**

- A)  $[3, -9]$
- B)  $[2, -6]$
- C)  $[-6, 2]$
- D)  $[-1, 3]$

**8. What is the equation of the line passing through the points  $A = [-2; 4]$  and  $B = [1; 3]$ ?**

- A)  $x + 3y = 10$
- B)  $y = -2x + 7$
- C)  $-x + 7y + 4 = 0$
- D)  $-2x - y + 7 = 0$

**9. Choose the correct statement for the function  $f(x) = 5 + (x-2)(x+5)$  on the interval  $(-5; 5)$**

- A) has minimum at  $x = -1.5$
- B) is decreasing
- C) is increasing
- D) has maximum at  $x = -5$

**10. The sum  $-1 + 2 - 3 + 4 - \dots - 99 + 100 - 101$  is equal to:**

- A) -51
- B) -101
- C) 0
- D) 50

**11. We randomly pick two different integers from 1 to 50. What is the probability that the sum of these two numbers will be an even number?**

- A)  $1/2$
- B)  $1/3$
- C)  $25/49$
- D)  $24/49$

**12. What curve is described by the following equation:  $-y^2/5 + x^2/7 = 2$ ?**

- A) a parabola
- B) a hyperbola
- C) an ellipse
- D) a circle

**13. Let  $i^2 = -1$ . Which of the following expressions represents a real number?**

- A)  $6 - i^6$
- B)  $3 + \sqrt{i}$
- C)  $2/i$
- D)  $4 + \sqrt{-4}$

**14. What is the size of an interior angle of a regular hexagon?**

- A)  $120^\circ$
- B)  $108^\circ$
- C)  $160^\circ$
- D)  $135^\circ$

**15. How many solutions of the equation  $|4 - 2x| = -4 - |2x|$  are there in domain  $\mathbb{R}$ ?**

- A) none
- B) 1
- C) 4
- D) 2

16. What is the 5th term of an arithmetical sequence if the 6th term is 30 and the 10th term is 35?

- A) 25
- B) 29
- C) 28.75
- D) 26.25

17. What is the area of a circle with a circumference of  $16\pi$ ?

- A)  $64\pi$
- B)  $16\pi^2$
- C) 24
- D)  $24\pi$

18. The probability of the symptom S1 occurrence is 75% and the probability of the symptom S2 (which occurs independently on the symptom S1) is 25%. What is the probability that at least one of those two symptoms is observed in a patient?

- A) more than 90%
- B) 80-90%
- C) 70-80%
- D) less than 70%

19. The function  $f(x) = x(x - 5)$  is decreasing on the interval:

- A)  $(-\infty, 2.5)$
- B)  $(5, +\infty)$
- C)  $(-\infty, +\infty)$
- D)  $(0, 5)$

20. What is the median of first 11 terms of a geometric sequence if the first term is 5 and the common ratio is -10?

- A) -10
- B) -550
- C) 5
- D) 550

21. The diameter of the circle circumscribing a regular hexagon is 3 cm. What is the perimeter of this hexagon?

- A) 6 cm
- B) 27 cm
- C) 18 cm
- D) 9 cm

22. If  $0 \leq \alpha \leq 2\pi$  what is the value of  $\sin(\pi + \alpha)$

- A)  $-\sin(\alpha)$
- B)  $\cos(-\alpha)$
- C)  $-\sin(-\alpha)$
- D)  $-\cos(\alpha)$

23. How many integers satisfy the inequality  $\frac{5|x-1|}{4} < 2$

- A) 3
- B) 5
- C) 1
- D) 7

24. What is the domain of function

$$f(x) = 1 + 3 \log_2(3x + 1)$$

- A)  $(-1/3; +\infty)$
- B) All real numbers
- C)  $(-\infty; -1)$
- D)  $(-1; +\infty)$

25. What is the maximum value of function

$$y = 1 + 2 \cdot \cos(3\pi - 4x^5) ?$$

- A) 6
- B) 3
- C) 1
- D) 9

26. The function  $f(x) = (x+2\pi) \cdot \cos(x+2\pi)$  is:

- A) neither even, nor odd, nor monotonic
- B) odd
- C) monotonic
- D) even

27. The cone C1 has a base radius of 5 and a height of 2, while the circular cone C2 has a radius of 4 and a height of 3. Compare the volumes of cones C1 and C2.

- A) volumes are equal
- B) the volume of cone C2 is larger
- C) the volume of cone C1 is larger
- D) we cannot decide, the information is not sufficient

28. What is the range of the function (the set of all value of the function):  $f(x) = 1 - 2 \cdot \ln(x+2)$

- A)  $(-\infty, +\infty)$
- B)  $\langle -1; 1 \rangle$
- C)  $\langle 1; +\infty \rangle$
- D)  $(-\infty; 1)$

29. A very thin film has been repeatedly folded, always in half. When folded 10 times, area of folded film dropped to about:

- A) 1/10 of the original area
- B) 1/100 of the original area
- C) 1/1000000 of the original area
- D) 1/1000 of the original area

30. There are three different units that can be combined to create a sequence of 5 units. How many permutations exist if the units can be repeated in the sequence without limit?

- A) 243
- B) 125
- C) 120
- D) 3125