Biology

1. The upper respiratory tract does not contain
    1. the glottis
    2. the pharynx
    3. **the trachea**
    4. the nasal cavity
    5. the larynx

2. In the eukaryotic cell, histones can be found in
    1. the mitochondrial matrix
    2. the lumen of endoplasmic reticulum
    3. the cytoplasm
    4. the plasma membrane
    5. **the nucleus**

3. The chief component of red blood cells is
    1. bilirubin
    2. erythropoietin
    3. thymosin
    4. immunoglobulin
    5. **hemoglobin**

4. Eukaryotic DNA is
A) synthesized in the S phase of cell cycle
B) replicated in 5´end to 3´end direction
C) associated with proteins
D) always circular
    1. B, C, D are correct
    2. A, B are correct
    3. D is correct
    4. **A, B, C are correct**
    5. B, C are correct

5. Goiter
A) is characterized by enlargement of the thyroid region
B) may result from lack of iodine
C) indicates lack of thyroid hormones production
D) is untreatable
   1. A, D are correct
   2. A, B are correct
   3. D is correct
   4. B, C, D are correct
   5. **A, B, C are correct**

---

6. Viral diseases include
A) chicken pox
B) measles
C) plague
D) tuberculosis
   1. A is correct
   2. A, B, C are correct
   3. C, D are correct
   4. B is correct
   5. **A, B are correct**

---

7. Which of the following entities will be largest?
   1. The red blood cell.
   2. **The egg cell.**
   3. The rhinovirus.
   4. The E. coli cell.
   5. The mycobacterium cell.

---

8. Bacterial cells do not contain
   1. **mitochondria**
   2. ribosomes
   3. cytoplasm
   4. cell wall
   5. DNA

---

9. In the cell, microtubules form
A) the contractile ring
B) the mitotic spindle
C) flagella
D) microvilli
  1. A, B are correct
  2. A, B, C are correct
  3. D is correct
  4. **B, C are correct**
  5. C, D is correct

---

10. Keratin is
  1. a complex lipid
  2. a vitamin
  3. a storage polysaccharide
  4. **a structural protein**
  5. a regulatory nucleic acid

---

11. Pepsin is produced in
  1. **the stomach**
  2. the pancreas
  3. the colon
  4. the kidneys
  5. the liver

---

12. Skin contains all the mentioned constituents but
  1. nerve endings
  2. epithelial cells
  3. melanocytes
  4. sweat glands
  5. **cartilage**

---

13. The organ of Corti is responsible for
  1. tasting
  2. balance and orientation
  3. seeing
  4. language processing
  5. **hearing**

---

14. An animal cell placed into distilled water will
A) quickly shrink
B) rapidly burst
C) not change its volume
D) gradually decrease its volume
   1. **B is correct**
   2. A is correct
   3. D is correct
   4. none of the provided answers is correct
   5. C is correct

---

15. The primary lymphatic organ is
   1. lymphatic vessels
   2. lymph nodes
   3. **red bone marrow**
   4. the spleen
   5. tonsils

---

16. In Mendelian genetics, true breeding means that
A) the parents with a particular phenotype produce offspring only with the same phenotype
B) the parents with a particular phenotype produce offspring not only with the same phenotype
C) the parents are homozygous for a trait
D) the parents are heterozygous for a trait
   1. A is correct
   2. **A, C are correct**
   3. D is correct
   4. B, D are correct
   5. C is correct

---

17. At the glomerulus, all the mentioned molecules are filtered from the blood but
   1. urea
   2. water
   3. ions
   4. glucose
   5. **globulins**

---

18. In a dividing cell, chromosomes align in equatorial plate during
    1. anaphase
    2. telophase
    3. prophase
    4. **metaphase**
    5. cytokinesis

___

19. In the brain, hippocampus belongs to
    1. **the limbic system**
    2. the spinal cord
    3. the cerebellum
    4. meninges
    5. the brain stem

___

20. Lower limb skeleton includes
A) the patella
B) the ulna
C) the tibia
D) tarsals
    1. B, C, D are correct
    2. A, B are correct
    3. **A, C, D are correct**
    4. B, C are correct
    5. B, D are correct

___

21. A mutation in the gene coding for clotting factor VIII will result in
    1. phenylketonuria
    2. sickle cell anemia
    3. **hemophilia A**
    4. leukemia
    5. hemophilia B

___

22. A human zygote with 47 chromosomes would be termed as
    1. polyploid
    2. haploid
    3. triploid
    4. monosomic
    5. **trisomic**

___

23. The largest artery in the systemic circuit is
    1. the superior vena cava
    2. the abdominal artery
    3. the hepatic portal vein
    4. the femoral artery
    5. **the aorta**

---

24. Aldosterone
A) belongs to so called mineralocorticoids
B) stimulates renal reabsorption of sodium
C) stimulates renal excretion of potassium
D) is produced in adrenal medulla
    1. A, B, C, D are correct
    2. A, B, D are correct
    3. A, B are correct
    4. A, D are correct
    5. **A, B, C are correct**

---

25. Proteosynthetic reading of mRNA sequence begins with so called start codon,
i.e. with
    1. UAA sequence
    2. UGA sequence
    3. UUG sequence
    4. AGG sequence
    5. **AUG sequence**

Chemistry

26. A compound with summary formula C_4H_6 could be
A) but-1,3-diene
B) but-1-yne
C) but-2-ene
D) cyclobutene
   1. C, D are valid
   2. B, D are valid
   3. **A, B, D are valid**
   4. only B is valid
   5. A, C are valid

27. Choose an acid with lowest dissociation ability:
   1. HBr
   2. H_2SO_4
   3. **HCN**
   4. HI
   5. HNO_3

28. Decarboxylation of 3-oxobutanoic acid results in
A) ethyl methyl ether
B) ketone
C) propane
D) aldehyde
   1. **only B is valid**
   2. only C is valid
   3. only A is valid
   4. only D is valid
   5. none (A-D) is valid

29. Prepare 20 kg of CaO from $CaCO_3$. How many kg of $CaCO_3$ are required if $CaCO_3$ contains 15 % of impurities? Ar: Ca = 40, C =12, O = 16
   1. 15
   2. 51
   3. 21
   4. **42**
   5. 30

30. In what ratio do you mix a 30% hydrogen peroxide solution with distilled water to form a 3% H_2O_2 solution?
1. 1:15
2. **1:9**
3. 1:5
4. 10:1
5. 1:10

---

31. Choose a saturated fatty acid from those mentioned below:
1. linolenic acid
2. oleic acid
3. arachidonic acid
4. **palmitic acid**
5. acrylic acid

---

32. Sodium hypochlorite
1. contains chlorine in the oxidation state -1
2. is a salt of a strong acid
3. **is a strong oxidising agent**
4. is not soluble in distilled water
5. is $NaClO_3$

---

33. Choose (an) element/s that can exist in the oxidation state +6:
A) phosphorus
B) sulphur
C) oxygen
D) nitrogen
1. B, C are valid
2. **only B is valid**
3. none (A-D) is valid
4. all (A-D) are valid
5. A, D are valid

---

34. Copper
A) belongs to transitional elements (d-elements)
B) could form complex salts
C) is known as a biogenic element
D) exists usually in oxidation states +1 and +2
   1. only C is valid
   2. B, C, D are valid
   3. **all (A-D) are valid**
   4. A, B are valid
   5. A, D are valid

---

35. The most typical reaction of toluene could be
   1. nucleophilic addition
   2. nucleophilic substitution
   3. isomerisation
   4. electrophilic addition
   5. **electrophilic substitution**

---

36. Compound $H_2N – CH_2 – CH_2 – OH$
A) contain a secondary amino group
B) could be reduced
C) could be named 2-aminoethan-1-ol
D) could react with acids
   1. B, C are valid
   2. B, D are valid
   3. only D is valid
   4. A, C are valid
   5. **C, D are valid**

---

37. Six mL of nitric acid (c=0.2 mol/L) were diluted by distilled water up to final volume 150 mL. Calculate the pH value of diluted solution.
   1. 1,8
   2. 2,8
   3. 3,1
   4. 0,7
   5. **2,1**

---

38. Choose a reducing agent from those mentioned below:
1. $KBrO_3$
2. $K_2Cr_2O_7$
3. $KMnO_4$
4. Na_2CO_3
5. **$FeCl_2$**

---

39. How many moles of NH_3 are produced on reaction of N_2 with 24 moles of H_2?
1. 36
2. 8
3. 24
4. **16**
5. 6

---

40. The highest number of oxygen atoms is present in
1. xylene
2. **potassium chromate**
3. urea
4. glyceraldehyde
5. benzoic acid

---

41. Pyrrol
A) contains nitrogen
B) contains benzene ring
C) contains oxygen
D) contains sulfur
1. C, D are valid
2. A, C are valid
3. **only A is valid**
4. only B is valid
5. A, B, D are valid

---

42. The reaction of two molecules of phenol can result in a(n)
1. ketone
2. ester
3. hemiacetal
4. aldol
5. **ether**

---

43. Choose (a) compound/s that can form optical isomers:
A) glycerol
B) 3-hydroxypropanoic acid
C) 1,4-dihydroxybenzene
D) 2-aminobutanoic acid
    1. only A is valid
    2. **only D is valid**
    3. none (A-D) is valid
    4. B, C are valid
    5. B, D are valid

___

44. Purine ring is present in
    1. **adenine**
    2. heme
    3. thymine
    4. uracil
    5. cytosine

___

45. Ester bond is present in
A) peptides
B) starch
C) triacylglycerols
D) sucrose
    1. A,C are valid
    2. only D is valid
    3. A, B, D are valid
    4. B, D are valid
    5. **only C is valid**

___

46. Compound $CH_2 = CH - COOH$
A) could form cis-trans isomers
B) could be hydrogenated
C) could be hydrated
D) is propenoic acid
    1. all (A-D) are valid
    2. **B, C, D are valid**
    3. A, B, C are valid
    4. B, C are valid
    5. C, D are valid

___

47. Choose (a) salt/s whose aqueous solution is acidic:
A) ammonium sulphate
B) sodium bicarbonate
C) potassium nitrate
D) sodium acetate
    1. none (A-D) is valid
    2. B, D are valid
    3. **only A is valid**
    4. chlorine is reduced
    5. B, C are valid

---

48. Enzymes
    1. are usually polysaccharides
    2. **do not affect the value of equilibrium constant**
    3. are not influenced by change in temperature or pH value
    4. increase the demands on energy supply
    5. are completely consumed in the reaction

---

49. Lactose
    1. contains an ester bond in its molecule
    2. contains ribose and glucose in its molecule
    3. contains fructose in its molecule
    4. **is a disaccharide**
    5. is a monosaccharide

---

50. Choose (a) true statement/s about the reaction $2 NaBr + Cl_2 \rightarrow 2 NaCl + Br_2$:
A) it is an example of substitution reaction
B) bromine precipitates
C) the reaction cannot proceed in the direction given
D) chlorine is reduced
    1. only C is valid
    2. A, B, D are valid
    3. none (A-D) is valid
    4. only B is valid
    5. **A, D are valid**

Mathematics

---

51. Solve for x the equation log [log (2 + log$_2$(x + 1))] = 0, where x > -1.
   1. x = 30
   2. x = 63
   3. **x = 255**
   4. x = 16
   5. x = 126

---

52. Find the solution of the equation and decide which of the statements is correct.
$3^{x+2} \cdot 2^{-(x+3)} + 3^{x+4} \cdot 2^{-(x+3)} = 20/9$
   1. **The equation has exactly one negative solution for x.**
   2. The equation has exactly one positive solution for x.
   3. The equation has no solution for real x.
   4. The equation has exactly two solutions for x.
   5. x=0

---

53. Find the maximum of the function $f(x)=x^3-3x^2-9x+4$.
   1. 10
   2. 7
   3. 8
   4. 6
   5. **9**

---

54. Calculate (complex numbers): 1/i-(2+i)/(i-1)+(2-i)/(i+1)
   1. -5/2
   2. -1
   3. 1+i
   4. **1-i**
   5. i

---

55. What is the sum of slopes of two lines which are perpendicular to two lines given by equations 3x+4y-5=0 and 6x-4y+10=0?
   1. -1,5
   2. 1
   3. 3/4
   4. -2/3
   5. **2/3**

---

56. Find the distance from the point (4,0) to the line given by equation $y = 4/3x + 3$.

1. 4
2. **5**
3. 7
4. 3
5. 6

57. The exponential function $y=A \cdot 10^{B \cdot x}$ has intercepts (0, 2) and (1, 0.2). What is the X coordinate of the third intercept (X, 20)?
1. 1
2. 3
3. 2
4. -2
5. **-1**

58. In how many ways can we select 4 marbles out of 10 blue, 8 red, and 6 green marbles? Marbles of the same colour are considered identical.
1. 64
2. 18
3. **15**
4. 12
5. 32

59. Calculate the area of cycle given by equation $x^2+y^2-4x-6y+4=0$.
1. 4π
2. **9π**
3. 16π
4. 6π
5. 2π

60. The car moves with constant acceleration and its trajectory is described by the equation $d=15t^2+20t+10$, where **d** is the distance in meters and **t** is the time in seconds. Find its acceleration in (m.s^{-2}).

1. 20
2. 60
3. **30**
4. 120
5. 10

Physics

61. Ice cube floats in the water. What is the density of ice if 10 % of the cube is above the level?
    1. 936 kg/m^3
    2. 981 kg/m^3
    3. 880 kg/m^3
    4. **900 kg/m^3**
    5. 100 kg/m^3

62. Calculate the critical angle for the water-air boundary.
    1. 0.438 rad
    2. 0.841 rad
    3. 0.524 rad
    4. 0.126 rad
    5. **0.851 rad**

63. An ideal heat engine operates with reservoir temperature between 200 °C and 50 °C. Calculate its efficiency.
    1. 0,178
    2. 0,423
    3. 0,75
    4. **0,317**
    5. 0,25

64. A 70 kg man runs up a flight of stairs 3 m high in 2 s. what average power does he produce to achieve this?
    1. 780 W
    2. 3040 W
    3. 2050 W
    4. **1030 W**
    5. no answer is correct

65. What is the total energy of two photons which are the outcome of annihilation of an electron and its antiparticle (positron)?
    1. 64.8*10^{-12} J
    2. **1.64*10^{-13} J**
    3. 41.0*10^{-16} J
    4. 82.0*10^{-13} J
    5. 9.81*10^{-14} J

66. A dental drill generates high frequency sound of intensity level 70 dB. What is the result intensity of sound of 10 identical drills?
1. 10^{-5} W.m^{-2}
2. 700 dB
3. 80 dB
4. **10^{-4} W.m^{-2}**
5. 10^{-6} W.m^{-2}

___

67. Determine the energy of a photon of wavelength 200 nm in the water.
1. $5.54*10^{-19}$ J
2. $6.36*10^{-19}$ J
3. **$7.48*10^{-19}$ J**
4. $86.3*10^{-19}$ J
5. $36.6*10^{-18}$ J

___

68. An object is placed 0.25 m away from the lens. The lens forms an image that is 0.167 m away from the lens, upright, and on the same side of the lens as the object. What is the focal length of the lens?
1. **-0.503 m**
2. 0.301 m
3. 0.201 m
4. -0.402 m
5. 0.607 m

___

69. A mathematical pendulum swings at frequency 1 Hz. How long is the pendulum in centimeters?
1. 42.4 cm
2. 34.8 cm
3. 92.4 cm
4. **24.9 cm**
5. 19.6 cm

___

70. A 12-volt battery is used to power a parallel circuit with a 2 Ω and a 3. Ω resistor. Determine the total power of the circuit.

1. **120 W**
2. 30 W
3. 240 W
4. 60 W
5. 180 W

___