



Precorsi per Medicina e Professioni Sanitarie

IMAT simulation - 31/07/21

Part: Logic

- 1. The library of Doctor Margaret has 160 books, divided in subjects: 20% of biology, 30% of medicine; 35% of literature; 5% of chemistry; 10% of history. Summing what books of different subjects can you obtain 88 as a result?**
 - A) Medicine and literature books
 - B) Biology and literature books
 - C) Literature and chemistry books
 - D) Biology and chemistry books
 - E) Biology and history books
- 2. Leonidas sells a small flat – whose market value is 100,000 euros – with a 4/5 discount. What is the final price of the flat?**
 - A) 20,000 euros
 - B) 40,000 euros
 - C) 75,000 euros
 - D) 80,000 euros
 - E) 60,000 euros
- 3. Marina's pencil case contains 1 blue pen, 2 red pens and 3 black pens. If she takes out one at random, what is the probability that it will be a red pen?**
 - A) 1/12
 - B) 1
 - C) 2
 - D) 1/3
 - E) 1/6
- 4. An office worker walks every morning for 10 minutes at 6 km/h, then he covers a ten times greater distance by train at 120 km/h and finally makes a 5 km bus ride at 60 km/h. How long does it take him to travel to work altogether?**
 - A) The given data are insufficient
 - B) 15 minutes
 - C) 20 minutes
 - D) 30 minutes
 - E) 10 minutes
- 5. X : often = little : Y**
 - A) X = never, Y= much
 - B) X= trivial, Y= precious
 - C) X= sometimes, Y= frequent
 - D) X= usual, Y= occasional
 - E) X= seldom, Y= much
- 6. ___ : to exhaust = ___ : to compensate for**
 - A) To wear out, to make up for

- B) To tell off, fix up
- C) To wear, to supply with
- D) To get into, get at
- E) To put down, to put up

7. If carpet = 12; sofa = 8; lamp= 8; armchair=?

- A) 18
- B) 14
- C) 10
- D) 12
- E) 16

8. Tom, Julia, Kate and David arrange to meet at the pub. Each of them arrives at the pub when his or her watch shows 10 p.m. It is known that two of them have watches that show the time as delayed, and the other two have watches that show the time sooner. If Kate's watch is delayed, it's NOT possible that:

- A) Kate arrived before Tom
- B) Kate arrived after Julia
- C) Kate arrived after Tom
- D) Kate arrived before David and Julia
- E) Tom arrived before David and Gary

9. In a children's story there are three types of monster, Bongles, Crannies and Dervies. Some Bongles (but not all) are Crannies and all Crannies are Dervies. Which one of the following is definitely NOT true?

- A) No Dervies are Bongles
- B) Some Dervies are both Bongles and Crannies
- C) Some Dervies are neither Bongles nor Crannies
- D) Some Bongles are Dervies
- E) All Crannies are either Bongles or Dervies or both

10. *"Studies are taking place to assess the benefits to dental health of adding fluoride to drinking water, a process known as mass medication. The Health Minister has urged consideration of fluoridation, particularly in deprived areas where dental care is poor. Fluoride can occur naturally in the water because of fluoride containing minerals. Fluoride, in the water, improves dental health by up to 50 percent. Even so, fluoridation should not take place. A campaign leader opposed to fluoridation has spoken of her experiences of living in a fluoridated area of the USA. She experienced feelings of apathy and depression; her 2 year old son showed autistic tendencies and has white flecks on hi teeth. These symptoms disappeared when they returned home from the USA."* Which of the following is an underlying assumption of the argument above?

- A) Mass medication is always wrong
- B) Fluoridation is cheaper than improving dental facilities
- C) Fluoridation is only necessary in deprived areas
- D) The reported health symptoms were caused by fluoride in water
- E) Fluoridation of water is a person's only source of fluoride

Part: General Culture

11. Dr Edward Jenner is well known for developing a vaccine against:

- A) Rabies
- B) Malaria
- C) HIV
- D) Smallpox

E) Polio

12. What does the letter P indicate in the OPEC organization acronym?

- A) Plastics
- B) Piracy
- C) Philosophy
- D) Physics
- E) Petroleum

13. Which of these correlations is NOT correct?

- A) Mario Capecchi – chemistry
- B) Enrico Fermi – nuclear physics
- C) Riccardo Giacconi – astronomy
- D) Rita Levi-Montalcini – neurology
- E) Camillo Golgi – histology

14. Pablo Picasso was all of these things except one. Which one is it?

- A) Poet
- B) Ceramist
- C) Sculptor
- D) Painter
- E) Graphic

15. Which of these artists is not an impressionist?

- A) Monet
- B) Renoir
- C) Mirò
- D) Degas
- E) Toulouse-Lautrec

16. Which is the capital of Tanzania?

- A) Dodoma
- B) Dar es Salaam
- C) Kigali
- D) Mogadiscio
- E) Nairobi

17. Which is the world's biggest island?

- A) Borneo
- B) Greenland
- C) Cuba
- D) Madagascar
- E) Sri Lanka

18. In which condition can a lunar eclipse be observed?

- A) New moon
- B) First quarter
- C) Last quarter
- D) Full moon
- E) In shot

19. Which of the pairing is incorrect?

- A) Iceland-Reykjavik

- B) Denmark-Copenhagen
- C) Norway-Oslo
- D) Finland-Helsinki
- E) Sweden-Malmö

20. Down syndrome is caused by:

- A) The presence of a chromosome in excess
- B) The presence of two chromosomes in excess
- C) The lack of one chromosome
- D) A viral infection
- E) The lack of two chromosomes

21. Who formulated the theory of motion of bodies which was considered true until the new discoveries of Galileo?

- A) Democrit
- B) Aristotle
- C) Euclid
- D) Ptolemy
- E) Galen

22. Darwin formulated the theory of evolution using, by analogy, the theory of a famous economist. Who was that?

- A) Marx
- B) Pareto
- C) Smith
- D) Malthus
- E) Ricardo

Part: Biology

23. A food item was burned in pure oxygen and released 830 kJ of energy. An identical food item of the same mass was found to produce 8 ATPs in respiration. Assuming it takes 31 kJ to produce one ATP molecule, estimate the efficiency of respiration.

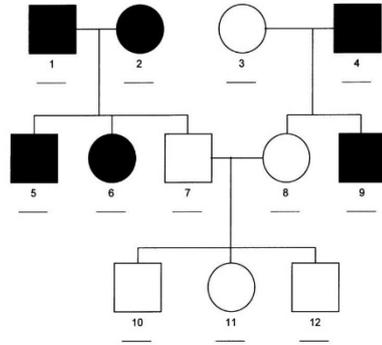
- A) 25%
- B) 10%
- C) 45%
- D) 50%
- E) 30%

24. What is the role of lactate dehydrogenase?

- A) It converts lactate to alanine
- B) It converts lactate to ethanol through an oxidative decarboxylation via the hydrolysis of ATP
- C) It converts lactate to pyruvate with the reduction of NAD⁺ to NADH
- D) It converts lactate to acetyl-CoA via an oxidative decarboxylation via the hydrolysis of ATP
- E) None of the above

25. The family tree below shows the inheritance pattern of a genetic disease. Which of the following statement/s is/are correct?

- 1) It is an X-linked disease
- 2) It is an autosomal recessive disease
- 3) it can show the inheritance pattern of Huntington disease
- 4) It is a dominant disease



Choose the correct answer:

- A) 1 and 4
- B) 4 only
- C) 2 and 3
- D) 4 and 3
- E) 1 only

26. Which of the following statement/s about erythrocytes is/are correct?

- 1) They can carry carbon dioxide
 - 2) On average their lifespan is around a month
 - 3) They do not present a nucleus
 - 4) They are able to proliferate
 - 5) They are synthesized in the spleen
 - 6) They are fragments of a bigger precursor
- A) 1, 3 and 4
 - B) All correct
 - C) 5, 6, 2 and 4
 - D) 2, 3 and 6
 - E) 1 and 3

27. A DNA filament in one of its coding region display originally the following sequence:

ATG CGT CGT ACC GCC GAT.

After a mutation happens, the DNA filament sequence is changed in:

ATG CGT CGC ACC GCC GAT

Most likely, what are going to be the consequences of the mutation?

- A) It is going to cause a frameshift mutation
- B) There won't be any consequence
- C) The mutation causes the synthesis of a trunk protein
- D) It is going to influence the splicing of the transcript
- E) It is going to influence the splicing of the transcript

28. What is glycogenin?

- A) It is a protein involved in the enzymatic cascade of glucagon
- B) It is a protein involved in the enzymatic cascade of insulin
- C) It is an enzyme involved in glycogen synthesis
- D) It is and enzyme involved in glycogenolysis
- E) None of the above

29. Which of the following components of a human immunodeficiency virus (HIV) contain peptide bonds?

- 1) Capsid
- 2) Envelope
- 3) Reverse transcriptase

Choose the correct answer:

- A) 1, 2 and 3
- B) 1 and 2 only
- C) 1 and 3 only
- D) 2 and 3 only
- E) 3 only

30. The bacterium *clostridium botulinum* is able to produce one of the strongest neurotoxin known, the botulinum toxin. It acts on SNARE proteins present in neural synapses, degrading them and therefore impeding the release of acetylcholine in the neuromuscular junction. If botulinum intoxication is not cured, consequences can lead to the death of the patient.

Which of the following is the more probable cause of death given the previous information?

- A) Hemorrhage
- B) Severe dehydration
- C) Lack of oxygen in central nervous system (anoxia)
- D) Multiple organ dysfunction due to cellular death
- E) Asphyxia

31. What's the main role of Carnitine?

- A) It is the transporter responsible for the transfer of fatty acids from the cytosol to the mitochondrion
- B) It is the transporter of fatty acids that is responsible for the uptake of glycerol in the cell
- C) It is a protein responsible for the uptake of cholesterol in the intestine
- D) It activates the enzyme Fatty Acyl-CoA synthetase which activates the fatty acids inside the cytosol
- E) It is an ammonium compound involved in the urea cycle

32. What is GLUT-2 and where is it located?

- A) It is the glucagon receptor located in the liver
- B) It is the glucose receptor located in the liver
- C) It is the glucose receptor located in the pancreas and liver
- D) It is a transmembrane carrier protein located in muscle cells
- E) It is a transmembrane carrier protein located in liver, pancreas, intestine and kidneys

33. Plasmodesmata are typical structures in plant cells: they are very similar to one of the following animal cell structures. Choose the option that most resembles them.

- A) Desmosomes
- B) Gap junctions
- C) Basal laminae
- D) Tight junctions
- E) Ion channels

34. A group of cells in a non-specified human tissue has been subjected to the same mutation. This causes the cells to acquire some properties: increased uptake of glucose and use of aerobic glycolysis as main energy source, increased proliferative abilities and resistance to apoptosis.

Which of the following statements describes those cells better?

- A) They have become tumoral cells
- B) They are unlikely to cause problems
- C) At a certain point every cell of the human body acquire those features as part of their normal healthy development
- D) The individual will certainly die without medical assistance
- E) The process described can happen only in specific tissues

35. Which cell(s) are more likely to contain the most mitochondria:

- 1) Erythrocyte
- 2) Epidermal cell
- 3) Lymphocyte
- 4) Muscle cell

Choose the correct answer:

- A) 1 and 3
- B) 2 and 4
- C) Only 4
- D) 2 and 3
- E) Only 2

Part: Human Anatomy and Physiology

36. What is the correct order of the following structures in the larynx?

- 1) Vocal folds
 - 2) Thyroid Cartilage
 - 3) Epiglottis
 - 4) Trachea
- A) 2, 3, 4, 1
B) 1, 4, 3, 2
C) 3, 4, 1, 2
D) 3, 2, 1, 4
E) 3, 2, 4, 1

37. Schwann cells are:

- A) A variety of glial cells
B) Blood cells
C) A variety of hepatocytes
D) Also called Silvio's cells
E) Part of the bone

38. Which of the following structures are part of the small intestine?

- 1) Duodenum
 - 2) Cecum
 - 3) Appendix
 - 4) Jejunum
 - 5) Ileum
- A) 1, 2 and 3
B) 1, 4 and 5
C) 3, 4 and 5
D) 2, 3 and 5
E) Only 4

39. Which of the following is/are part of the lymphatic system?

- 1) Lymph nodes
 - 2) Sympathetic chain
 - 3) Thoracic duct
 - 4) Azygos
- A) 1 only
B) 1 and 2
C) 1 and 3
D) 3 only
E) 3 and 4

40. What is the correct order of the following brain structures, in a craniocaudal projection?

- 1) Pons
 - 2) Cerebrum
 - 3) Medulla
 - 4) Midbrain
- A) 2, 4, 1, 3
B) 3, 4, 1, 2
C) 3, 1, 4, 2
D) 1, 2, 3, 4
E) 3, 2, 1, 4

Part: Chemistry

41. A 250 ml solution 0.5M of HCl was added to an HCl solution of unknown concentration, resulting in 1L solution 0.25M. What is the concentration of the unknown HCl solution?

- A) 0.125 M
- B) 0.16 M
- C) 0.25 M
- D) 0.1 M
- E) 0.22 M

42. Which of the following elements belongs to the Chalcogens group?

- A) Xe
- B) Os
- C) Te
- D) At
- E) Cs

43. Given the reaction: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

Which volume of CO₂ is formed from 4 moles of C₃H₈, at standard temperature and pressure (STP)?

- A) 238,8 l
- B) 298,8 l
- C) 248,8 l
- D) 218,8 l
- E) 268,8 l

44. Which is the IUPAC of the following compound: $CH\equiv C-CH_2Cl$?

- A) 1-chlorpropyne
- B) 3-chlorpropene
- C) Chloroacetylene
- D) 3-chlorpropyne
- E) 1-chlorine-1-proyne

45. Which of the following statements regarding optical isomerism are correct?

- 1) The property of a compound to rotate the plane of polarized light depends on the percentage of enantiomers that compose it
- 2) Two enantiomers have identical chemical and physical properties in an achiral environment
- 3) A carbon atom is said to be asymmetrical when it is bound to at least three different substituents
- 4) All amino acids, except glycine, have chiral carbon and are all in the form of D in living organisms

- A) 1, 2, 3 and 4
- B) 1 and 2 only
- C) 1, 2 and 4
- D) 1 and 3 only
- E) 2 and 4 only

46. Which of the following gives the right combination with a starting volume of 200 ml of water 1 M?

	Initial M	Volume added	Final M
1	2 M	200 ml	1.5 M
2	1 M	400 ml	1.5 M
3	1 M	800 ml	1 M
4	1.5 M	500 ml	2 M
5	2 M	150 ml	0.2 M

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

47. Hydrogen peroxide can be either the oxidising or the reducing agent. In which of the following reactions oxygen is reduced?

1. $\text{H}_2\text{O}_2 + 2\text{H}^+ \rightarrow 2\text{H}_2\text{O}$
2. $\text{H}_2\text{O}_2 \rightarrow \text{O}_2 + \text{H}^+$
3. $\text{H}_2\text{O}_2 \rightarrow 2\text{OH}^-$
4. $\text{H}_2\text{O}_2 + 2\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O}$

- A) 1 and 3 only
- B) 2 and 4 only
- C) 1, 2 and 4
- D) 1 and 4 only
- E) 3 and 4 only

48. What mass of solute must be dissolved in 900 cm^3 of solution to be 17% m/V?

- A) 278 g
- B) 153 g
- C) 96 g
- D) 125 g
- E) 263 g

49. What is the freezing point depression of a solution of 0.16 moles of Na_2CO_3 in 100 mL of ethanol? [$K_f = 1.99 \text{ K}\cdot\text{kg}/\text{mol}$; density of ethanol = $789 \text{ kg}/\text{m}^3$]

- A) 4 K
- B) 1,2 K
- C) 9,6 K
- D) 12 K
- E) 3,2 K

50. Which of the following element has this electronical configuration: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4$?

- A) Ar
- B) Br
- C) Se
- D) Br^-
- E) Ga^+

51. In which of the following compound pairs, the oxidation stages of the underlined atoms are equal?

1. $\text{K}_2\underline{\text{Cr}}_2\text{O}_7 - \underline{\text{Cr}}\text{F}_2$
2. $\text{K}_3\underline{\text{P}} - \underline{\text{P}}\text{H}_3$
3. $\underline{\text{K}}\text{NO}_2 - \underline{\text{N}}\text{H}_3$

- A) Only 1
- B) Only 2
- C) Only 3
- D) 1 and 2
- E) 2 and 3

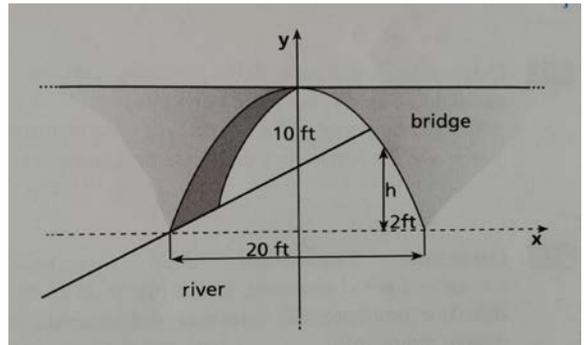
52. The IUPAC name of caffeine is 1,3,7-trimethylpurin-2,6-dione; knowing this which of these functional groups are NOT present in this substance?

1. Double bond

- 2. Ketone group
- 3. Carboxylic group
- 4. Hydroxyl group
- A) 3 and 4 only
- B) 1 and 4 only
- C) 1 and 3 only
- D) 2 and 4 only
- E) 1, 2 and 3

Part: Math and Physics

53. A bridge over a stream is in the form of a parabolic arch. The stream is 20 feet across and the bridge is 10 feet high at midstream. What is the equation of the arch?



- A) $y = -\frac{1}{10}x^2 + 10$
- B) $y = -\frac{1}{10}x^2 + 10x - 10$
- C) $y = \frac{1}{100}x^2 + 10$
- D) $y = \frac{1}{10}x^2 - 10$
- E) $y = +\frac{1}{10}x^2 + 10$

54. Gon is doing a test which is divided into 3 stages, with increasing difficulty. The chances of winning the first stage are 75%. If you pass the first stage, the chances of winning the second are 40%. If you pass them both, the chances of winning the third stage are 20%. To win you have to pass them all in this order. If Gon lost, what is the probability of him losing in the second stage?

- A) 3/5
- B) 30/47
- C) 25/94
- D) 9/20
- E) 45/94

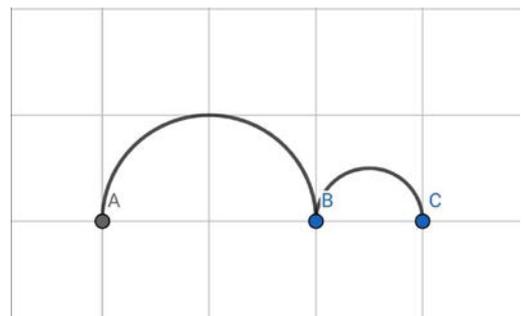
55. The function $y = (-2x+10)^2$ corresponds to:

- A) A parabola with downward concavity, tangent to the x axis
- B) A parabola with upward concavity, tangent to the x axis
- C) A parabola which is not tangent to the x axis
- D) A circumference with centre (5;0)
- E) A linear function

56. Determine the point B, belonging to AC=10a, so as the sum of the semicircles with diameter AB and BC

is $\frac{13\pi a^2}{2}$

- A) AB=4a v AB=6a
- B) AB=8a v AB=12a
- C) AB=5a v AB=6a
- D) AB=2a v AB=3a
- E) AB=4a v AB=9a



57. A mouse manages to escape the cage you've been keeping it in. It then starts running around your lab at a constant speed of v_m until it's too tired to go on. At this point, it starts slowing down, in uniformly decelerating motion, until it stops. During the deceleration, which lasts for 10 seconds, it covers a distance of 20 meters. What was the speed of the mouse (v_m)?
- A) 2 m/s
 - B) 3 m/s
 - C) 4 m/s
 - D) 5 m/s
 - E) 6 m/s
58. An electric circuit contains a generator and three resistors in series. When a voltmeter is placed in parallel with the first resistor R_1 , a voltage ΔV is measured. If the voltmeter has an internal resistance $r=0,5R_1$, what is the voltage across the first resistor when the voltmeter is absent?
- A) $3/2 \Delta V$
 - B) $1,1 \Delta V$
 - C) It is the same, because voltmeters are designed not to influence the voltage across two points
 - D) $3\Delta V$
 - E) $2/3 \Delta V$
59. Which of these are state functions?
- A) Heat, work, Gibbs free energy
 - B) Entropy, Heat, Work
 - C) Entropy, Enthalpy, Heat
 - D) Entropy, Enthalpy, Gibbs free energy
 - E) Entropy, Enthalpy, Heat
60. A tank is full of water. A manometer measures a pressure of 4×10^4 Pa at the bottom of the tank. What's the height of the water inside the tank? Use $g=10\text{m/s}^2$ and $d=1000\text{kg/m}^3$ (density of water).
- A) 0,04 km
 - B) 0,004 km
 - C) 400000 mm
 - D) 4000000 mm
 - E) 0,004 cm