**Associazione**
**Studenti e Professori di Medicina Uniti Per**

**In collaborazione con Ufficio Tutor della Scuola di Medicina**
**dell'Università degli Studi di Padova**

## *Precorsi per Medicina e Professioni Sanitarie*

## *IMAT simulation – 08th May 2021*

### General Knowledge and Logical Reasoning

1. **There are cats lying under Barbara's desk. Therefore:**
   A) If there are some cats that do not lie on the carpets, then there cannot be a carpet under Barbara's desk
   B) If cats do not lie on carpets, then there must be an area under Barbara's desk that is uncarpeted
   C) If there is a carpet under Barbara's desk, then all cats lie only on carpets
   D) If there is a carpet under Barbara's desk, then all cats lie only on carpets
   E) Barbara has no cats

2. **Coffee granules are awailable in two jar sizes, regular and large. The regular jar contains 250 grams and costs 4.50 $. The large jar is 60% bigger, containing 400 grams, but at 6.30$ it costs only 40% more than the regular jar. By how much per kilogram is the large jar of coffee better value for money than the regular jar?**
   A) 0.90 $
   B) 2.25 $
   C) 3.60 $
   D) 3.15 $
   E) 6.00 $

3. **Four relatives (Diana, Karen, Ron and Mike) were invited to a party.**
   1) **Diana announced that she would go only if Ron didn't go.**
   2) **Mike announced that she would go only if at least two other relatives went.**
   3) **Karen announced that she would go only if Mike went.**
   **At least two of the relatives came to the party; it therefore must follow that:**
   A) Diana came to the party
   B) Ron did not come to the party
   C) Only two of the relatives came to the party
   D) Three of the relatives came to the party
   E) No one of the relatives came to the party

4. **Paul, Steve and Michael are brothers. One of them always tells the truth, while the other two always lie. Paul says: "Michael always tells the truth". It therefore follows that:**
   A) Paul always tells the truth
   B) Michael always tells the truth
   C) Steve always tells the truth
   D) It's impossible to know which of them always says the truth
   E) No one of the brothers tells the truth

5. **A printing house buys an ink-jet printing machines for 84,000 euros and a computer to process images for 14,000 euros. Which is the ratio between the price of the computer and that of the printing machine?**
   A) 1/3
   B) 1/42
   C) 42/7

D) 1/6

E) 4/3

6. **Read the following three statements:**
   1) **All smokers are pub-goers.**
   2) **Only smokers can be football fans.**
   3) **Some italians are football fans.**
   **Which of the following conclusions does not follow from the given information?**
   A) There are italians who are smokers
   B) Only italians smoke
   C) There is no football fan who doesn't smoke
   D) There are some italians in the pub
   E) Not all italians are football fans

7. **Three red balls, three yellow balls and one green ball are placed in a bag and the bag is shaken. I place my hand in the bag and pull out a red ball followed by a green ball. I do not replace either ball. Which of the following statement is true?**
   A) The next ball will definitely be yellow
   B) At least one of the next three balls must be yellow
   C) The next two balls cannot be red
   A) The next ball could be any of red, yellow or green
   B) At least one of the next three balls must be red

8. **Two security guards, Dave and Jeff, are patrolling an airbase. Dave passes the front gate every 8 minutes. Jeff passes the front gate every 15 minutes. They have just set off on their individual routes at the start of their shift. How long will it be before they meet up at the front gate again?**
   A) 3 hours
   B) 1 hour 30 mins
   C) 1 hour
   D) 2 hours 30 mins
   E) 2 hours

9. **A teacher in school from children from 11 to 16 years old sets a code number to unlock his classroom door. He has a method for remembering his code. He uses:**
   **1) The two digits of his birth reversed (for example, february which is 02 would be reversed to 20);**
   **2) then the age of the children in his class at the start of the year with the digits reversed;**
   **3) and finally, the date of his birthday in the month, reversed.**
   **Which of the following coud not be his code to unlock the door?**
   A) 602124
   B) 903121
   C) 701131
   D) 215150
   E) 115191

10. **A street of houses is numbered starting on one side with 1,2,3,4... At the far end the numbers continue down the other side in the opposite direction so the largest number is opposite number 1. The houses are of identical width so each house has another directly opposite to it. If number 17 is directly opposite to number 56, how many houses are in the street?**
    A) 72
    B) 37
    C) 39
    D) 36
    E) 73

11. **Which of these events occurred in the XVIII century?**
    A) Thirty Years' War
    B) Boston Tea Party
    C) First edition of the Modern Olympic Games in Athens
    D) Bay of the Pigs Invasion
    E) Battle of Waterloo

12. **Dr Luc Montagnier is well known for his studies concernig:**
    A) H1N1
    B) Malaria
    C) HIV
    D) BSE
    E) Polio

13. **The UN Security Council has**
    A) 10 permanent members and 5 non permanent members
    B) 5 permanent members and 10 non permanent members
    C) 5 permanent members and 5 non permanent members
    D) 5 permanent members and 15 non permanent members
    E) 10 permanent members and 10 non permanent members

14. **Which set of statements about the People's republic of China is NOT correct?**
    A) It's the most populous state in the world
    B) It's the world's larger exporter of goods
    C) It's a single-party governed by the Communist Party of China
    D) It's the largest country by land area
    E) It's the emerging superpower of the 21th century

15. **Francesco Cossiga was president of the Italian republic in the years in which:**
    A) Began the Korea war
    B) Ended the Cold war
    C) Ended the Vietnam war
    D) Was fought the Kippur war
    E) Was fought the Falkland war

16. **For what lenght of term is the French president voted?**
    A) 4 years
    B) 5 years
    C) 6 years
    D) 7 years
    E) 8 years

17. **Islamabad is the capital of:**
    A) Belucistan
    B) Bhutan
    C) Nepal
    D) Kashmir
    E) None of these countries

18. **In 1945, the nobel prize for medicine was assigned to:**
    A) Albert Sabin
    B) Alexander Fleming

C) Louis Pasteur
D) Ivan Pavlov
E) Max Theiler

**19. Atonement is a literary work by:**
A) Salman Rushdie
B) Martin Amis
C) Anthony Burgess
D) Ian McEwan
E) Antonia Byatt

**20. Entered into force in 1994, the NAFTA agreement is between:**
A) 3 american countries
B) 15 asian countries
C) 7 african countries
D) 27 european countries
E) 5 american countries

**21. Which of the following Italian movie director worked with Hollywood star Marlon Brando?**
A) Michelangelo Antonioni
B) Federico Fellini
C) Mario Monicelli
D) Bernardo Bertolucci
E) Luchino Visconti

**22. Which set of statements about Oscar Wilde is correct?**
A) He was from London, was educated in Oxford, died before 1900
B) He was from Bristol, was the son of Edith Warton, wrote poetry
C) He was from Edimburgh, wrote poetry, was son of Mary Shelley
D) He was from Dublin, wrote novels, plays and poetries, died in 1900
E) He was of a noble family, was born in the eighteen century, wrote tragedies

**Biology**

**23. Which one of the following phases comes immediately after metaphase in mitosis?**
A) Telophase
B) Prophase
C) Prometaphase
D) Anaphase
E) Cytokinesis

**24. Myoglobin:**
A) Its structure mostly consists of alpha-helical stretches
B) Binds oxygen with lower affinity than hemoglobin
C) Binds oxygen mainly at low $PO_2$
D) Normally binds oxygen with $Fe^{3+}$ ion in the heme group
E) Is found in red blood cells

**25. Which of the following plasma membrane's components is responsible for the AB0 antigen system in red blood cells?**
A) Lipids
B) Transmembrane proteins
C) Glycoproteins

D) Phospholipids
E) Cholesterol

26. **Which of the following can be random processes?**
    1) **Mutations**
    2) **Artificial selection**
    3) **Genetic drift**
    **Choose the correct answer:**
    A) 1 and 2 only
    B) 2 and 3 only
    C) 1 and 3 only
    D) 1, 2 and 3
    E) None

27. **Which of the following statements are related to sickle cell anemia?**
    1) **This** disease is a result of a punctiform substitution that results in a missense mutation
    2) This disease in the result of a punctiform substitution that results in a nonsense mutation
    3) The mutation results in the substitution of glutamic acid with valine
    4) The mutation results in the substitution of valine with glutamic acid
    A) 1 and 4 only
    B) 2 and 3 only
    C) 1 and 3 only
    D) 2 and 4 only
    E) None of them

28. **Which one of the following does not contain aminoacids?**
    A) Viruses
    B) Enzymes
    C) Antibodies
    D) Cell membranes
    E) Amylose

29. **Which of the following events is most likely to happen in the case a plant is watered with sea water?**
    1) **The Vacuole will lose water, turgidity and the volume of the cell will decrease**
    2) **The vacuole will acquire water, resulting in an increase in volume**
    3) **The cell will detach from the cell wall and collapse inward**
    **Choose the correct answer:**
    A) 1 and 2
    B) 2 and 3
    C) 1, 2 and 3
    D) 1 and 3
    E) All of them

30. **What is the role of Epigenetics in the genome?**
    A) It refers to changes in gene expression that result from changes in chromatin structure without alteration of DNA sequences
    B) It refers to changes in gene expression that result from changes in chromatin structure with alteration of DNA sequence
    C) It is heritable
    D) Statements B and C
    E) Statements A and C

31. **What is the specific molecule to which the main portion of free fatty acids released by the adipose tissue bind to?**
   A) VLDL
   B) HDL
   C) LDL
   D) Albumin
   E) All of them

32. **The lock-key model is the most representative mechanism of enzyme-substrate interaction. Choose the answer that better clarifies/rejects this statement:**
   A) The statement is true because there is a perfect match in shape between the substrate and the active site of the enzyme
   B) The statement is true because there is a perfect chemical interaction between the substrate and the active site of the enzyme
   C) The statement is false because the substrate interacts with the active site and not with the enzyme
   D) The statement is false because when the substrate interacts with the active site there is an adjustment in the enzyme fit the substrate
   E) Statements C and A

33. **Which of the following hormones does not derive from cholesterol:**
   A) Estrogen
   B) Progesteron
   C) Estradiol
   D) Retinol
   E) Cortisol

34. **Which of the following statements regarding enzymes is incorrect:**
   1) **They catalyze all chemical reactions**
   2) **They directly increase the reaction speed**
   3) **They indirectly accelerate chemical reactions of metabolic processes**
   4) **Enzyme inhibitors are often used in the pharmaceutical field**
   **Choose the correct answer:**
   A) Only 4
   B) 1 and 2
   C) 3 and 4
   D) 2 and 4
   E) Only 2

35. **Insulin is a protein involved in the regulation of human blood glucose levels. Genetic engineering can be used to allow the large-scale production of human insulin. Which statement describes the process of genetic engineering in this case:**
   A) Taking insulin from a human and inserting it into the DNA of a bacterium. As the bacterium reproduces, it makes large quantities of insulin DNA that can be used to treat human diabetes
   B) Taking insulin from a cow and inserting it into the DNA of a bacterium. As the bacterium reproduces, it makes large quantities of insulin that can be used to treat human diabetes
   C) Taking the insulin gene from the human chromosome and inserting it into the DNA of a bacterium. As the bacterium reproduces, it makes large quantities of insulin DNA that can be used to treat human diabetes
   D) Taking the insulin gene from a human chromosome and inserting it into the DNA of a bacterium. As the bacterium reproduces it makes large quantities of insulin that can be used to treat human diabetes
   E) Taking the insulin gene from a human chromosome and replacing it in another human chromosome in the same human, so that it will work better to produce large quantities of insulin

36. **Which of these bones are articulated with the Scapula?**
    1) **Radius**
    2) **Ulna**
    3) **Humerus**
    4) **Clavicle**
    5) **First rib**
    A) 1, 2, 3 and 4
    B) 2, 3, 4 and 5
    C) 3 and 5
    D) 3 + 4 only
    E) 1 + 2 only

37. **Which is the correct association between hormones and glands?**
    A) Prolactin - Pituitary gland posterior lobe
    B) Antidiuretic Hormon (ADH) - Pituitary gland anterior lobe
    C) Calcitonin - Thyroid gland
    D) Cholecystokinin - Delta cells of Pancreas
    E) Progesteron - Testes

38. **What is the correct order of the following structures in the nephron?** Loop of Henle
    1) **Loop of Henle**
    2) **Proximal convoluted tubule**
    3) **Collecting duct**
    4) **Distal convoluted tubule**
    A) 1, 2, 3, 4
    B) 2, 1, 4, 3
    C) 2, 1, 3, 4
    D) 4, 3, 2, 1
    E) 1, 3, 2, 4

39. **Where is the liver located?**
    A) In the right upper quadrant of the abdomen
    B) In the left upper quadrant of the abdomen
    C) In the right lower quadrant of the abdomen
    D) In the left lower quadrant of the abdomen
    E) In the thorax

40. **Which of the following structures may be involved in an infarctus?**
    1) **Heart**
    2) **Kidney**
    3) **Liver**
    4) **Lung**
    A) 1, 2 and 3
    B) 1 and 2
    C) 1 and 3
    D) 1, 2, 3 and 4
    E) Only 1

## Chemistry

41. **Consider the following reversible reaction at constant temperature 25 ℃.**

**2A + 1B ⇌ 2C + 2D**
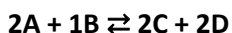
**What's the value of the equilibrium constant Kc of this equation, if at equilibrium there are 0,1 mole of A, 0,2 moles of B, 0,5 moles of C and 1 mole of D?**

A) Kc = 125
B) Kc = 12,5
C) Kc = 0,1
D) Kc = 0,008
E) Kc = 5,95

42. **Which of these elements is a noble gas?**
    A) Rhodium
    B) Radon
    C) Caesium
    D) Osmium
    E) Curium

43. **Which of the following sequences of inorganic compounds are composed only by salts (binary or tertiary)?**
    A) Nitric acid, sodium phosphate, hydrochloric acid, potassium sulphate
    B) Potassium nitrate, sodium nitrite, hydrochloric acid and orthophosphoric acid
    C) Calcium sulfite, boric acid, calcium chloride, carbon dioxide
    D) Sodium phosphate, calcium sulfite, potassium sulphate, magnesium nitrate
    E) Hydrochloric acid, calcium chloride, sodium phosphate and boric acid

44. **In which of the following reactions, the oxidizing and reducing substances are the same?**
    1. $P_4 + H_2O \rightarrow PH_3 + H_3PO_4$
    2. $KOH + Cl_2 \rightarrow KCl + KClO_3 + H_2O$
    3. $Cu + HNO_3 \rightarrow Cu(NO_3)_2 + NO + H_2O$
    A) Only 1
    B) Only 2
    C) 1 and 2
    D) 2 and 3
    E) 1, 2 and 3

45. **Which sentence, regarding the following reaction (to be balanced), is incorrect?**
    $Cl_2 + KOH \rightarrow KCl + KClO_3 + H_2O$
    A) Chlorine is reduced
    B) Chlorine is oxidised
    C) $Cl_2$ loses 10 electrons to become $KClO_3$
    D) In $Cl_2$, Chlorine's oxidation number is "0"
    E) None is incorrect

46. **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?**
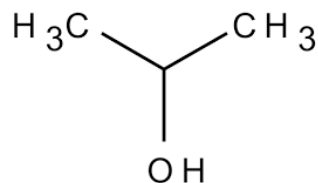    A) 0.125M
    B) 0.16M
    C) 0.25M
    D) 0.1M
    E) 0.22M

47. **What is the electron configuration of $As_{33}$ (arsenic)?**
    A) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$

B) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^3$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
E) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

48. **Which is the name of this compound?**
    A) 2-propanol
    B) 2-butanol
    C) Ethyl alcohol
    D) Methane
    E) Benzoic acid

49. **In a compound there are 18 g of carbon, 18 g of oxigen and 36 g of hydrogen. Which of the following could be?**
    1. **Fructose**
    2. **Carbon dioxide**
    3. **Cholesterol**
    4. **Glucose**
    5. **Glycine**
    A) All of them
    B) 2, 3, 4
    C) 1, 2, 4
    D) None of them
    E) 1,4

50. **Which of these categories is/are spatial isomers?**
    1. **Enantiomers**
    2. **Regioisomers (position isomers)**
    3. **Rotamers**
    A) 1 only
    B) 2 only
    C) 3 only
    D) 1 and 3 only
    E) 2 and 3 only

51. **Meloxicam is a nonsteroidal anti-inflammatory drug used to treat pain and inflammation. The peculiarity of this drug in that, unlike all others NSAID drugs, it's selective for COX-2 isoform and has fewer side effects. Which of the following organic functional groups can be found in this molecule?**
    A) Alcohol, carboxylic acid, ether, oxyme
    B) Sulfide, sulfonamide, alcohol, amide
    C) Carboxylic acid, amine, alcohol
    D) Ketone, Carboxylic acid, amine
    E) Aldehyde, alcohol, amine
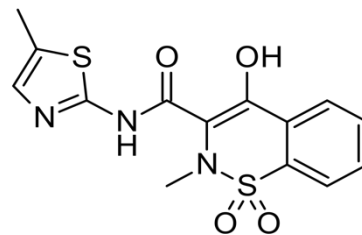
52. **What is the oxidation number of Cl in KClO₃?**
    A) +7
    B) -1
    C) -6
    D) +5
    E) +1

53. **What is the domain of the function $y = \frac{2x-5}{x+1}$?**
    A) D: ∀x>-1
    B) D: ∀x ≠ -1 V x≠ 5/2
    C) D: ∀x ≠ -1
    D) D: ∀x>0
    E) D: ∀x<-1 V x>2/5

54. **There are three rooms, A, B and C. In A there are 4 sick people and 6 are healthy. In B we count 2 sick people and 4 healthy, in C there are 3 sick people and 12 healthy. Picking up a random sick person, which is the probability for it to be in room C?**
    A) 1/3
    B) 3/14
    C) 1/3
    D) 5/14
    E) 6/14

55. **A square's area is double the area of a smaller square. The sum of the two squares' sides is 10 cm. How long is the side of the smallest square?**
    A) $10(\sqrt{2} - 1)cm$
    B) $-10(\sqrt{2} + 1)cm$
    C) $10(\sqrt{2} - 3)cm$
    D) $10(\sqrt{2})cm$
    E) $(\sqrt{2} - 1)cm$

56. **Which of the following sets is shown with roster notation?**
    A) $G$ = {letters in the English alphabet}
    B) {q∈Z| -4 ≤ q < 3}
    C) $X$ = {red, blue, yellow}
    D) H = [7; 14; 21]
    E) None of the above

57. **A beam of particles of mass $1,6 \cdot 10^{-27}\ kg$ and charge $1,6 \cdot 10^{-19}\ C$ enters a charged capacitor on a direction parallel to its plates, and it is seen bending towards the negative plate under the effect of the electrostatic field, which has a magnitude of $5,0 \cdot 10^3\ \frac{N}{C}$. However, when a magnetic field (uniform, parallel to the plates and perpendicular to the beam) of magnitude $2,5 \cdot 10^{-3}\ T$ is applied, the particles are kept on a straight line. What is the speed of the particles entering the capacitor?**
    A) $2,0\ m/s$
    B) $5,0 \cdot 10^{-7}\ m/s$
    C) $2,0 \cdot 10^6\ m/s$
    D) Very close to the speed of light
    E) $5,0 \cdot 10^6\ m/s$

58. **While Cinderella is coming home from the ball on her carriage, she is thinking about physics. In particular, she knows that the radius of the wheels is 2/π m and that they are spinning at π s⁻¹. What distance does the carriage cover in half an hour's time?**
    A) 900 m
    B) 1800 m
    C) 3600 m
    D) 7200 m
    E) It is impossible to know

59. An artery has a radius of 2 mm where the blood has a pressure of $p_1$= 50 mmHg and speed $v_1$=0,8 m/s. At a certain point, there's an aneurysm of radius $r_2$= 4 mm. What's the pressure in the aneurysm considering that the vessel is horizontal and the density of blood equals the density of water?
    A) 50,23 mmHg
    B) 30 Pa
    C) 6664,5 Pa
    D) 0.23mmHg
    E) It is impossible to know

60. You use your hand to apply a force (F) to a stone that weighs 500 grams, because you want to throw it in the air. While throwing it, your hand moves the stone upwards for 0,5 m. After parting from your hand, the stone reaches up, covering a height of 10 meters before coming back down. What was the intensity of the force?
    A) 90 N
    B) 95 N
    C) 100 N
    D) 105 N
    E) It is impossible to know