



**Precorsi per Medicina e Professioni Sanitarie**

**IMAT simulation – 20th March 2021**

**General Knowledge and Logical Reasoning**

1. Using an encrypted language the name “JACOPO” is turned in 1013151615 and the name “KLAUS” becomes 111212119, using the same language how would be “VESALIO” written?  
A) 22416112913  
B) 22519112915  
C) 12195915215  
D) 15191513221  
E) 22519111915
2. In a big basket, there are 10 bags: each one of them contains a different number of chocolates, from 1 to 10. Five kids pick from the basket 2 bags each. Alex gets 5 chocolates, Ben 7, Chris 9 and Daisy 16. How many chocolates does Emily find in the last two bags?  
A) 9  
B) 12  
C) 13  
D) 17  
E) 18
3. “Every architect can draw. Jacob is an architect. Someone who uses AutoCAD is an architect.”  
If the previous information are true, which one of the following sentences is not necessarily true?  
A) Jacob can draw  
B) Someone who doesn't use AutoCAD is not an architect  
C) Jacob may not have AutoCAD  
D) Someone who uses AutoCAD can draw  
E) Someone who is not an architect doesn't use AutoCAD
4. Complete the sequence: 22-.....-37-57-97  
A) 33  
B) 27  
C) 46  
D) 32  
E) 12
5. Complete with the right couple Bizarre: ..... = .....: worn-out  
A) Extravagant-shabby  
B) Normale-shabby  
C) Strange- new  
D) Normale-kind  
E) Tired-shy

6. This table shows the number of people aged 20-35, 36-50, 51-65 who enjoyed a range of beauty treatments in a beauty centre on a Saturday.

Treatment	20-35	36-50	51-65
Face massage	21	32	45
Cryotherapy	18	22	36
Acupuncture	8	12	16
Ayurvedic massage	26	30	43
Sauna	10	21	30
Lymphatic drainage	31	26	15

In which of the other treatments was the proportion of the clients in the three age ranges closest to that for the face massage?

- A) Ayurvedic massage  
 B) Sauna  
 C) Cryotherapy  
 D) Lymphatic drainage  
 E) Acupuncture
7. <<According to the US Centers for Disease Control and Prevention, the second dose of the vaccine can be administered up to 42 days, or six weeks, after the initial inoculation. So if your appointment for a second dose was delayed or canceled due to winter weather, there should still be time to get fully vaccinated.

Both vaccines on the US market -- developed by Pfizer-BioNTech and Moderna -- require two doses to reach about 95% efficacy, and the second doses were intended to be administered 21 days and 28 days after the first, respectively.

The CDC's website says the agency still recommends the second dose be administered "as close to the recommended interval as possible."

"However, if it is not feasible to adhere to the recommended interval and a delay in vaccination is unavoidable," the website says, "the second dose of Pfizer-BioNTech and Moderna COVID-19 vaccines may be administered up to 6 weeks (42 days) after the first dose." The CDC is clear patients should not receive the second dose earlier than recommended, and there's still limited data on how effective the vaccines are if the second inoculation takes place beyond the six-week window.>> (CNN.com) Which of these statements cannot be inferred from this article?

- A) Extreme cold has slowed down the vaccine supply chain over the USA.  
 B) The Center for disease control and prevention stated that the second dose should be administered within a 21- to 28-day interval starting from the first dose.  
 C) BioNTech's vaccine has its second dose administered around 21 days after the first.  
 D) If the second dose is administered within a 6-week interval starting from the first dose, the inoculation provides an effective immunization.  
 E) Immunization can be achieved even if the second dose is administered a few days after the official prescription from BioNTech or Pfizer.

8. In spring, Rose is so happy since she can revitalize her vegetable garden. They proliferate so fast and Rose takes note of the amount of plants at the end of each week, beginning with the first of April and so on:

- 3 at the end of 1st
- 6 at the end of 2nd
- 15 at the end of 3rd
- 42 at the end of the month

According to this trend, how many plants does she find in her vegetable garden at the end of the 1st week of May?

- A) 123  
 B) 60

- C) 75
- D) 71
- E) 150

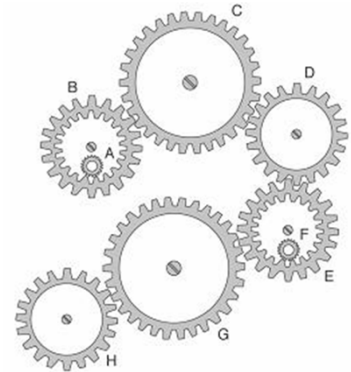
9. Complete the syllogism with the right sentence.

'No logic teachers are kind people. Some dictators are kind people.'

- A) Some dictators are not logic teachers
- B) Kind people are dictators
- C) Some dictators love logic
- D) Some logic teacher hate democracy
- E) Some dictators are logic teachers

10. The sprockets in the following system are free to rotate around a fixed pin. If sprocket C turns clockwise, in which direction does sprocket F turn?

- A) Counterclockwise
- B) In the same direction of sprocket A
- C) In the opposite direction to sprocket B
- D) In the opposite direction to sprocket H
- E) None of the answers are correct



11. In which city were the 1968 summer Olympics held?

- A) Mexico City
- B) Los Angeles
- C) Paris
- D) Tokyo
- E) Rio De Janeiro

12. Which of the following is not a work of Plato:

- A) Phaedo
- B) Theateteus
- C) Timaeus
- D) Nicomachean Ethics
- E) Defence of Socrates

13. Identify the incorrect relation:

- A) Centimeter - lenght
- B) Gallon - volume
- C) Acre - surface
- D) Pound - temperature
- E) Grain - mass

14. Where was the famous painter Vincent van Gogh born and raised?

- A) Zundert, Netherlands
- B) Paris, France
- C) London, England
- D) Berlin, Germany
- E) Brussels, Belgium

15. 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

**16. The author of the dystopian romance "1984" was:**

- A) Charlotte Bronte
- B) Thomas Eliot
- C) Agatha Christie
- D) Steven Spielberg
- E) George Orwell

**17. Which one of the following US presidents declared the "War on drugs" in 1971?**

- A) John F. Kennedy
- B) Ronald Reagan
- C) Richard Nixon
- D) Harry Truman
- E) George H. W. Bush

**18. How many member states are there in the Commonwealth of Nations?**

- A) 53
- B) 50
- C) 56
- D) 54
- E) 51

**19. Who was Winston Churchill succeeded by as Prime Minister of the UK in 1955?**

- A) Clement Attlee
- B) Margaret Thatcher
- C) Harold Macmillan
- D) Anthony Eden
- E) Harold Wilson

**20. Which of the following is nowadays the tallest building in the world? (NOTE: The ones that are not finished yet are not to be considered)**

- A) One World Trade Center, New York City, USA
- B) Kingdom Jeddah Tower, Jeddah, Saudi Arabia
- C) Burj Khalifa, Dubai, UAE
- D) Ping An Finance Center, Shenzhen, China
- E) Seoul Light DMC Tower, Seoul, South Korea

**21. Which singer and songwriter received the Nobel Prize in literature in 2016?**

- A) Bob Dylan
- B) Elton John
- C) Bruce Springsteen
- D) Paul McCartney
- E) Mick Jagger

**22. Where is Benghazi located?**

- A) Syria
- B) Lebanon
- C) Jordan
- D) Libya
- E) Israel

## Biology

### 23. The fermentation:

1. Is an oxidation
2. Transforms glucose into lactate
3. Produces lactate under aerobic conditions
4. Under anaerobic conditions can produce alcohol

Choose the correct answer:

- A) None of them
- B) 1,2 and 3
- C) 2 and 4
- D) 4 only
- E) 1 and 3

### 24. The Permeability Transition Pore (PTP), long studied in Paduan laboratories, is an ionic channel located on the inner membrane of the mitochondrion. It is believed to correspond to an ATP synthase that starts working in reverse.

Which may be the direct effects of this inversion?

- A) The ATP is consumed instead of being produced
- B) Sudden stop of protein translation
- C) The proton gradient is dissipated, thus reducing the functionality of the respiratory chain
- D) A and C are both correct
- E) Osmotic lysis

### 25. Lac operon is:

- A) A particular type of enzyme that digests lactose molecules
- B) Typically used by plants
- C) An example of the bacterial functioning unit of DNA transcription
- D) Secreted near the mammary glands
- E) Active in the first stages of human life

### 26. Which one of the following mutations always leads to a truncated protein?

1. Nonsense mutation
2. Missense mutation
3. Silent mutation
4. Frameshift mutation

Choose the correct answer:

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

### 27. Which of the following statements is correct about epistatic genes?

- A) Their expression is silenced by another gene
- B) They code for epiphyses
- C) They are a form of non-Mendelian inheritance
- D) They are frequently involved in hemostasis
- E) None of these

### 28. Tricarboxylic acid cycle:

- A) Occurs whenever the cell decides to
- B) Is carried out by eight enzymes

- C) Occurs only in the bacterial cytoplasm
- D) Reduces NADH to NAD<sup>+</sup>
- E) Results in four molecules of ATP, two of water and two of FADH<sub>2</sub>

29. Which of the following statements regarding Adenosine triphosphate is correct?

1. It is classified as a nucleotide triphosphate
2. It can be produced by glycolysis, the citric acid cycle / oxidative phosphorylation, and beta-oxidation.
3. It consists of three components: a nitrogenous base (inosine), the sugar ribose, and the triphosphate
4. It is one of four "monomers" required in the DNA synthesis only

Choose the correct answer:

- A) 3 and 4
- B) Only 1
- C) Only 2
- D) 1, 2 and 3
- E) None of them

30. Four students discuss transcription and translation. Marta says that transcription always requires RNA maturation, that, as a rule, in the prokaryotes, the translation occurs at the same time as the transcription and that all RNAs are destined to be translated into proteins. Silvia says that RNA maturation occurs only in prokaryotes, that in the RNA transcript, each Guanine of the DNA will be replaced with Thymine and disproves Martha's third statement by taking rRNA as an example. Marco says that the RNA maturation occurs only in Eukaryotes, that each Thymine of the DNA is replaced with Uracil and agrees with Silvia that not all RNAs are coding for proteins. Jonathan says that splicing is always required in order to create an mRNA molecule that can be translated into protein and agrees with Silvia's II and Marta's III statements.

students	I statement	II statement	III statement
Marta	Transcription always requires RNA maturation	Transcription and translation take place simultaneously in prokaryotes	all RNAs=proteins
Silvia	RNA maturation occurs only in prokaryotes	Each G of the DNA is replaced with T	rRNA is a type of non-coding RNA
Marco	RNA maturation occurs only in Eukaryotes	Each Thymine is replaced with Uracil	agrees with Silvia
Jonathan	splicing is always required, in order to create an mRNA molecule that can be translated into protein	agrees with Silvia	agrees with Marta

Which of them got it wrong in all statements?

- A) None of them, they are right on at least one statement
- B) Marco and Marta
- C) Jonathan and Silvia
- D) Marta and Silvia
- E) Jonathan

31. How many amino acids cannot be synthesized by the human body?

- A) 8
- B) 9
- C) 10
- D) 12
- E) 20

32. Ethanol is a product of alcoholic fermentation. It can be formed in:

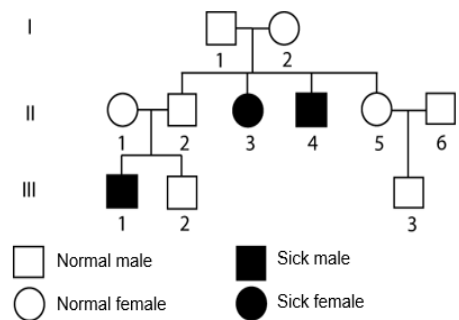
1. Prokaryotic cells
2. Eukaryotic cells
3. Prions
4. Viruses

Choose the correct answer:

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

33. Given this family tree, indicate which line of the table contains the correct information in regard to the disease. Please note that the three last columns indicate the genotype of the individuals involved.

Line	Dominance	Transmission	II-1	II-2	III-1
1	Recessive	Autosomal	Nn	Nn	nn
2	Dominant	Autosomal	NN	nn	NN
3	Recessive	X-linked	Nn	NN	nn
4	Dominant	X-linked	nn	Nn	NN
5	Recessive	Autosomal	NN	NN	nn



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

34. Given the following combinations, choose the one that correctly indicates which elements are exclusive only of prokaryotes and which only to eukaryotes. Some of them are common to both types of cell.

1. Nuclear Pore Complex
2. Centromere
3. Nucleotide
4. Ribosomes
5. Cytoskeleton
6. Histones
7. Plasmid
8. Introns
9. Nucleoid
10. Sex Pilus

- A) Prokaryotes: 2, 9, 6; Both: 3, 4, 7
- B) Eukaryotes: 3, 10, 6; Both: 7, 2, 4

- C) Both: 9, 4, 5
- D) Eukaryotes: 1,8,6; Prokaryotes: 9,10,7
- E) Eukaryotes: 2,1,6; Prokaryotes: 8,7,9

**35. Which of the following enzymes are involved in DNA replication?**

**telomerase topoisomerase primase RNA polymerase**

- A) All the options are correct
- B) 1 and 2
- C) 2, 3 and 4
- D) 1, 2 and 3
- E) 2 and 3

### Human Anatomy and Physiology

**36. Which of these following structures, necessary during fetal life, go into regression after birth?**

1. Foramen ovale
2. Ductus arteriosus
3. Umbilical artery

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

**37. The body is divided by the sagittal plane into:**

- A) Superior and inferior
- B) Right and left
- C) Ventral and dorsal
- D) Medial and lateral
- E) Proximal and distal

**38. Blood performs many important functions within the body, which of the following is NOT a blood function?**

- A) Supply of oxygen to tissues
- B) Removal of glucose, amino acids, and fatty acids
- C) Immunological functions
- D) Coagulation
- E) Messenger functions

**39. Which of the following organs is/are directly involved in the production and release of oxytocin?**

1. Breasts
2. Anterior pituitary
3. Hypothalamus
4. Posterior pituitary

- A) 1 and 2
- B) 1 and 3
- C) 2 and 3
- D) 3 and 4
- E) All of them

**40. In which of the following joints can we find a meniscus?**

- A) Hip



- B) Knee
- C) Elbow
- D) Wrist
- E) Ankle

### Chemistry

- 41. Oxygen is an element that presents three stable isotopes: O-16, O-17 and O-18. Considering that these isotopes are present in a 99,76: 0,04: 0,2 ratio, what is the final atomic weight of oxygen:**
- A) 16,00
  - B) 16,24
  - C) 16,36
  - D) 16,44
  - E) 16,56
- 42. Which of the following element is NOT a halogen?**
- A) Chlorine (Cl)
  - B) Fluorine (F)
  - C) Iodine (I)
  - D) Bromine (Br)
  - E) Oxigen (O)
- 43. Which one of the following molecules is a structural isomer of 2,4-dimethyl-2-pentene?**
- A) Heptyne
  - B) Methylcyclohex-2-yne
  - C) Cycloheptane
  - D) Benzene
  - E) 2-ethylpentane
- 44. A compound consists in 3 benzene rings joned together. Which of the following could be the formula?**
- A) C<sub>10</sub>H<sub>10</sub>
  - B) C<sub>14</sub>H<sub>10</sub>
  - C) C<sub>14</sub>H<sub>14</sub>
  - D) C<sub>18</sub>H<sub>18</sub>
  - E) C<sub>6</sub>H<sub>6</sub>
- 45. Alcohols can be oxidized to their respective carboxylic acid with two consecutive oxidation processes. Which of the following properties of the alcohol is necessary for the aforementioned process to occur?**
- A) The alcohol needs a chloride in the alpha position
  - B) The alcohol needs to have at least 3 carbon atoms
  - C) The alcohol must be tertiary alcohol
  - D) The -OH group needs be close to an acid carbon
  - E) The alcohol must be primary alcohol
- 46. About the reaction:  $Mg(s)+Cu^{2+}(aq) \rightarrow Mg^{2+}(aq)+Cu(s)$**
- 1. It is a heterogeneous reaction.**
  - 2.  $Mg^{2+}$  is oxidized**
  - 3. Cu is an oxidizing agent**
- Which of the following statements are correct?**
- A) Only 1
  - B) Only 2
  - C) 1 and 3
  - D) 2 and 3

E) 1, 2 and 3

47. 50 ml of a 0.80 M HCl solution are diluted with H<sub>2</sub>O until a final volume of 250ml has been reached. Determine the pH and concentration.

- A) pH: 2.69 Concentration: 0.002 M
- B) pH: 4 Concentration: 0.0002 M
- C) pH: 3.69 Concentration: 0.0002 M
- D) pH: 3.69 Concentration: 0.002 M
- E) pH: 4 Concentration: 0.002 M

48. In which of these compounds does Carbon have an oxidation number of 3?

- A) COCl<sub>2</sub>
- B) CO
- C) CO<sub>3</sub><sup>2-</sup>
- D) (CN)<sub>2</sub>
- E) CHCl<sub>3</sub>

49. A fixed amount of helium is present in a container at a 1 atm pressure and 25 °C. What's the final temperature of the gas if it undergoes an isovolumetric transformation and its final pressure is 2,5 atm?

- A) 745°C
- B) 472°C
- C) 472°K
- D) 62,5°K
- E) 62,5°C

50. In which of those compounds the oxidation numbers are wrong?

- A) H<sub>2</sub>SO<sub>4</sub> (+1,+6,-2)
- B) H<sub>2</sub>O<sub>2</sub> (+1,-1)
- C) KNO<sub>3</sub> (+1,+2,-1)
- D) H<sub>3</sub>PO<sub>2</sub> (+1,+1,-2)
- E) LiH (+1,-1)

51. Which of the following lines contains homogeneous mixtures only?

1	Wine	Pancake syrup	Natural gas
2	Spray paint	Smoke	Air
3	Fog	Blood	Granite
4	Coke	Hydrogen peroxide	Mayonese
5	Milk	Oil paint	Bronze

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

52. What is the electron configuration of a neutral atom of Scandium (Sc)?

- A) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>5</sup>
- B) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> 3p<sup>6</sup> 4s<sup>2</sup> 3d<sup>10</sup> 4p<sup>5</sup>
- C) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> 3p<sup>6</sup> 4s<sup>2</sup> 3d<sup>1</sup>
- D) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> 3p<sup>6</sup> 4s<sup>2</sup> 3d<sup>10</sup> 4p<sup>6</sup> 5s<sup>2</sup> 4d<sup>10</sup>
- E) 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>6</sup> 3s<sup>2</sup> 3p<sup>6</sup> 4s<sup>2</sup> 3d<sup>6</sup>

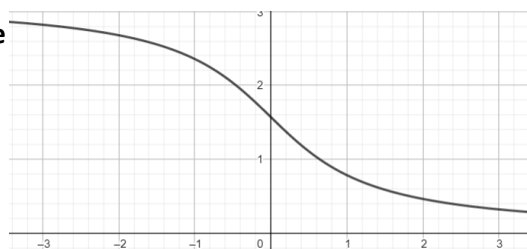
### Math and Physics

53. A tank has the shape of a rectangular solid. 37 hl of water have been poured in it. Knowing that the external sizes are 314 cm, 164 cm, 114 cm and that the solid is 7 cm thick, how many more liters are necessary to fill it?

- A) 800 l
- B) 900 l
- C) 400 l
- D) 4500 l
- E) 1600 l

54. Which of the following functions corresponds to the one represented in the image?

- A)  $x = \cot(y)$
- B)  $y = -1/2 x$
- C)  $y = \tan(x)$
- D)  $x = \tan(y)$
- E)  $x = -\sin(y)$



55. A dice has 12 faces, numbered from 1 to 12. The 12th has twice the probability of the other faces to show up when the dice is rolled. Which is the probability to get a multiple of 4 or 6 rolling the dice once?

- A) 7/12
- B) 1/3
- C) 5/13
- D) 7/13
- E) 5/12

56. A dive resort rents scuba equipment at a weekly rate of \$150 per week and charges \$8 per tank of compressed air used during the week of diving. What equation represents a diver's cost for one week of diving at the resort?

- A)  $y=8x-150$
- B)  $y=(150-8)x$
- C)  $7y=150+8x$
- D)  $y=8x+150$
- E)  $7y= (150+8)x$

57. The light bulb in your room has an electric power of 100 W, and, on average, it stays on 3 hours a day. You decide to switch to a low wattage model, with a quarter of the electric power. If, in your house, the cost of 1 kWh is 0.50 \$, how much money do you expect to save over a period of 30 days?

- A) 3.4 \$
- B) 340 \$
- C) 4 \$
- D) You spend more money because lower power means lower efficiency.
- E) 3.2 \$

58. The flow capacity rate of the Aorta vessel is  $Q = 80 \text{ cm}^3/\text{s}$ . What's the speed of blood in the small arteries knowing that the Aorta vessel splits into 200 small arteries, each of which has  $20 \text{ mm}^2$  of section.

- A) 2 cm/s
- B) 400 m/s
- C) 4 m/s
- D) 2 m/s

E) 40 m/s

59. How many of the following units of measurement are equivalent?

- $W \cdot s$
- $N \cdot s$
- $N \cdot m$
- $J$
- $kg \cdot m / s^2$

- A) They are all different  
B) Two  
C) Three  
D) Four  
E) They are all equivalent

60. What kind of thermodynamic process is described by the indicator diagram?

- A) Carnot cycle  
B) Adiabatic process  
C) Isothermal process  
D) Isochoric process  
E) Isobaric process

