

MEDICINA IN LINGUA INGLESE



Teoria ed esercizi commentati
per la preparazione ai test di ammissione

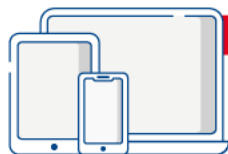
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Teoria ed **esercizi** commentati
per la preparazione ai **test di ammissione**

MEDICINA IN LINGUA INGLESE

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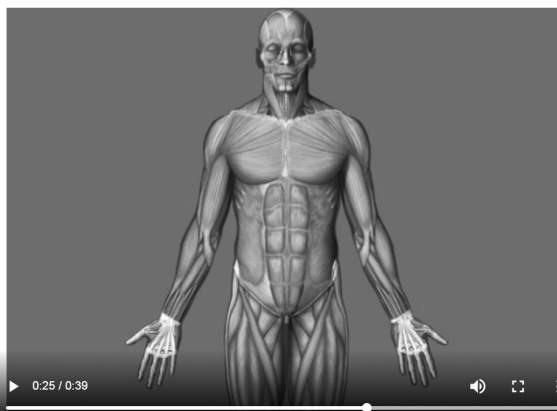
ATLANTE DI ANATOMIA VIRTUALE

Numerosi video con immagini tridimensionali e a colori in cui è illustrata la struttura del corpo umano a livello linfatico, nervoso, sistemico e morfologico.

Seleziona tra le voci del menu laterale gli argomenti di tuo interesse per visualizzare e comprendere l'anatomia dell'uomo.

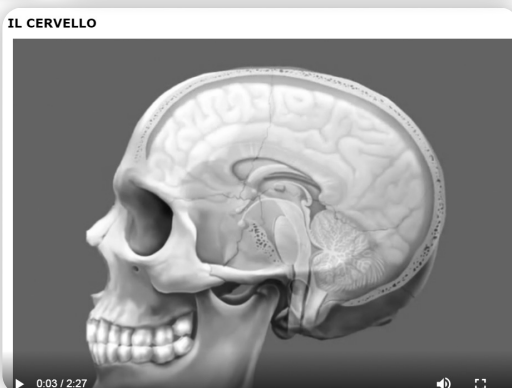
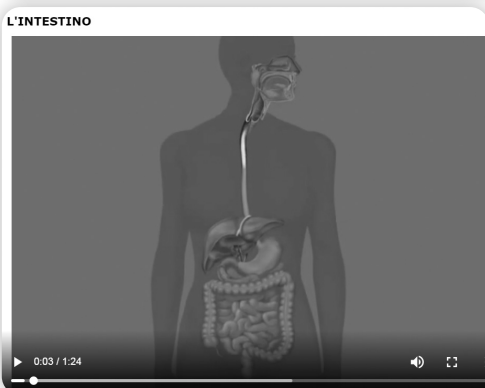
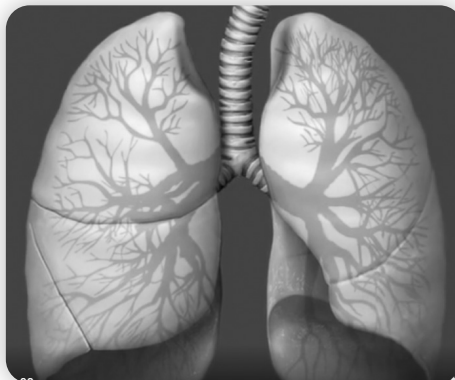
1. Gli elementi strutturali del corpo
2. La cellula
3. I cromosomi e il DNA
4. L'attività della cellula
5. I tessuti
6. La struttura del corpo
7. La pelle
8. La struttura dell'osso
9. Lo sviluppo e l'accrescimento dell'osso
10. Lo scheletro
11. La testa
12. La colonna vertebrale
13. Le mani e i piedi
14. Le articolazioni
15. I muscoli
16. Il tessuto muscolare
17. Il sistema nervoso
18. I nervi
19. Il sistema nervoso centrale
20. Il cervello
21. I neuroni
22. Le funzioni motorie del sistema nervoso
23. Il cinque sensi
24. Il tatto
25. La vista
26. L'udito
27. L'equilibrio
28. Il gusto
29. L'olfatto
30. La circolazione sanguigna
31. Il sangue
32. L'apparato cardiovascolare
33. I vasi sanguigni
34. Il cuore
35. Il sistema linfatico
36. L'immunità
37. Il sistema endocrino
38. L'apparato urinario

LA STRUTTURA DEL CORPO



Anatomia Umana Virtuale

LA PELLE

A 3D anatomical model of the human skin structure, showing a cross-section of the epidermis and dermis. The epidermis is the outer layer, and the dermis is the inner layer, containing various structures like hair follicles and sweat glands. A video player interface is visible at the bottom, showing a progress bar at 0:03 / 1:24 and control icons for play, volume, and full screen.



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Teoria & Test

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per la preparazione ai test di ammissione

MEDICINA IN LINGUA INGLESE

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PREFAZIONE

Rivolto a tutti i candidati al test di ammissione ai corsi di laurea in **Medicina e Chirurgia in lingua inglese**, questo volume costituisce uno strumento efficace di preparazione, fornendo tutte le **conoscenze teoriche** necessarie e una **raccolta di quiz svolti** per affrontare il test di ingresso, oltre a una serie di **informazioni utili** relative alla struttura della prova.

Il testo è organizzato in due sezioni, completamente **in inglese**.

La prima sezione, **Studio**, tratta in maniera approfondita le materie d'esame (Logical Reasoning, Biology, Chemistry, Mathematics and Physics) sulla base delle prove degli ultimi anni.

All'inizio di ogni capitolo è presente un **QR code** che rimanda a contenuti aggiuntivi, in italiano: esercizi, spiegazioni e approfondimenti. Per fruirne, è necessario accedere o registrarsi su **edises.it**.

La seconda sezione, **Esercitazione**, raccoglie numerosi quesiti a risposta multipla risolti e commentati. I **quiz, ripartiti per materia e argomento**, consentono un utile ripasso delle nozioni teoriche acquisite e offrono la possibilità di mettersi alla prova con quesiti analoghi a quelli realmente somministrati.

Il **codice personale**, contenuto nella prima pagina del volume, dà accesso a una serie di servizi riservati ai clienti tra cui:

- il **software di simulazione online** (infinite esercitazioni per materia, sulle prove ufficiali degli anni passati e simulazioni d'esame gratuite);
- materiali di approfondimento e contenuti extra.



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STUDY



CHAPTER 2

Classical algebra



2.1 • Monomials and operations on monomials

A *monomial* is an algebraic expression that does not include additions or subtractions. It is represented as the product of a number (*coefficient*) and powers of variables with different bases (literal part):

$$\frac{1}{3}a^2bc^3 \quad \text{coefficient} = \frac{1}{3}, \text{ literal part} = a^2bc^3.$$

Two monomials with the same literal part are called similar monomials: $\frac{3}{2}a^2b$ and $-5a^2b$

Two similar monomials with opposite coefficients are called opposite monomials:

$$-\frac{3}{2}ab, \quad \frac{3}{2}ab$$

●○ Degree of a monomial

- **with respect to a variable:** it is the exponent with which the variable appears.

$$3x^2yz^5 \left\{ \begin{array}{l} \text{Degree with respect to } x : \alpha = 2 \\ \text{Degree with respect to } y : \alpha = 1 \\ \text{Degree with respect to } z : \alpha = 5 \\ \text{Degree with respect to any variable not appearing in the expression: } \alpha = 0 \end{array} \right.$$

- **overall degree:** it is the sum of the exponents of all the variables appearing in the literal part $-2x^3y^5z$ the overall degree is $\beta = 3 + 5 + 1 = 9$.

2.1.1 • Algebraic operations

●○ Sum of similar monomials

The algebraic sum of similar monomials is a monomial similar to the given monomials, with the coefficient being the algebraic sum of the coefficients:

$$\frac{3}{10}x^2 + \frac{1}{2}x^2 - 5x^2 + x^2 = \left(\frac{3}{10} + \frac{1}{2} - 5 + 1\right)x^2 = -\frac{16}{5}x^2$$

●○ Multiplication

The product of two or more monomials is a monomial with the coefficient being the product of the coefficients and the literal part being the product of the literal parts:

$$(-3a^2b) \cdot \left(-\frac{1}{6}a^5b^3c^4\right) = (-3) \left(-\frac{1}{6}\right) (a^{2+5}b^{1+3}c^4) = \frac{1}{2}a^7b^4c^4$$



●○ Power

The n -th power of a monomial is obtained by raising both the coefficient and each variable in the literal part to the n -th power:

$$\left(-\frac{1}{2}x^3yz^2\right)^3 = \left(-\frac{1}{2}\right)^3 (x^3)^3 (y)^3 (z^2)^3 = -\frac{1}{8}x^9y^3z^6$$

●○ Quotient of integer monomials

A monomial A (dividend) is said to be divisible by a monomial $B \neq 0$ (divisor) if there exists a third monomial Q (quotient) such that, when multiplied by the divisor, it gives the dividend:

$$\frac{A}{B} = Q \quad \text{se} \quad Q \cdot B = A$$

For A to be divisible by B , it is necessary that A contains all the variables in B , each with an exponent greater than or equal to the respective exponent in B . The monomial Q will have as its coefficient the ratio of the coefficients of A and B , and as its literal part, all the variables of A raised to the difference between their respective exponents in A and B :

$$\frac{\frac{3}{4}x^4y^3z^2}{-2x^2y^3z} = \left(\frac{3}{4}\right)\left(-\frac{1}{2}\right)x^{4-2}y^{3-3}z^{2-1} = -\frac{3}{8}x^2y^0z^1 = -\frac{3}{8}x^2z$$

2.1.2 • Greatest common divisor (G.C.D.) and least common multiple (l.c.m.)

●○ G.C.D.

The G.C.D. of two or more monomials is a monomial whose literal part is the product of the common variables, taken once with the smallest exponent, and whose coefficient is the G.C.D. of the coefficients, taken as a positive number if the coefficients are integers, or as “+1” if one of the coefficients is not integer:

$$8x^4y^2z, -12x^2y^4, 4x^6yz^3: \quad \text{G.C.D.} = 4x^2y$$

$$\frac{1}{3}a^2b^3c^5, -3a^5b^4c, 2a^5b^7: \quad \text{G.C.D.} = a^2b^3$$

●○ l.c.m.

The l.c.m. of two or more monomials is a monomial whose literal part is the product of the common and non-common variables, taken once with the largest exponent, and whose coefficient is the l.c.m. of the coefficients, taken as a positive number if the coefficients are integers, or as “+1” if one of the coefficients is not integer:

$$-5x^2y, 10x^3y^4z^3, 20x^5y^3z^2: \quad \text{l.c.m.} = 20x^5y^4z^3$$

$$-\frac{1}{2}x^4y, 3x^2yz^5, 2xy^3: \quad \text{l.c.m.} = x^4y^3z^5$$



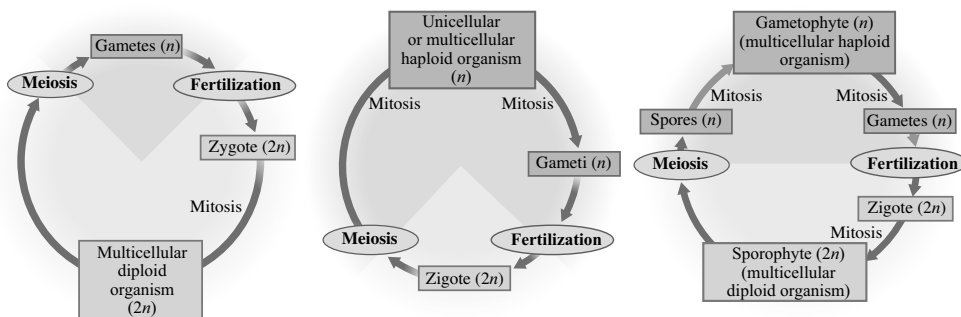
CHAPTER 4

Reproduction and Inheritance



4.1 • Life cycles

Life cycles of organisms are not all identical. Some representative life cycles are depicted in Fig. 4.1, where it is evident that in sexually reproducing organisms, meiosis occurs at different points in each life cycle.



•• **Figure 4.1 Representative life cycles.** (a) In animals, the organism is diploid ($2n$) for most of its life cycle; its somatic cells (diploid) divide by mitosis. The haploid phase (n) is very short, limited to the gametes produced during gametogenesis through meiosis. The fusion of gametes results in the formation of a new diploid individual. (b) Many simple eukaryotes, unicellular or multicellular (e.g., some fungi and algae), remain haploid (n) for most of their life cycle, dividing through mitosis. Two haploid gametes, produced by mitosis, fuse to form a diploid zygote ($2n$) that undergoes meiosis to restore the haploid state. (c) The life cycle of plants and some algae exhibits an alternation of generations, involving a multicellular diploid state ($2n$) called the sporophyte and a multicellular haploid state (n) called the gametophyte. A sporophyte produces haploid spores through meiosis. These spores divide via mitosis, forming haploid gametophytes, which produce gametes by mitosis. Male and female gametes fuse to create a new multicellular diploid sporophyte. In higher plants, including flowering plants (angiosperms), the diploid sporophyte, comprising roots, stems, and leaves, is the dominant form, while the gametophytes are small.

4.2 • Asexual and sexual reproduction

The survival of each species relies on the ability of individuals to reproduce. There are two primary forms of reproduction: asexual and sexual.

In **asexual reproduction** (*agamogenesis* or *vegetative* reproduction), a single parent, typically through processes such as *fission* (or *schizogony*), *budding*, or *fragmentation*, generates two or more individuals without fertilization (Fig. 4.2). These new organisms arise via mitosis from the parental individual, making them genetically identical to the parent, barring spontaneous mutations. This mode of reproduction is advantageous in stable environmental conditions. Examples of animals that reproduce asexually

include *porifera* (common sponges), *cnidaria* (small marine organisms with a polyp-like shape), *echinodermata* (starfish), and *platyhelminthes* (flatworms). In plants, for instance in flowering plants, asexual reproduction may involve modified stems (*rhizomes*, *tubers*, *bulbs*, *corms*, *stolons*), roots (production of *suckers*), or leaves (production of *plantlets* along the edges of the leaves). **Parthenogenesis** (the development of an unfertilized egg into a new individual, typically haploid) is another form of asexual reproduction. It is common among **insects** (especially bees and wasps), although it is also found in some species of **vertebrates** (e.g., fish and reptiles).

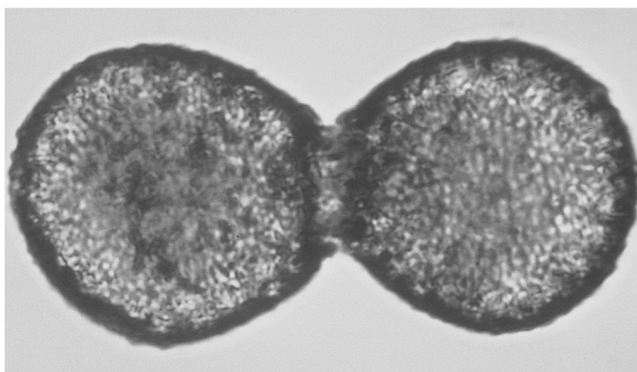
In contrast, **sexual reproduction** involves the formation of a new individual through the union of male (*sperm*) and female (*egg*) gametes (Fig 4.3). Sexual reproduction leads to an increase in *genetic variability* (§ 2.7.2), that is, a reshuffling (recombination) of genes. As a result, living species that reproduce sexually have a greater ability to adapt to environmental changes.

Sexual reproduction includes two essential processes:

- 1) **meiosis**, which causes the transition from the **diploid** condition (chromosome number $2n$) to the **haploid** condition (chromosome number n) (Fig. 4.4);
- 2) **fertilization**, the fusion of male and female gametes, which restores the diploid condition in the zygote. The zygote develops into a new individual through successive divisions (mitosis) of somatic cells.

Regarding diploidy, it is important to note that each chromosome is present in pairs: the two chromosomes of each pair (*remembering that one is of maternal origin and the other of paternal origin*) are called **homologous chromosomes**. The *diploid* organism is represented as $2n$ (where n indicates the number of chromosomes in the haploid state; in humans, $2n = 46$) (Fig. 4.4).

Reproductive cells or gametes, from whose union the individual of the next generation originates, are *haploid*, with a chromosome number equal to n (in humans, $n = 23$). Gametes are formed in the **gonads**. In animals, male gonads are the **testes**, and female gonads are the **ovaries**. In plants, male gonads are the *stamens*, and female gonads are the *ovaries*.



•• **Figure 4.2 Asexual reproduction.** This unicellular amoeba reproduces through mitosis, dividing into two parts that form two new amoebas, identical to the parent.

EXERCISE



CHAPTER 1 | Text Comprehension

1) “The contrast between Rousseau and Nietzsche can be illustrated precisely by the different attitudes each expresses regarding the naturalness and artificiality of equality and inequality. In his *Discourse on the Origin of Inequality*, Rousseau starts from the consideration that men are born equal, but that civil society—that is, the society that slowly superimposes itself upon the state of nature through the development of the arts—has made them unequal. Nietzsche, on the contrary, starts from the premise that men are by nature unequal (and it is a good thing they are, because, among other reasons, a society founded on slavery like that of Ancient Greece was, precisely due to the existence of slaves, an evolved society) and only society, with its herd mentality, its religion of compassion and resignation, has made them all equal. That same corruption which, for Rousseau, generated inequality, has, for Nietzsche, generated equality. Where Rousseau sees artificial inequalities—and therefore to be condemned and abolished because they conflict with the fundamental equality of nature—Nietzsche sees an artificial equality, and therefore to be loathed as it diminishes the beneficial inequality that nature intended to reign among men. The antithesis could not be more radical: in the name of natural equality, the egalitarian condemns social

inequality; in the name of natural inequality, the inegalitarian condemns social equality. (...) The idea formulated here, according to which the distinction between Left and Right corresponds to the difference between egalitarianism and inegalitarianism (...) is positioned at such a level of abstraction that it can serve, at most, to distinguish two ideal types. (...) I repeat once more that I am not saying that greater equality is a good and greater inequality an evil. As I stated from the beginning, I suspend all value judgments (...). Moreover, if equality can be interpreted negatively as leveling, inequality can be interpreted positively as the recognition of the irreducible uniqueness of every individual. There is no ideal that is not ignited by great passion. Reason, or rather the reasoning that brings forth arguments pro and con to justify one’s choices before others, and first of all before oneself, comes later. For this reason, great ideals withstand time and changing circumstances and are, to one another, irreducible. The drive toward ever-greater equality among men is, as Tocqueville observed in the last century, irresistible. (...) Never before in our era have the three main sources of inequality—class, race, and sex—been so questioned. The gradual equalization of women to men, first in the small society of the family, then in the larger civil and political society, is one of the surest signs of the unstoppable march of the human race toward equality.”

From Norberto Bobbio,
Right and Left, 1994

ONLY ONE of these deductions follows from the reported text. Which one?

- A. The fact that history proceeds toward ever-greater equality implies that the Nietzsche-inspired conception, which supports inequality, will sooner or later cease to exist.
- B. Bobbio recognizes an unequivocally and undeniably more positive function in leftist movements, as they are characterized by egalitarian utopia, than in right-wing movements.
- C. Seeing inequality as the recognition of the irreducible uniqueness of the individual characterizes Nietzscheanism which, having been defeated by history, is destined to disappear.
- D. If adherence to the party of equality is mostly passionate, adhering to the opposite party is generally the result of a process, however debatable, of rational analysis.
- E. The contrasting conceptions of the “state of nature” held by Rousseau and Nietzsche have been adopted as the foundation for different ideal projects.

2) “Richard C. Lewontin, an eminent population geneticist at Harvard University, and Martin Kreitman, his young collaborator, are sequencing a particular gene in several varieties of *Drosophila*. *Drosophila* is the world-famous fruit fly that has served as the preferred testing ground for geneticists for over half a century. The gene whose sequence Kreitman and Lewontin are analyzing directs the synthesis of a rather common enzyme, an alcohol dehydrogenase, which is ideal for identifying the often infinitesimal genetic differences between individuals of the same species. In genetics, these differences are called polymorphisms. The best-known case in humans is that of blood groups (A, B, AB, O). One of the most surprising results of Kreitman

and Lewontin’s research is that the silent regions of genes, known as introns, mutate at exactly the same frequency as the coding regions, known as exons. These dormant segments, found within the genes of higher organisms, are never ‘translated’ or ‘expressed’ into finished products—that is, into proteins.”

Which of the following statements is NOT derived from the passage?

- A. *Drosophila* has been studied by geneticists for a long time.
- B. Alcohol dehydrogenase is an enzyme.
- C. Genetic differences between individuals of the same species are called polymorphisms.
- D. Blood group polymorphisms are different from enzyme polymorphisms.
- E. Regions of genes are divided into introns and exons.

3) “The island of Crete is in a particularly favorable geographical position: stretching from West to East, it serves as a natural bridge from the Peloponnese to Asia Minor. Its predominantly mountainous character allows for land exploitation only in small areas: the Chania coastal strip, the Heraklion plain (where Knossos is located), the eastern coastal plain where Zakros lies, and the Messara plain, which is home to Phaistos and Agia Triada. The very layout of the palaces at the center of these flat areas immediately reveals their primary function: the collection and redistribution of agricultural products. In the Neolithic period, with the transformation of man from hunter to farmer, the transition from the oldest cave settlements to open-air settlements was most likely linked to the development of agriculture. No traces remain of the first open-air settlements, which were presumably huts made of straw and mud. The oldest structures date back to the Sub-Neolith-



ic/Early Minoan I period and, despite their simplicity, bear witness to a form of housing tied to agriculture. The floor plan of a house in Magasà (circa 2800 BC) features an entrance opening onto a vestibule, perhaps used as a warehouse, from which one passes into a single room. This structure contains within it the two typical elements of Minoan architecture.”

On which of the following topics is NO information provided by the text?

- A. The morphology of the island of Crete.
- B. Land use during the Minoan era.
- C. The transition from the Paleolithic to the Neolithic.
- D. The topography of private buildings.
- E. The topography of public buildings.

4) “Penelope’s web, or Who is deceiving Whom. Many years ago, there lived in Greece a man named Ulysses (who, although wise enough, was very cunning) married to Penelope, a beautiful woman of many talents, whose only flaw was an immoderate passion for weaving—a habit thanks to which she had been able to spend long periods alone. Legend has it that every time Ulysses, with his cunning, discovered that—despite his prohibitions—she was preparing to start yet another one of her endless webs, he could be seen at night quietly preparing his boots and a good boat; then, without saying a word to her, he would set off to roam the world and find himself. In this way, she managed to keep him away while she flirted with her suitors, making them believe that she wove because Ulysses was traveling, and not that Ulysses was traveling because she wove—as Homer might have imagined, who, however, as is well known, sometimes nodded off and noticed nothing at all.”

From Augusto Monterroso: “The Black Sheep and Other Fables”

This non-conformist interpretation of the legend of Ulysses allows for some inferences; among those formulated here, one is NOT authorized by the text. Identify it.

- A. Penelope’s passion for weaving was a pretense; in reality, she desired to be left alone and to flirt freely with her suitors.
- B. If Homer had not, as is well known, sometimes nodded off, he might have imagined the true reason why Ulysses traveled.
- C. It is very difficult for a person who is reasonably wise to also be capable of cunning.
- D. Knowledge of the world and the search for oneself are the purpose, not the cause, of Ulysses’ travels.
- E. Penelope loves to flirt with her admirers, convincing them that she virtuously weaves because Ulysses is away.

5) “In the south transept of Chartres Cathedral, in what is perhaps the most beautiful of medieval stained-glass windows, the four Evangelists are depicted as dwarfs sitting on the shoulders of the four prophets of the Old Testament: Isaiah, Jeremiah, Ezekiel, and Daniel. When I saw these windows for the first time, it was 1961 and I was a boastful young student who immediately recalled Newton’s famous aphorism – (...) – and believed I had made an important discovery revealing the famous physicist’s lack of originality. Years later, having become more humble, I discovered that Robert K. Merton, the celebrated sociologist of science from Columbia University, had dedicated an entire book to the use of this metaphor before Newton (...) Although Merton constructed his book as a pleasant journey through the intellectual life of medieval and Renais-

CHAPTER 1 | Matter

1) **D.** The defining characteristic of a specific element X is that all its atoms have the same number of protons, which represents the atomic number Z. In fact, its atoms also have the same number of electrons, as they are neutral. Since they exist in nature as a mixture of isotopes, they do not all have the same number of neutrons and therefore differ in their mass number A, as this number is given by the sum of the number of protons and the number of neutrons.

2) **B.** According to Proust's law, in every compound, the numerical ratio between the masses of elements X and Y is definite and constant. Conversely, in a mixture, the ratio between X and Y can vary as desired. When combined in a compound, X and Y exhibit different properties from those they have in the uncombined state; in mixtures, however, X and Y retain their properties. Pure X and Y can be obtained from both a compound and a mixture; in the former case, a chemical transformation is required, while in the latter, separation occurs through physical transformations.

3) **C.** The mixture of water, salt, and copper consists of two phases: a solution of water and salt, and copper which is insoluble in water. First, the copper must be removed via filtration, and subsequently, the water must be evaporated: pure salt is thus obtained from the filtrate.

4) **E.** The number of neutrons is calculated by the difference between the mass number (shown as a superscript to the left of the element symbol) and the atomic number Z (shown as a subscript to the left of the element symbol). The neutrons present in the proposed atoms are: $120 - 50 = 70$ for Sn; $123 - 51 = 72$ for Sb; $128 - 52 = 76$ for Te; $127 - 53 = 74$ for I; and $133 - 55 = 78$ for Cs, which is therefore the atom with the greatest number of neutrons.

5) **C.** According to Proust's law, the weight ratio in which two elements combine to form a compound is definite and constant; in this case, in the compound CO_2 , it is 3(C):8(O). Therefore, the kilograms of oxygen that combine with 4,5 kilograms of carbon are calculated from the proportion: $3 \text{ kg (C)} : 8 \text{ kg (O)} = 4,5 \text{ kg (C)} : x \text{ kg (O)}$, resulting in $x = 12 \text{ kg}$.

CHAPTER 2 | The orbital atomic model

6) **C.** The symbol [Ne] indicates the electron configuration of the noble gas neon, which corresponds to 10 electrons. The other 6 can only be found in the orbitals. Of

the only two alternatives that include 6 electrons, one must be excluded because it does not follow Hund's rule.

7) D. The energy of an orbital depends on the principal quantum number and increases as this number increases. The spin quantum number is related only to the direction of rotation (clockwise or counter-clockwise) of the electrons occupying the orbital, and the magnetic quantum number expresses only the spatial orientation of the orbital.

8) B. An electron in an excited state has higher energy than it has in the ground state; it follows that in the transition described in the question, the electron emits energy. Note that the emission of energy is the only phenomenon that occurs during the transition of an electron from one energy state to another.

9) D. A consequence of the Pauli principle is that two electrons can occupy the same orbital, thus having three identical quantum numbers (principal, secondary/azimuthal, and magnetic). However, the two electrons must differ in the fourth quantum number, the spin number, which takes the only possible values (+1/2 and -1/2); therefore, the two electrons have antiparallel rather than parallel spins. Furthermore, note that an orbital cannot contain a third electron, as it would have a spin number identical to one of the two electrons already present in the orbital.

10) B. The atomic number $Z = 12$ indicates that level 1 is complete (2 electrons), level 2 is also complete (8 electrons), and therefore the remaining 2 electrons can only be found in the orbital with the next highest energy, belonging to level 3, specifically in the 3s subshell. The electron configuration of magnesium is, in fact, $1s^2, 2s^2, 2p^6, 3s^2$.

CHAPTER 3 | The Periodic Table

11) D. Avogadro's number ($6,02 \cdot 10^{23}$) corresponds to the number of molecules contained in 1 mol; therefore, the number 3 by which it is multiplied indicates that the molecules present in the sample are contained in 3 mol. By observing the molar masses (MM) of the samples and their masses, it is clearly noted that only 234 is triple 78, which, expressed in g/mol, represents the mass of 1 mol. The H_2S , H_2O , and $CHBr_3$ samples correspond to 0,5 mol, 2 mol, and 1 mol respectively, while the CO_2 sample is slightly more than 1 mol.

12) B. It is sufficient to observe the numerical subscript (4) of oxygen in the formula of phosphoric acid to understand that in 1 mol of H_2PO_4 (i.e., in 98 g), there are $4 \times 16 \text{ g} = 64 \text{ g}$ of oxygen. Therefore, in 3 mol of acid, there are $3 \times 64 \text{ g} = 192 \text{ g}$ of oxygen.

13) D. Only the number of grams is not equal. In fact, the volume reported in the text (3 L) is the same for both gases. Under the temperature and pressure conditions



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