

LOGIC AND GENERAL KNOWLEDGE

- 1) Nick Shorts is studying for his biochemistry exam. Today he is tired of studying and he decides to take some time off reading some Nietzsche. Unfortunately, some raspberry jam drops on his book, thus making part of the passage incomprehensible. What are the words that most likely fit in place of the numbers?
“True __ (1) __ reach for the future with a creative hand and everything that is and was becomes a means, a __ (2) __, a hammer for them. Their “knowing” is creating, their creating is a __ (3) __, their will to truth is – will to power. – Are there philosophers like this today? Have there ever been philosophers like this? Won’t there have to be philosophers like this?”.
[Nietzsche, “Beyond good and evil”]
- A) (1) men; (2) alienate; (3) philosophy
B) (1) philosophers; (2) tool; (3) legislating
C) (1) powerful; (2) aware; (3) abstraction
D) (1) philosophers; (2) tool; (3) idea
E) (1) capitalists; (2) alienate; (3) generosity
- 2) **All the students who graduate in July have an IQ higher than the average. Taking this assertion into account, which of the following statements is surely false?**
- A) Maffe, who graduated in July, surely has an IQ higher than the average
B) Sben, who graduated in October, has an IQ higher than the average
C) Jack, who graduated in October, surely has an IQ higher than the average
D) None of those who do not graduate in October has an IQ higher than the average
E) Those who graduate in March are also intelligent
- 3) **Which of these couples of terms logically satisfies the following assertion:
x: actors = pack : y**
- A) x = background actors; y= sharks
B) x = men; y = brothers
C) x = director; y= prey
D) x = cast; y = wolves
E) x = group; y = film
- 4) **Which of these couples of terms logically satisfies the following assertion:
x= grey; y= blue**
- A) x= olivine; y= plum
B) x= anthracite; y= indigo
C) x= slate; y= tiziano (shade of red)
D) x= crimson; y= indigo
E) x= ivory; y= strawberry
- 5) **Ago, Corra and Torre want to check who of them has the fastest car. Torre says: “My car is surely the fastest, Ago doesn’t have the fastest one!” Corra warns: “Never trust Torre...” Ago insists Torre doesn't lie and really does drive the fastest car.
Knowing that only one is telling the truth, who has the fastest car?**

- A) Corra lies, Torre has the fastest car
 B) Corra has the fastest car and is the only one telling the truth
 C) There aren't enough information to answer this question
 D) Ago has the fastest car
 E) Ago has the fastest car and Corra isn't telling the truth.
- 6) **Jonji comes to uni on his moppet when he isn't using his car. Today, his brother needs his car, so we are definitely going to see him drive his moppet. Which of the following statements has the same logical foundation of the aforesaid reasoning?**
- A) Cenci is constantly dubious about what to do. Tonight he doesn't know whether he is fancying parmigiana or a steak, therefore he decides to have both
 B) Ale buys only red jewelry. Today she is wearing a yellow necklace, therefore it's likely she didn't buy it herself
 C) Astrid either goes to the pool or to the gym when she is not studying. Today she doesn't have to study and the pool is closed, so we will surely find her at the gym
 D) Enriquez always has either lemon flavored or orange flavored popsicles. The bar has both flavors today, so we are surely going to see him with a lemon one
 E) Tall boys play the guitar very well. Mage is extremely tall, therefore he is surely an excellent guitarist
- 7) **Find the element out of place:**
- A) protection
 B) prognosis
 C) probability
 D) prostration
 E) process
- 8) **Shower gel is now used much more than soap when people take a shower. This is unfortunate. Shower gel requires much more packaging which means more rubbish. There is also a tendency for people to use more of it when washing in comparison with soap. Therefore, more natural resources are consumed in the manufacturing process than they would be if people used only soap. So, the trend towards shower gel is bad for the environment. This is because it creates more problems of waste disposal and uses up more resources than soap. We should make people more aware of the environmental impact of such simple decisions. Which one of the following is the main conclusion of the above argument?**
- A) The use of shower gel increases the problems of waste disposal
 B) It is unfortunate that shower gel has become more popular than soap
 C) The manufacture of shower gel is more wasteful of natural resources
 D) The increased popularity of shower gel is bad for the environment
 E) People should be made more aware of the environmental consequences of choosing shower gel
- 9) **On average, 11 years old children of smokers are shorter than the children of non-smoking parents. Therefore, parental smoking tends to reduce the growth rate of children up to 11 years old. Which of the following statements explain what is wrong with this argument?**
- A) By 18 years of age, children of parents who smoke might be the same height, on average, as the children having parents who do not smoke

- B) Lower average heights in 11 year olds may be associated with parental smoking, but not caused by it
- C) Children of smokers may be shorter on average at 11 years old, but this does not mean that all children of smokers are shorter than all children of non-smokers at this age
- D) Even though they are shorter, the children of parents who smoke might be better developed physically in other ways than the children of non-smokers
- E) Children of parents who smoke may have a higher rate of growth after the age of 11, thus reaching the same height of children of parents who do not smoke by the time they become adult

10) “As one of the millions around the world watching the much anticipated Live Earth concerts, I found myself increasingly irritated by the artists chosen to make us all more aware of the damage we are doing to the environment. Fly less, drive less, waste less, recycle more. Yet these pop stars rack up thousands of miles a year on increasingly large world tours, leading to higher sales of CDs, which in turn produce thousands of tonnes of waste in plastic packaging. They own private jets, fleets of cars, and heat and light huge mansions that are empty for half the year. They then go and pocket extra cash and exposure advertising cars and soft drinks. By taking part, the artists increase their public profile and gain exposure to new audiences, thereby landing bigger tours, selling more CDs and being able to buy more planes, cars and houses, all whilst encouraging me to give up my holidays and cycle to work. Rather than let these people lecture me about what I could do, I left my TV on standby and went for a drive.”
If true, which of the following present effective challenges to the position taken by the writer?

- 1) Pop stars and celebrities have a broader appeal than politicians and environmentalists and are more likely to influence the public
 - 2) By becoming more aware of themselves, the artists will start to do more to raise awareness of environmental issues
 - 3) The artists weren't paid to perform and therefore did not gain financially from the concert
- A) 1 only
 - B) 2 only
 - C) 1 and 2 only
 - D) 2 and 3 only
 - E) All of the above

11) “Despite the growing problem of eating disorders among young women, the media still contribute to the problem by featuring photographs of models far thinner than most ‘ordinary’ people. On the one hand they publish articles about the dangers of anorexia and bulimia, but on the other hand they use images of excessively thin models to promote the latest fashions.”

- Which one of the following could be drawn as a conclusion of the passage above?**
- A) Young women are more influenced by photographs in the media than by articles about eating disorders
 - B) The print media are unaware of the effects of the photographs they publish
 - C) The print media are inconsistent in their approach to this issue
 - D) The public are only interested in fashion models who are extremely thin
 - E) The dangers of anorexia and bulimia are insufficiently understood

12) **Recent research has shown that people who keep pets tend to live longer than those who do not. The explanation seems to be that factors such as increased exercise (for dog or horse owners), the soothing properties of stroking a furry animal (such as a cat) and the emotional benefits of affectionate relationships combine to benefit human longevity. Everyone who can own a pet, should do so. Obviously this suggestion is not appropriate to people who are allergic to animals.**

Which of the following is an assumption of the above argument?

- A) People who have allergies can never have pets
- B) The more pets a person keeps, the longer s/he will live
- C) Dogs, horses and cats are always affectionate to humans
- D) People who have never kept pets may not appreciate their benefits
- E) Everyone should try to live longer

13) **Increases in blood pressure associated with old age are endemic in developed countries, but are rarely seen in underdeveloped countries where people tend to maintain a high level of physical activity throughout their lives. At the other end of the age-range, obesity and diabetes are more common among young people in developed countries, where largely sedentary lifestyles give limited opportunity for exercise.**

Which one of the following can be drawn as a conclusion from the passage above?

- A) Further gains in longevity in developed countries will not be achievable without a change in lifestyle
- B) People who do not take sufficient exercise will suffer from obesity and diabetes
- C) People gain no benefit from physical activity unless it continues into old age
- D) Lifelong exercise is associated with maintaining good health
- E) Young people are more affected by lack of exercise than old people

14) **As every morning, Mini wakes up early to go to class with his amazing Morini. Leaving from QT8 he goes North for 5 minutes, then turns left and continues straight on for 2 minutes, then he turns right and continues for 3 minutes, turns right again and continues for 3 minutes. He turns North and after 6 minutes he turns left for the last minute and a half of travel time arriving at Sacco hospital. Knowing that for the first half of the journey Mini travels at 30km/h, and in the second half, after having realized that he is late for class, he increases his velocity by 1/3, how far are QT8 and Sacco hospital as the crow flies?**

- A) 8 km
- B) 7 km
- C) 9 km
- D) 10 km
- E) Morini falls apart on the motorway

15) **Sacco F.C. joins a football tournament with 8 teams, where each team plays against all the other teams only once. The only possible outcomes are victory or defeat and 28 games are played. These are the final standings with some results:**

TEAMS	WINS	LOSSES
Sacco F.C.	?	?
Team II	3	?

Team III	?	5
Team IV	3	4
Team V	4	?
Team VI	6	?
Team VII	?	5
Team VIII	?	6

How many games did Sacco F.C. win?

- A) 5
- B) 4
- C) 7
- D) 6
- E) 3

- 16) Bob, Dave and Passe are three medical students. They have very different averages of grades, but the mean of their averages is equal to 27.5. If Passe's average is 28, and Dave's average is 2 points lower than Bob's average, what is Bob's average?**

- A) 29
- B) 28.25
- C) 28.5
- D) 28.66
- E) 28.75

- 17) Tommaso is doing some workouts. He wants to increase the number of push-ups that he does every day. On day 1, he does 5 push-ups; on day 2, 11; on day 3, 19; on day 5, 41, and on day 6, 55 push-ups. How many push-ups did he do on day 4?**

- A) 27
- B) 28
- C) 29
- D) 30
- E) 36

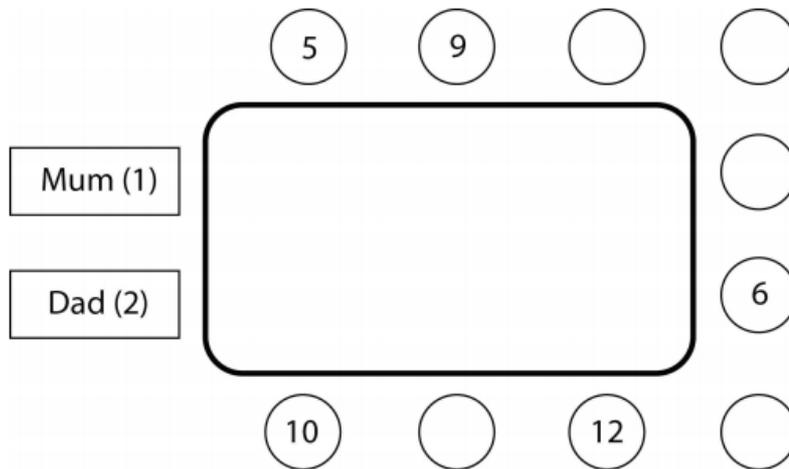
- 18) Matthew Shoe wants to buy some Nutella. He goes to the supermarket and he sees it's on offer! What a beautiful day! Usually, a small jar contains 75g, a medium jar contains 150g, and a large jar contains 300g. At the moment, each jar contains 20% extra product for the normal price. In addition, if you buy a large jar you get a small jar for free. If you buy a large one, what is the total extra percentage of Nutella that you get for the normal price?**

- A) 25%
- B) 45%
- C) 50%
- D) $\frac{2}{3}$
- E) $\frac{3}{5}$

19) Marco and Francesco are affected by a serious form of kleptomania; for this reason, they have to take a pauperizing drug that is proportional to their body weight. Marco weighs 60 kg and Francesco weighs 100 kg. Two identical bottles of drug contain, in total, the dose necessary for both Marco and Francesco. What is the exact dose that Francesco should take?

- A) One bottle and one sixteenth
- B) One bottle and one fifth
- C) One bottle and a quarter
- D) One bottle and one sixth
- E) One bottle and one tenth

20) Franci is having a birthday party. She invited ten friends to her house, but she loves logic games. When the guests arrive, she gives each of them a card numbered 3-12. Some seats are already numbered, whereas others need to be figured out by the guests, respecting one criterion: the sum of any four place numbers that fall in a straight row makes 29.



What will be the number of the person sitting opposite number 9?

- A) 3
- B) 4
- C) 7
- D) 8
- E) 11

21) The first University of Europe was born in:

- A) Cambridge
- B) Oxford
- C) Naples
- D) Bologna
- E) Paris

22) Which of the following statements regarding Olympic Games is true?

- A) The winners of WWI prevented defeated nations from joining the Olympics in 1920
- B) The next Winter Olympic Games will be held in Japan
- C) The first Olympics of the Modern Age were held in 1896 in Athens
- D) A+C
- E) B+C

BIOLOGY

- 23) Recombination frequency:**
- A) is equal to crossing-over frequency
 - B) is the number of recombinant gametes over non-recombinant gametes
 - C) is equal to half the crossing-over frequency
 - D) is the number of non-recombinant gametes over recombinant gametes
 - E) is the number of non-recombinant gametes over the total number of gametes
- 24) It is not possible to have:**
- A) color-blind females
 - B) color-blind healthy male carrier
 - C) hemophilic healthy female carrier
 - D) color-blind males
 - E) color-blind children
- 25) Which of the following is not a structural component of eukaryotic genes?**
- A) Promoter
 - B) Exons
 - C) Introns
 - D) ATG starting codon
 - E) 3' poly-adenylation tail
- 26) Jimmy is a medical student and is doing some research about Alzheimer. In one of his attempts, he puts the brain of a pig on his balcony in order to irradiate it with UV light. Doing so, he induces a point mutation in the gene coding for preseniline, which unexpectedly does not cause any alteration in the final proteic compound. Which of the following mechanisms is not an adequate explanation to this phenomenon?**
- A) Genetic redundancy
 - B) The presence of non-coding genome inside the gene (i.e. introns)
 - C) The presence of exons
 - D) DNA repair mechanisms
 - E) Alternative splicing
- 27) The Sodium-Potassium pump is:**
- A) an antiporter
 - B) a symporter
 - C) an ionic channel
 - D) a polysaccharide
 - E) present only in some cells
- 28) Which of the following statements regarding ribosomes is correct?**
- A) They are made of two small subunits and two large ones
 - B) They have three binding sites for tRNA
 - C) They adhere to the membrane of the SER
 - D) They are absent in prokaryotes
 - E) They are two in each cell

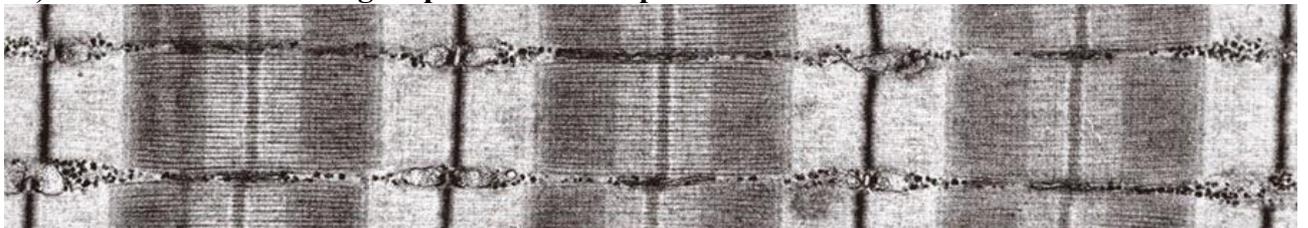
29) Mitosis occurs:

- A) only in somatic cells
- B) only in germ cells
- C) in both germ and somatic cells
- D) only in mutate somatic cells
- E) none of the previously stated

30) In women, germ-line meiosis:

- A) is completed only after fertilization
- B) entirely occurs in the ovary from puberty on
- C) entirely occurs in the ovary before delivery
- D) begins with the maturation of the ovarian follicle
- E) occurs at the moment of sperm ejaculation in the woman genital tract

31) What does the image reported below represent?



- A) The content of chloroplasts granules
- B) Some sarcomeres
- C) A nerve axon section
- D) Part of a vertebral column radiography
- E) A cotton fiber at the electron microscope

32) Where is the Eustachian tube?

- A) In the heart
- B) It is an organ of the female genital tract
- C) In paranasal sinuses
- D) Between the pharynx and the middle ear
- E) In bile ducts

33) Oxygenated blood:

- A) flows only in arteries
- B) flows only in the pulmonary circle
- C) flows in pulmonary veins
- D) increases in systemic capillaries
- E) is a synonym of venous blood

34) Which of the following does not contribute to the lymphatic system?

- A) Peyer's patches
- B) Spleen
- C) Glomerulus
- D) Tonsils
- E) Thymus

35) What kind of nucleic acid can be observed in viruses?

- A) Only DNA

- B) Only RNA
 - C) Both DNA and RNA synchronously
 - D) Either DNA or RNA
 - E) Viruses don't have any nucleic acid
- 36) If a coding sequence is composed by 900 bases, how many amino acids will the protein produced by that gene contain?**
- A) 300
 - B) 450
 - C) 600
 - D) 1800
 - E) 2700
- 37) In 1957 Meselson and Stahl provided experimental proofs to sustain that each strand of DNA is used as a template for the new DNA, thus demonstrating the process of semiconservative DNA duplication. They grew a strain of E. Coli in a soil with heavy nitrogen (15N), then they moved it to a soil containing light nitrogen (14N). After one generation, they examined the results and observed that the percentage of DNA composed by one heavy helix (with nitrogen 15) and one light helix (with nitrogen 14) was:**
- A) 100%
 - B) 75%
 - C) 50%
 - D) 25%
 - E) 0%
- 38) Among the following statements about protein synthesis, indicate the false one:**
- A) ribosomes bear three binding sites, one for mRNA on the minor subunit and two for tRNA on the major subunit
 - B) there are three phases of ribosomal translation: initiation, elongation, termination
 - C) once translated into mRNA, ATT, ACT, and ATC triplets of DNA cause the termination and the separation of the two ribosomal subunits
 - D) protein synthesis does not require ATP
 - E) the same mRNA strand is often translated by more than one ribosome (polysome)
- 39) Recombinant DNA is:**
- A) a molecule of DNA containing segments of DNA from a different cell
 - B) a molecule of DNA that underwent recombination during crossing-over
 - C) a new molecule of DNA, of synthetic origin
 - D) the substitution of an altered eukariotic chromosome with a healthy one
 - E) the rapid duplication of a chromosome
- 40) Which of the following statements is correct?**
- A) The fox is a producer
 - B) The earthworm is not part of any food chain
 - C) The shamrock is a producer
 - D) Herbivores are not consumers
 - E) Carnivores are not part of the normal food chains

CHEMISTRY

- 41) **Sodium (Na, Z=11) and aluminium (Al, Z=13) have different melting points. Both of them belong to the third group of the periodic table, but while sodium has a melting point of 371K, aluminium has one of 933K. Explain why the aluminium melting point is higher than the sodium one.**
- A) Al has a stronger electrostatic attraction force between the nucleus and the delocalised electrons than Na
- B) The positive ion of Al has a bigger charge compared to the positive ion of Na
- C) There is a much bigger number of delocalised electrons in the Al structure than in the Na one
- D) All of the above
- E) Only B and C
- 42) **Elements of Period 2 show periodic trends. State the general trends in ionization energies, atomic radius and electronegativity across Period 2.**
- A) Decreasing ionization energy, decreasing atomic radius, increasing electronegativity
- B) Increasing ionization energy, increasing atomic radius, increasing electronegativity
- C) Increasing ionization energy, decreasing atomic radius, decreasing electronegativity
- D) Decreasing ionization energy, increasing atomic radius, decreasing electronegativity
- E) Increasing ionization energy, decreasing atomic radius, increasing electronegativity
- 43) **Zinc forms many different salts including zinc sulfate, zinc chloride and zinc fluoride. People who have zinc deficiency can take hydrated zinc sulfate ($\text{ZnSO}_4 \cdot x\text{H}_2\text{O}$) as a dietary supplement. A student heated 5.74 g of hydrated zinc sulfate and obtained 3.22 g of anhydrous zinc sulfate. Which is the value of the whole number x in $\text{ZnSO}_4 \cdot x\text{H}_2\text{O}$? (ZnSO_4 , Mr=161)**
- A) 2
- B) 7
- C) 1
- D) 24
- E) 3
- 44) **Le Chatelier's principle says that:**
- A) when a system in equilibrium is disturbed, the equilibrium shifts in a direction which tends to reduce the disturbance
- B) if any factor which affects an equilibrium is changed, the position of equilibrium will shift so as to oppose the change
- C) if a system in chemical equilibrium is subjected to a disturbance, it tends to change in a way that opposes this disturbance
- D) all of the above
- E) none of the above
- 45) **The relative abundances of each isotope in a mass spectrum of a selenium sample are the following:**
- ^{76}Se : 11.2%
- ^{78}Se : 23.8%
- ^{80}Se : 49.8%
- ^{82}Se : 15.2%
- Calculate the relative atomic mass of this selenium sample.**
- A) 79,4
- B) 80,3

- C) 7940
 D) 79
 E) 7900

46) Balance the following equation for the reaction of serpentine with carbon dioxide.

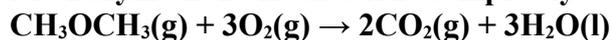


- A) 8; 8; 4; 4
 B) 3; 3; 2; 2
 C) 4; 3; 1; 2
 D) 4; 2; 3; 1
 E) Both A and B are correct

47) With respect to the hydrogen atom, deuterium has:

- A) one proton more
 B) one neutron less
 C) two neutrons less
 D) one neutron more
 E) one electron less

48) Methoxymethane in air burns completely according to the following equation:



The standard formation enthalpies of these compounds are:

Substance	$\text{CH}_3\text{OCH}_3(\text{g})$	$\text{O}_2(\text{g})$	$\text{CO}_2(\text{g})$	$\text{H}_2\text{O}(\text{l})$
ΔH_f (kJmol ⁻¹)	-185	0	-394	-286

How much is the standard enthalpy change of methoxymethane combustion?

- A) -495 kJmol⁻¹
 B) -603 kJmol⁻¹
 C) -1461 kJmol⁻¹
 D) +495 kJmol⁻¹
 E) +1461 kJmol⁻¹

49) The atomic radius of ¹²⁴Te compared to that of ¹³⁰Te is:

- A) equal because they have the same number of protons
 B) equal because they have the same electron configuration
 C) equal because they have the same number of electrons
 D) both A and C
 E) both A, B and C

50) In a chemical reaction a catalyst:

- A) shifts the equation towards the products
 B) lowers the threshold of activation energy
 C) boosts the equation velocity
 D) both B and C
 E) transforms an irreversible reaction into a reversible one

51) Considering the equation $\text{Zn} + \text{NaNO}_3 + \text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{NH}_3 + \text{H}_2\text{O}$, which of the following is true?

- A) Sodium is a spectator ion

- B) The environment is acidic
- C) Zinc gets oxidized
- D) Nitrogen gets reduced
- E) It is a redox reaction

52) According to Bronsted-Lowry definition, which of the following ions can behave exclusively as a base:

- A) NH_4^+
- B) PO_4^{3-}
- C) HPO_3^{2-}
- D) HPO_4^{2-}
- E) All but NH_4^+

MATHEMATICS AND PHYSICS

53) $\sqrt[3]{7} \cdot \sqrt[8]{7}$ equals:

- A) $\sqrt[24]{49}$
- B) $\sqrt[24]{7^{11}}$
- C) $\sqrt[24]{14}$
- D) $\sqrt[11]{7}$
- E) $\sqrt[11]{14}$

54) In a group composed by 100 kids, not all of them like apple candies. However, if you pick two of them at least one will love the candy. How many kids like apple candies?

- A) 50
- B) 49
- C) 51
- D) 98
- E) 99

55) An angle measures $\frac{7}{9}$. What's the measure of the angle expressed in sexagesimal?

- A) 70°
- B) 75°
- C) 140°
- D) 280°
- E) can't be determined

56) The equation of the line passing by the points P(-2;1) and Q (0;3) is:

- A) $y+x-3=0$
- B) $y=x+1$
- C) $y=x+3$
- D) $x-y-1=0$
- E) $y=3x+1$

57) The field lines of an electrostatic field formed by a point charge:

- A) cannot be closed lines

- B) they are always closed
- C) they are always straight
- D) they intersect at points where potential is maximum
- E) they can have any form

58) The units of measurement of the SI related to mechanics are:

- A) length, second, meter
- B) mass, length, second
- C) length, mass, time
- D) gram, time, centimeter
- E) meter, kilogram, second

59) Baruf's car, which initially travels at a 144 km/h velocity, slows down decelerating constantly until it stops, having traveled 200 m. Its deceleration is:

- A) 5 m/s^2
- B) 3 m/s^2
- C) 9 m/s^2
- D) 4 m/s^2
- E) 1 m/s^2

60) Ceci Bonino is forced, by her demanding boyfriend, to iron his shirts every day, and she is willing to calculate the amount of current she is using to see if she can afford it. A flat iron charged with a 220 V voltage absorbs 0.55 kW/h of energy in 30 min. The absorbed current equals:

- A) 0.083 A
- B) 300 A
- C) 5 A
- D) 1.25 A
- E) it's not possible to answer this question unless further information about the resistance of the flat iron are provided