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Consorzio Interuniversitario
Sistemi Integrati per l'Accesso

SAMPLE TEST

English TOLC-I

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Edizioni CISIA

Contents

MATHEMATICS

1. Lewis has two sons who are 15 and 11 years old respectively. In 18 years, Lewis' age will be equal to the sum of his sons' age. How old is Lewis now?

   A. 30

   B. There is insufficient data to answer.

   C. 52

   D. 26

   E. 44

2. Find x such that $\cos(x) + \sin(x) = 0$.

   A. $x = \frac{\pi}{4}$

   B. $x = 0$

   C. $x = \pi$

   D. $x = \frac{\pi}{2}$

   E. $x = \frac{3\pi}{4}$

3. Consider the equation $\sin(x) = 2 - k$, with $0 \leq x \leq \pi$. This equation has *at least* one solution if and only if:

   A. $k \geq 1$

   B. $1 \leq k \leq 2$

   C. $k \leq 2$

   D. $-1 \leq k \leq 1$

   E. $1 \leq k \leq 3$

4. If x is a real number, the inequality $x^4 + 5 < 0$ is satisfied for:

   A. all x

   B. $x = -5$

   C. no values of x

   D. $x > -5$

   E. $x < -\sqrt[4]{5}$

5. If x is a real number, what is the solution set of the following inequality?

$$\frac{x+3}{x+1} \geq 2$$

   A. $-1 < x \leq 2$

   B. $x \leq 1$

   C. $x \geq 1$

   D. $x < -1$

   E. $-1 < x \leq 1$

6. If we divide $x^5 - 3x^4 + 3$ by $x + 1$ the remainder is:

   A. -1

   B. 1

   C. 3

   D. 0

   E. $x - 1$

7. Consider an *isosceles* right triangle T. The sum of the cosines of the internal angles of T is:

   A. 2

   B. 1

   C. $\sqrt{3}$

   D. $1 + \sqrt{2}$

   E. $\sqrt{2}$

8. Which of the following equalities is satisfied for all real numbers x and y?

A. $3^{x+y}3^{x-y} = 3^{x^2-y^2}$

B. $3^{x+y}3^{x-y} = (3^x)^2$

C. $3^{x+y}3^{x-y} = 3^{x^2} - 3^{y^2}$

D. $3^{x+y}3^{x-y} = 3^{x^2}$

E. $3^{x+y}3^{x-y} = 3^x(3^y3^{-y})$

9. Consider a circle with centre O and a $1\,\text{cm}$-long radius. Let P be a point outside this circle.
The tangent lines from P to the circle meet the circumference in two points A and B.
We know that the area of $PAOB$ is equal to $\sqrt{3}\,\text{cm}^2$. What is the distance between P and O?

A. $3\,\text{cm}$

B. $2\,\text{cm}$

C. $4\,\text{cm}$

D. $\frac{\sqrt{3}}{2}\,\text{cm}$

E. $\frac{3}{2}\,\text{cm}$

10. Let x be a non–zero real number. The equation $x + \frac{1}{x} = k$ has one and only one solution if:

A. $k = 1$

B. $k = 3$

C. $k = -3$

D. $k = -1$

E. $k = 2$

11. The Cartesian equation

$$x^2 + y^2 + 4x = \gamma$$

with γ a positive real number, represents:

A. a circumference centred in $(-2,0)$ with radius $\sqrt{\gamma + 4}$

B. a circumference centred in $(0,-4)$ with radius $\sqrt{\gamma + 2}$

C. a circumference centred in $(0,0)$ with radius $\sqrt{\gamma}$

D. a circumference centred in $(-4,0)$ with radius $\sqrt{\gamma + 2}$

E. a circumference centred in $(0,-2)$ with radius $\sqrt{\gamma + 4}$

12. Let x be a positive real number and $f(x) = \log_{10} x$. Then $f(10 \cdot x^{-2})$ is equal to:

A. $\dfrac{1}{f(x)}$

B. $2 - 2f(x)$

C. $1 - 2f(x)$

D. $\dfrac{1}{2f(x)}$

E. $-2f(x)$

13. Consider a semicircle with diameter $AB = 2\,\text{cm}$ and centre O. If we take away the semicircle of diameter AO, then we rotate the resulting figure along AB by 360°, we obtain a solid whose volume is:

A. $\frac{25}{3}\pi\ \text{cm}^3$

B. $\frac{7}{6}\pi\ \text{cm}^3$

C. $\frac{5}{6}\pi\ \text{cm}^3$

D. $4\pi\ \text{cm}^3$

E. $\frac{28}{3}\pi\ \text{cm}^3$

14. How many points $P(x,y)$ on a Cartesian plane satisfy the following conditions?

$$(x+y)^2 = 1, \quad x^2 + y^2 = 1, \quad x + y \leq 0$$

A. One.

B. Two.

C. Infinite.

D. Zero.

E. Four.

15. Consider two points $A(0,0)$ and $B(1,1)$ on a Cartesian plane. The equation of the axis of the segment AB is:

A. $y = \frac{1}{2} - x$

B. $y = 2 - x$

C. $y = 1 - \frac{x}{2}$

D. $y = 1 - x$

E. $y = \frac{1-x}{2}$

16. The number $\left(\frac{81}{\sqrt{64}}\right)^{1/4}$ is equivalent to:

A. $\frac{3}{\sqrt{2}}$

B. $\frac{3}{2\sqrt{2}}$

C. $\frac{24}{8^{5/4}}$

D. $\frac{24}{64}$

E. $\frac{3}{2}$

17. The following expression

$$\frac{\left(3^{20}+3^{20}+3^{20}\right)^{1/3}}{(3^3)^2}$$

is equal to:

A. 3^2

B. 1

C. 3

D. $\frac{1}{3}$

E. $\frac{1}{9}$

18. Let Q be a square of side ℓ, C_1 a circle circumscribed around Q, and C_2 a circle inscribed in Q.
The ratio between the area of C_1 and the area of C_2 is:

A. 4

B. 2

C. $\sqrt{2}$

D. depends on the value of ℓ

E. $2\sqrt{2}$

19. Consider an equilateral triangle ABC whose side is $2\,\text{cm}$ long. Let D, E, and F be the midpoints of AB, BC, and AC respectively. Find the area of the rhombus $DECF$.

A. $\frac{\sqrt{3}}{2}\,\text{cm}^2$

B. $2\,\text{cm}^2$

C. $\sqrt{3}\,\text{cm}^2$

D. $\sqrt{2}\,\text{cm}^2$

E. $\frac{1}{\sqrt{3}}\,\text{cm}^2$

20. 30% of the students enrolled in a university course passed the final exam during the first session. 10% of the remaining students passed the exam during the second session.
How many students still have to pass the exam after the first two sessions? Express the result as a percentage of the total number of students enrolled in the course.

A. 37%

B. 63%

C. 70%

D. 60%

E. 40%

LOGIC

21. Consider the following numbers:

28, 29, 36, 43, 55

We want to order them so that each odd number is in an odd position, and each even number is in an even position. How many ways are there to order them given this condition?

A. 3

B. 24

C. 12

D. 5

E. 6

22. In a building hall there is the following warning:

It is allowed to play football in the courtyard, except on Sundays and between 1 p.m. and 4 p.m.

Therefore in this building:

A. it is not forbidden to play football in the courtyard at 12 (noon), provided that it’s not Sunday

B. it is not forbidden to play football in the courtyard on Sundays after 4 p.m.

C. any day other than Sunday it is forbidden not to play football in the courtyard before 1 p.m. and after 4 p.m.

D. it is not forbidden to play football in the courtyard at 2 p.m., provided that it’s not Sunday

E. it is not forbidden to play football in the courtyard at 2 p.m., provided that it’s Sunday

23. Uncle Scrooge forgot the *combination* that opens his electronic vault. He only remembers that:

    - the combination is made by 4 different digits (from 0 to 9)
    - it does not contain 4
    - the third digit is half of the fourth
    - the digits are in ascending order from the first one the last one

    What is the minimum number of attempts Uncle Scrooge has to make to be sure to open his vault?

    A. 3

    B. 4

    C. 5

    D. 6

    E. 2

24. Martha, a bookkeeper, has 195 euros and no coins. A client of the bookshop asks if she can break a 10, a 20, a 50, or a 100 euros banknote, but unfortunately her answer is always no.
How many 20 euros banknotes does Martha have (considering that the lowest–value banknote is 5 euros)?

A. 1

B. 4

C. 3

D. 2

E. 0

25. Chef John noticed that, if he does not use a gas oven, roasted meat remains raw inside or becomes burnt outside (or both). Therefore we can infer that:

A. if the meat is well cooked inside, it must have been cooked in a gas oven

B. if the meat is well cooked inside or is not burnt outside, it must have been cooked in a gas oven

C. if the meat is well cooked inside and is not burnt outside, it must have been cooked in a gas oven

D. if the meat is raw inside, it has not been cooked in a gas oven

E. if the meat has been cooked in an electric oven, the meat is raw inside and burnt outside

26. The great mathematician Countalot discovered the *Incredible* numbers; he does not know yet if they are finite or infinite, but he made the following conjecture:

If they are infinite, then at least one of them has 8 distinct prime factors.

One of his students, Countagain, showed that Countalot's conjecture is false. Therefore he proved that:

A. if *Incredible* numbers are finite, then none of them has 8 distinct prime factors

B. if *Incredible* numbers are finite, then all of them have 8 distinct prime factors

C. *Incredible* numbers are infinite

D. *Incredible* numbers are infinite and none of them has 8 distinct prime factors

E. *Incredible* numbers are infinite and all of them have 8 distinct prime factors

27. *Archaebacteria* are single–celled organisms that live in ponds and reproduce by fission (i.e. each bacterium splits in two identical organisms). If you put one *archaebacterium* in a certain pond, it will reproduce by fission once a day; in 30 days, the whole pond surface will be completely covered by bacteria. How many days will it take to cover the whole surface, if we initially put two bacteria in the pond?

A. 30 days.

B. 28 days.

C. 29 days.

D. It depends on the pond surface area.

E. 15 days.

28. A survey is conducted among all 1000 inhabitants of the town of Sparagna who are older than 55. The results show that 40% of them own a fridge, 25% of them own a TV, and 15% of them own both. Therefore, in the town of Sparagna:

A. among those who are younger than 55, less than 40% owns a fridge

B. among those who are older than 55, less than 45% owns a TV or a fridge

C. among those who are older than 55, 50% does not own a TV nor a fridge

D. among those who are younger than 55, more than 25% owns a TV

E. among those who are older than 55, more than 50% owns a TV or a fridge

29. Which pair of numbers x, y should be inserted into the following table?

1	3	6	10	x	21	28
1	2	6	24	120	y	5040

A. $x = 14$ and $y = 720$

B. $x = 14$ and $y = 240$

C. $x = 15$ and $y = 720$

D. $x = 12$ and $y = 240$

E. $x = 15$ and $y = 240$

30. In a conversation with her friends, Julia states that:

We all like coffee, except Paula, who does not like it.

Caroline points out that Julia is wrong. Therefore:

A. all of Julia’s friends like coffee

B. Paula likes coffee

C. one of Julia’s friends, who is not Paula, does not like coffee

D. Paula likes coffee or there is someone among Julia’s friends, other than Paula, who does not like coffee

E. it is not possible that only one of Julia’s friends does not like coffee

SCIENCE

31. Two bodies A and B have the same volume and masses $m_B = 3m_A$. Both bodies are completely immersed in a liquid, and are initially held still. When they are let go, the buoyant force exerted by the liquid on B is:

A. equal to the buoyant force exerted on A

B. 9 times the force exerted on A

C. 3 times the force exerted on A

D. one ninth of the force exerted on A

E. one third of the force exerted on A

32. A body of weight P, placed close to the Earth's surface, is let fall from rest. Let g be the gravitational acceleration and let the air resistance be negligible. Then the kinetic energy possessed by the body after t seconds is:

A. $(1/2)Pgt$

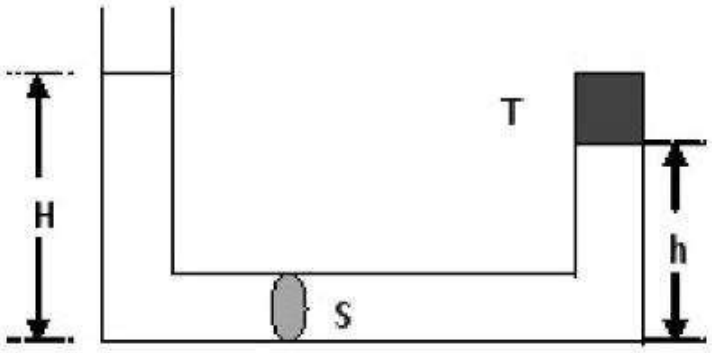
B. $(1/2)Pgt^2$

C. $2Pgt$

D. $2Pgt^2$

E. $(1/2)Pg^2t^2$

33. A pipe with constant cross–sectional area S is bent into a U–shape. One side of the pipe is open whereas the other one is closed by a cap T (as in the figure). The pipe is filled with water (density ρ) that reaches heights H ed h in the two arms. The force that the water exerts on T is equal to:



A. $\rho g(H-h)$, downwards

B. ρgh, upwards

C. ρgHS, upwards

D. $\rho g(H+h)$, downwards

E. $\rho g(H-h)S$, upwards

34. A heat engine has a 75% efficiency. How much heat is absorbed during a full cycle if the total work produced by the engine is equal to 3,6 kJ?

A. 2,7 kJ

B. 4,8 kJ

C. 14,4 kJ

D. 0,9 kJ

E. 3,6 kJ

35. In the periodic table, chemical elements are ordered by:

A. number of protons

B. alphabetical order

C. abundance in the universe

D. size

E. year of discovery

36. Sound is:

A. a wave that propagates in an elastic medium with a speed that depends on the medium itself

B. an elastic wave that propagates in vacuum at a speed of 340 m/s

C. a wave that propagates in an elastic medium at a speed of 300 000 km/s

D. an elastic wave that propagates in vacuum at a speed of 300 000 km/s

E. a wave that propagates in vacuum and all material mediums at a speed of 340 m/s

37. You mix 60 liters of water at 20 °C with 20 liters of water at 60 °C. Neglecting heat dispersion, the final temperature reached is:

A. 25 °C

B. 28 °C

C. 40 °C

D. 30 °C

E. 35 °C

38. Two metallic spheres A and B are suspended from the ceiling by insulating wires. A positively charged glass rod is first brought near A, then near B, without touching them. We observe that A is attracted to the rod, whereas B is repelled by it. Therefore we can infer that:

A. both A and B could be electrically neutral

B. B is positively charged

C. both A and B are negatively charged

D. A is negatively charged, whereas B could be either positively charged or neutral

E. A is negatively charged and B is positively charged

39. Let "$\cdot$" represent the scalar product and "$\times$" the vector product. Which of the following operations gives the magnitude of the projection of vector $\vec{a}$ on vector $\vec{b}$?

A. $\vec{a} \times \dfrac{\vec{b}}{|\vec{b}|}$

B. $\vec{a} \times \vec{b}$

C. $\vec{a} \cdot \vec{b}$

D. $\vec{a} + \vec{b}$

E. $\vec{a} \cdot \dfrac{\vec{b}}{|\vec{b}|}$

40. A train travels at a speed of 144 km/h. Its wheels perfectly adhere to the rails (no sliding) and have a diameter $d = 80$ cm. How many turns do they do in one second, roughly?

A. 8

B. 57

C. 32

D. 115

E. 16

READING COMPREHENSION

INSTRUCTIONS

This section of the Test consists of one or more excerpts taken from works published in English. The text has not been modified in any way and reflects the writing styles typical of the time and context in which the authors lived.

Each text is followed by five questions with five closed answers labelled with capital letters from A to E.

For each question choose the answer you consider correct based on what is explicitly or implicitly stated; in other words base your answer only on what is written in the text, and not on what you might already know about the subject.

TEXT I

The development of electronic publishing in small markets

From: Ivona Despot and Tomislav Jakopec, *The strategy for the development of electronic publishing in small markets*, Libellarium: journal for the research of writing, books, and cultural heritage institutions, [S.l.], v. 6, n. 1-2, p. 81 – 90, mar. 2014.

[1] Throughout history, publishing has adjusted to market requirements, aiming for cheaper production and book prices in order to attract a larger number of readers. Today, in the majority of developed publishing markets, e-books have become part of the publishing business. However, every new technology can represent a factor of "creative destruction": transistors put an end to the cathode tube industry, and photocopying to the indigo paper industry. So, can the digitized book be considered a milestone in the history of publishing and what are the consequences? This study presents new trends and attempts to predict their potential impact on publishing, with a special focus on small linguistic distribution markets such as the Croatian book market.

[2] While on the one hand, some experts predict the collapse of major publishers and booksellers due to their failure to focus on the future needs of readers in the digital environment, on the other, poor sales of e-publications and high prices of e-readers have led publishers to question the future success of the e-publishing business.

Claims that e-publishing needs to be promoted through conferences in order to become lucrative support this skepticism. However, the most likely outcome is a balance between continuity and discontinuity. While it is true that people do not reject their old habits and activities whenever a new technology emerges, it is commonly believed that the advancement of technology and the emergence of a simpler and cheaper process of digitization, will probably lead to an increased market for content published in digital form.

[3] Seen from the perspective of aspiring authors, expert Miha Kovac affirms that digital technology has turned book publishing into one of the most democratic media industries. Today, online bookstores offer titles published by the authors themselves, without official publishers. Apple has launched the *iBooks Author* programme which allows the author to shape his work graphically and forward it directly to the bookstore. Technology has cheapened and simplified the book publishing process, and opened the door to new players. Enriched e-books with added video and audio content offer new dimensions to the reading experience. As for the traditional role of the publisher, the rapid development of self-publishing inevitably leads to content overproduction of varying quality. Consequently, a publisher is needed to help the readers select the best content available. The book chain is changing, the publisher's role is adjusting to the new system, but it is still considered very necessary.

[4] So what does the future hold? On the one hand, information and communication technology is developing at such a rapid rate that future products and services cannot be easily predicted. Leading companies in this field keep their future products and services secret until market placement in order to protect themselves from

competition. However, meeting the individual needs of each user is essential. With this in mind, the publishing industry has announced the emergence of the "pay as you read" business model allowing partial payment of content, unlike the previous practice of paying for the whole unit. This is particularly useful in the field of academic and scientific publications allowing, for example, each user to purchase a single article rather than an entire journal or one chapter instead of the whole book. Users can create the book they need by combining different articles or chapters.

[5] There can be no doubt, therefore, that e-publishing is here to stay. However, when it comes to small markets, like Croatia, the two factors affecting the development of e-publishing are market size and language coverage. According to Digital Agenda for Europe indicators, Croatian society does not yet possess the necessary pre-requisites for successful e-publishing, but it is slowly moving towards that goal. Consequently, e-book publishing development strategies should be aimed towards ensuring a long-term cultural development in terms of digital infrastructure and internet use, whereas the concrete implementation of this new development should be left to the market in question.

TEXT I QUESTIONS

41. The primary purpose of the passage is to:

A. present the results of statistical analyses and propose further studies

B. explain a recent development and predict its eventual consequences

C. identify the reasons for a negative trend and recommend measures to address it

D. outline several theories about major technological changes from the past

E. reconcile conflicting research findings

42. In paragraph **[2]**, the author states that:

A. there is general agreement that e-publishing will soon replace paper books

B. experts believe that e-publications will dominate the scientific sphere

C. technological advances enabling cheaper digitalization will make e-publications more popular

D. many important publishers are in serious financial difficulty due to the rise in e-publications

E. conferences promoting e-books have been very successful

43. According to paragraph **[3]**, due to an increase in self-publishing:

A. the publisher’s role is changing

B. the quality of publishing has improved

C. publishers are no longer necessary

D. there is more need for digital experts

E. publishing has become more exclusive

44. The author states in paragraph **[4]** that, today, publishers:

A. require payment only if the reader likes the book

B. share new products and services with rival publishing houses

C. are particularly interested in developing the scientific market

D. no longer protect works by copyright

E. must aim to satisfy the needs of individual users

45. In the final paragraph (**[5]**), the author states that Croatia:

A. has the necessary foundations on which to develop an e-publishing market

B. has a prosperous e-publishing market

C. will not be able to develop an e-publishing market due to its limited language coverage

D. needs to develop its broadband network and reduce the digital divide

E. will not be able to develop an e-publishing market due to its small market size

TEXT II

Coconut oil

From: Renato da Silva Lima and Jane Mara Block, *Coconut oil: what do we really know about it so far?*, Food Quality and Safety, Volume 3, Issue 2, May 2019, pages 61-72.

[1] Coconut is one of the most important foods in various tropical and subtropical countries where the coconut tree is referred to as the "tree of life". The coconut is a very useful plant with a wide range of products being sourced from it. Coconut products are used to make everything from clothing to animal feed to beauty creams. Its kernel is harvested for its edible flesh and delicious water, while its husk is used for its strong fibres. Most important, however, are its oils, which are extracted, processed, and marketed for culinary, medicinal and cosmetic uses alike. The plant is cultivated in more than 90 countries with a total yield of 59 million tonnes in 2016. The production of coconut is extremely important in Asia, which is responsible for over 80 per cent of the world’s coconut production.
[2] In tropical countries, coconut oil has always been used as a cooking oil and in the late 19th century, the demand for edible oils also began to increase in Europe and in the USA. Once Europeans became aware of the possibilities offered by the fruit and recognised its versatility, they started establishing coconut plantations in the Caribbean, Southeast Asia, and the South Pacific and from the 1890s onwards, coconut oil became very popular in European countries and in the USA as an edible oil. This first coconut oil boom lasted

until the onset of World War II, around 1940, when the supply of the product was cut off to Western countries leading to a coconut oil shortage. As a result of this scarcity, the price of the commodity surged, thus **paving the way** for the rival soybean oil industry to expand and develop. The shift to soybean oil was further aided by the use of more modern technology which was employed in the processing facilities of the product.

[3] Once the war was over, countries with high coconut production tried to reintroduce the fruit into Western countries but with little success. Coconut oil was rejected at this point due to its high-saturated fat content. This rejection was associated with the findings of epidemiological studies conducted by the American physiologist, Ancel Keys, who formulated a hypothesis of the association between the consumption of high-saturated fat with a high blood cholesterol level and therefore the increased likelihood of cardiovascular disease. In 1956, in parallel to Keys' research, the American Heart Association started informing the population that consuming large quantities of high-saturated fat foods could increase the risk of cardiovascular disease. This, in turn, led to a decline in the popularity of coconut oil which was known to be high in saturated fat.

[4] In recent years, however, coconut oil has once again attracted the attention of the population worldwide, especially in Europe and North America. Celebrities, digital influencers, and even doctors have endorsed the use of this oil as a cooking medium in substitution of other vegetable oils and as a supplementary ingredient to be consumed with coffee and vitamin shakes. Blogs, internet videos, and articles are now promoting the consumption of coconut oil as a potential "miracle" food. Some media vehicles and health

specialists claim that this oil is capable of promoting health benefits, such as weight loss and the lowering of cholesterol levels as well as having anti-inflammatory effects and it is now affirmed that the consumption of coconut oil may actually help in the prevention of cardiovascular diseases. Clearly, these claims are now being used by coconut oil companies to market the product and boost sales. Nevertheless, governmental regulatory agencies in many countries remain sceptical about the benefits obtained by the consumption of coconut oil due to its high-saturated fatty acid content. In general, studies in this field present conflicting results and there is a serious lack of long term human-based clinical trials. Therefore, as a saturated fat, coconut oil should be consumed with moderation and the health allegations should not be used to market the product considering that they have not been scientifically proven so far.

TEXT II QUESTIONS

46. The author of the passage is primarily concerned with:

A. exploring research underlying the uses of coconuts

B. discussing the appeal of coconut oil and some concerns about its use

C. arguing for the adoption of coconut oil in promoting health benefits

D. comparing the advantages of coconut oil over other edible oils

E. clarifying the future of coconut oil companies

47. In paragraph **[2]**, the expression **paving the way** means:

A. blocking the future

B. indicating the method

C. making it easier

D. contrasting the desire

E. giving an example

48. According to paragraph **[2]**, which of the following statements is true?

A. Coconut plantations were destroyed during World War II.

B. Europeans preferred soybean oil as it was produced in Western countries.

C. Consumers stopped using coconut oil because soybean oil was a more modern equivalent.

D. Soybean oil had never been used as an edible oil until after World War II.

E. Soybean oil replaced the use of coconut oil due to the difficulties incurred in acquiring the latter.

49. Paragraph **[3]** states that:

A. eating coconut oil leads to heart problems in Western countries

B. the use of coconut oil in food was banned by the American Heart Association

C. consumers began to eat less coconut oil as it was thought to be a health risk

D. the American Heart Association advised consumers not to consume coconut oil

E. Western countries were unable to produce coconut oil

50. In conclusion, the author indicates that:

A. previous studies into the dangers of coconut oil were unfounded

B. research now shows that coconut oil should be used instead of other vegetable oils

C. further studies will prove the dangers of eating coconut oil

D. research into the consumption of coconut oil must be widened

E. coconut oil companies are funding further research

Question	Correct Answer
1	E
2	E
3	B
4	C
5	E
6	A
7	E
8	B
9	B
10	E
11	A
12	C
13	B
14	B
15	D
16	C
17	C
18	B
19	A
20	B
21	C
22	A
23	A
24	D
25	C
26	D
27	C
28	C

29	C
30	D
31	A
32	B
33	E
34	B
35	A
36	A
37	D
38	B
39	E
40	E
41	B
42	C
43	A
44	E
45	D
46	B
47	C
48	E
49	C
50	D

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