

II SIMULAZIONE IN INGLESE

General Knowledge and Logical Reasoning

1. Six islands make up the Republic of Bondia.

Island	Area (km ²)	Population
Brosnan	5079	716,184
Connery	5816	931,896
Craig	2474	1,786,140
Dalton	5448	793,845
Lazenby	1735	1,458,253
Moore	5763	2,942,391
Total	26315	8,628,709

Which island contains less than 10% of the population of Bondia, despite accounting for more than 20% of its area?

- A. Brosnan
- B. Connery
- C. Craig
- D. Dalton
- E. Lazenby

2. People with pale skin may be lacking in vitamin D, which is important for healthy bones and teeth. Most people get enough vitamin D with short exposures to the sun (10 to 15 minutes a day). A small amount also comes from the diet, in foods like oily fish and dairy products. But people with pale skin do not seem to be able to get enough. Part of the reason might be that people who burn easily are more likely to cover up and avoid the sun. But some pale-skinned individuals are less able to make and process vitamin D in the body, regardless of how long they sit in the sun.

Based on these findings, pale-skinned people should be added to the list of those for whom vitamin D supplements are recommended by the government. Certain groups are already identified as at higher risk of deficiency and needing supplements. This includes people with very dark skin, such as people of African-Caribbean and South Asian origin, and people who wear full-body coverings, as well as pregnant and breastfeeding women, the elderly and people who avoid the sun.

Which of the following best expresses the main conclusion of the passage?

- A. Pale-skinned people need more exposure to sunlight.
- B. Vitamin D can best be obtained by exposure to sunlight.
- C. Pale-skinned people should be recommended to take vitamin D supplements.

- D. Longer exposure to sunlight increases the risk of skin cancer.
- E. People with very dark skin have a higher need of vitamin D supplements than paleskinned

3. Electric engines are more efficient than petrol engines in converting fuel into mechanical power, thus they are more economical in fuel use. But their electricity has to come from somewhere.

The UK electricity grid is powered by a mix of sources: coal, gas and nuclear with a few renewables thrown in. If you make extra demand in order to fuel electric cars, only fossil fuels, which produce emissions of CO₂, can provide the extra capacity. Wind turbines cannot turn any faster than wind speed allows, and extra capacity from nuclear power will be possible only when new nuclear power plants are built.

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

- A. The electricity needed to power electric cars cannot be provided by the UK electricity grid.
- B. Electric cars cannot yet be fuelled without increasing emissions of CO₂ from electricity production.
- C. Wind power will never be able to provide more electricity than it does at present.
- D. The use of electric engines in place of petrol engines will increase emissions of CO₂
- E. None of the above

4. The Organisation for Economic Co-operation and Development (OECD) has released data from a study of 15 year olds in the principal industrialised countries. It shows unequivocally that teenage students whose parents discuss political or social issues with them, either weekly or daily, score 28 points higher at reading (on average) than those whose parents discuss these issues less often or not at all. Other factors were also associated with better reading ability: discussing books or television programmes, eating main meals together at a table and spending time talking to children. Discussing news and serious issues showed the strongest association, so if parents spend time discussing these issues with their children they will help their children read well.

Which of the following best expresses the flaw in the argument above?

- A. It implies that discussing serious issues with parents is more influential than discussion with a peer group.
- B. It assumes that eating meals together at a table is practical in all households.
- C. It fails to consider teenagers in rural countries.
- D. It does not show why reading ability is so important in a teenager's development.
- E. It suggests a causal relationship between discussion and reading.

5-8. The following table shows the infection statistics of Clostridium difficile infection (Cdl) for a number of organisations for 2009 and 2010.

Organ-isation	Types of hospital	2009				2010			
		Number of hospitals	Patient days	Cases	Rate of infection*	Number of hospitals	Patient days	Cases	Rate of infection*
1	L,S	3	56,867	0	0	3	53,967	1	1.85
2	S	1	16,330	1	6.12	1	16,163	0	0
3	L,S	56	540,891	26	4.81	59	543,042	25	4.60
4	L	1	11,549	0	0	1	30,432	3	9.86
5	DC,TC	9	70,009	4	5.71	9	69,397	2	2.88
6	L	4	178,556	3	1.68	7	180,805	6	3.32
7	L	1	18,155	0	0	1	18,931	1	5.28
8	L,S	29	320,009	2	0.62	29	317,876	5	1.57
9	L,S,TC	32	110,925	3	2.70	31	136,586	2	1.46
10	L	1	82,293	1	1.22	1	80,456	3	3.73
11	L,S	33	409,574	12	2.93	33	394,693	12	3.04
12	L	1	18,278	5	27.36	1	16,792	6	35.73
13	L	1	29,202	12	41.09	1	30,308	11	36.29

* rate of infection is calculated as number of cases per 100,000 patient days.

The codes for the different types of hospital are L (large), S (small), DC (diagnosis centre) and TC (treatment centre). The number of patient days is calculated from the number of days that patients were in hospital. For example, a day case (a patient who was not in hospital overnight) would count as 1 patient day and a patient staying in the hospital over 3 consecutive nights would count as 4 patient days.

The rate given is the rate per 100,000 patient days.

5. What is the overall rate (over both years) per 100,000 patient days for organisation 4 in the table?

- A. 4.93
- B. 6.57
- C. 7.15
- D. 9.86
- E. 14.0

6. What is the largest proportion of cases in 2009 that came from a single organisation?

- A. 17%
- B. 26%
- C. 33%
- D. 38%
- E. 44%

7. Not all organisations had reported all data for 2010 by the time that the table was completed (so 2010 figures only include data to the end of November).

If the number of patient days per month is constant and organisation 2 did have one case in December 2010, what would the rate of infection for that organisation in that year have been?

- A. 5.28
- B. 5.67
- C. 6.19
- D. 6.51

E. 6.75

8. Which of the following statements can be reliably concluded from the data in the table?

- A. Cdl is more likely for patients in large hospitals.
- B. Cdl is more likely for patients in small hospitals.
- C. There were more cases of Cdl in large hospitals than small ones in 2010.
- D. Cdl occurs in all four types of hospital.
- E. None of the above statements.

9. The unusual weather the UK has experienced over the past few years - very dry warm springs and very cold winters - is what one would expect if the melting of Arctic ice were influencing our weather. And indeed, over the same period the Arctic has undergone its most dramatic shrinkage of sea ice. This means that the Arctic Ocean is warming, which can upset the global balance between cold Arctic air and warm tropical air.

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

- A. The melting of the Arctic ice is the only explanation for the UK's unusual weather
- B. If the Arctic ice were not melting the UK would not have experienced this unusual weather.
- C. The melting of the Arctic ice must have caused the unusual weather in the UK.
- D. The unusual weather in the UK could have been caused by the melting of the Arctic ice.
- E. None of the above

10. Oxytocin, known as the 'love hormone', is a hormone that is released in mothers' bodies during childbirth. Research has shown that when people are exposed to it by means of a nasal spray they can become better at recognising the emotions of others, and are more likely to perceive others as trustworthy and approachable. As a result of its apparently positive influence on sociability, there is optimism that it could help to treat conditions such as autism and schizophrenia. Oxytocin sprays are readily available online, and are being used by parents to treat children with autism. Although clinical trials are now under way, the use of oxytocin as a treatment has not yet been approved. So parents of children with autism are damaging their children's health by using the sprays.

Which one of the following, if true, would weaken the above argument?

- A. Some studies reveal that oxytocin can stimulate feelings of envy.
- B. The scientific studies of oxytocin have never used children as subjects.
- C. The amount of oxytocin in the sprays sold online is too low to have any effect in children.
- D. The effects of oxytocin on individuals vary depending on the type of culture they live in.
- E. Oxytocin reduces trust and co-operation in people who are anxious and sensitive to Rejection

11. The International Astronomical Union (IAU) downgraded the status of Pluto to that of a dwarf planet because it did not meet the three criteria the IAU uses to define a full-sized planet. Essentially Pluto meets all the criteria except one....

Which are the two criteria that Pluto meets?

- A. is in orbit around the Sun; has "cleared the neighborhood" around its orbit.
- B. has sufficient mass to assume hydrostatic equilibrium (a nearly round shape);

has "cleared the neighborhood" around its orbit.

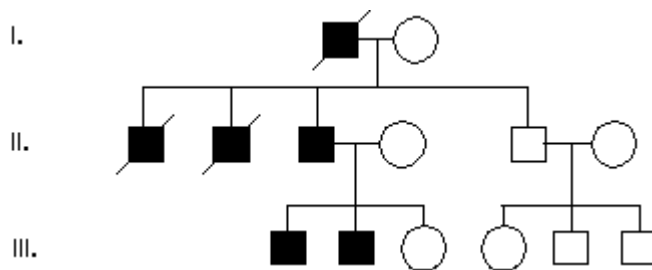
C. is in orbit around the Sun; has sufficient mass to assume hydrostatic equilibrium (a nearly round shape)

D. is in orbit around the Sun; has a body of water

E. none of the pairs above

Biology

12. What is the most likely pattern of inheritance in this pedigree?



A X-linked recessive

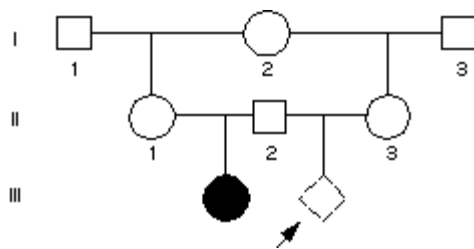
B Autosomal recessive

C Autosomal dominant

D X-linked dominant

E Mitochondrial

13. The family below is segregating the mutant allele for disease X, a very rare genetic disorder inherited in an autosomal recessive pattern, with 100% penetrance. II-2's first wife delivers an affected child, but dies in childbirth. II-2 later marries his first wife's half-sister (II-3), and she becomes pregnant. What is the chance that this child will be affected?



A 1/2

B 1/4

C 5/32

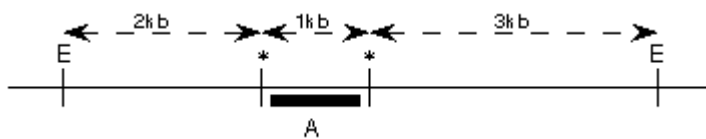
D 1/16

E mutant allele frequency, squared (q^2)

14. A young woman of northern European descent is the single parent of a child with autosomal recessive cystic fibrosis. She marries her first cousin and becomes pregnant. What is the probability that her child will have cystic fibrosis?

A	1/2500
B	1/100
C	<u>1/32</u>
D	1/8
E	1/4

15. A particular RFLP is diagrammed below. 'E' represents invariant EcoRI restriction sites. '*' represents polymorphic EcoRI sites. The dark box represents the location of a particular DNA probe 'A'. What are all the possible alleles (i.e. size of bands) seen on a Southern blot probed with 'A'?



- A 1kb, 2kb, 3kb, 4kb, 5kb, 6kb
 B 1kb, 3kb, 4kb, 6kb
 C 3kb, 4kb, 6kb
 D 2kb, 3kb, 6kb
 E None of the above

16. For a given autosomal recessive disease, $q = 0.01$ (where q is the allele frequency of the mutant allele). Approximately what percentage of the population has two copies of the normal allele?

- A. 2%
 B. 98%
 C. 19%
 D. 90%
 E. 95%

17. "One gene, one enzyme" is a phrase describing the concept that:

- A functional enzymes are never made up of subunits encoded by different genes
 B only one copy of the gene needs to be inactive to cause severe disease due to 50% levels of enzyme activity
 C most metabolic disorders are X-linked recessive
 D individual metabolic steps are controlled by individual enzymes encoded by specific genes
 E alteration of genes by rare enzymes are the main cause of metabolic disease

18. The oxygen produced in photosynthesis comes from what molecule?

- A. glucose
- B. water
- C. P680
- D. ATP
- E. carbon dioxide

19. In the light dependent reactions, when light strikes the pigments (P700 or P680) what is the immediate result?

- A. excited electrons are passed to electron acceptors
- B. electrons are fused to form ATP
- C. glucose is produced
- D. carbon fixation occurs
- E. None of the above

20. If all of a cell's proteins suddenly became inactive, which of the following processes could still occur?

- A. aerobic cellular respiration
- B. diffusion across the plasma membrane
- C. active transport across the plasma membrane
- D. the breakdown of hydrogen peroxide into liquid water and oxygen gas
- E. None of the above

Chemistry

21. What is the molarity of a solution that contains 30 g of NaOH in 500 mL of solution?

- A. 0.75 M
- B. 1.3 M
- C. 1.5 M
- D. 0.5 M
- E. 2.6 M

22. Which will dissolve more quickly when mixed with water?

- A. Sugar granules
- B. Sugar cubes
- C. Both dissolve at the same
- D. None of the above
- E. All of the above are true

23. Which of these actions will cause more sugar to dissolve in a saturated sugar water solution?

- I. Add more sugar while stirring
- II. Add more sugar and heat the solution

III. Grind the sugar to a powder; then add while stirring

- A. I only
- B. II only
- C. III only
- D. I and II only
- E. II and III only

24. Which set of chemical name and formula for the same compound is correct?

- A. Tin(IV)bromide ; SnBr₄
- B. Iron(II)oxide ; Fe₂O₃
- C. Aluminum fluorate ; AlF₃
- D. Potassium chloride ; K₂Cl₂
- E. None of the above

25. What is the correct name for the N³⁻ ion?

- A. Nitride ion
- B. Nitrite ion
- C. Nitrate ion
- D. Nitrogen ion
- E. None of the above

26. Which of the following formulas represents an ionic compound?

- A. CS₂
- B. BaI₂
- C. PCl₃
- D. N₂O₄
- E. None of the above

Physics and Mathematics

27. What is the buoyant force that acts on a 2,300,000 N boat if it doesn't sink?

- A. 230,000 N
- B. 234,000 N
- C. 2,300,000 N
- D. 22,540,000 N
- E. 24,000,000 N

28. Weight density multiplied by depth or force divided by area both measure

- A. pressure.
- B. air content.
- C. capacity.
- D. force
- E. acceleration

29. In an ellipse, the normal at one end of a latus rectum passes through an end of the minor. If e is the eccentricity, then $e^4 + e^2 = ?$

- A. 2
- B. 1.5
- C. $\frac{4}{3}$
- D. $\frac{1}{5}$
- E. 5

30. What is the maximum number of normals which can be drawn to an ellipse from a given point ?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5