



# VANDA

## SCIENCE GLOBAL FINALS

### Secondary 2 / Grade 8

Full Name: \_\_\_\_\_ Country: \_\_\_\_\_

School: \_\_\_\_\_ Index Number: \_\_\_\_\_

#### Instructions to Students:

1. Only scientific calculators are allowed during the contest for secondary school/Grade 7 and above students.
2. The duration of this contest is **1 hour**. You may not leave the contest venue within the first half an hour of the paper.
3. This examination paper contains **20** questions and comprises of **14** printed pages, inclusive of the cover page.
4. Each question has only 4 possible answers: **A, B, C** and **D**. You must shade your correct option on the Answer Entry Sheet provided.
5. The total marks for this paper is 70 points:

#### **Section A:**

Question 1 to 5: +2 points for correct answer, 0 points for no answer and –1 point for wrong answer.

#### **Section B:**

Question 6 to 10: +3 points for correct answer, 0 points for no answer or wrong answer.

#### **Section C:**

Question 11 to 20: +4 points for correct answer, 0 points for no answer or wrong answer.

6. You are not allowed to bring the question paper and answer script out of the contest venue.

#### **Note:**

- 1) You may assume that there is no air resistance throughout the contest, unless otherwise stated.
- 2) All temperatures are in degree Celsius, unless otherwise stated.
- 3) Room temperature is 25°C at 1 atmospheric pressure.
- 4) Gravitational Acceleration is taken to be 9.8 m/s<sup>2</sup>.

## **Rough Working**

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**Section A** (Question 1 to 5: +2 points for correct answer, 0 points for no answer and -1 point for wrong answer.)

1. Which of the following sets is classified wrongly?

	<u>solute</u>		<u>solvent</u>	→	<u>solution</u>
A.	oxygen	+	nitrogen	→	air
B.	water	+	salt	→	seawater
C.	bromine gas	+	water	→	bromine water
D.	tin	+	copper	→	bronze

2. Human fertilisation is a process by which a male human sperm fuses with a female human egg to form a zygote.



The primary aim of birth control is to prevent human fertilisation from taking place. Two of the methods are illustrated below.

Method K (elimination of either sperm and/or egg during intercourse):



Method L (barrier to prevent meeting of sperm and egg):



Which of the following birth control methods are classified correctly?

	method K	method L
A.	ligation	intra-uterine device
B.	spermicide	condom
C.	intra-uterine device	spermicide
D.	condom	spermicide

3. The following statements describe the process of a substance undergoing a change of state.

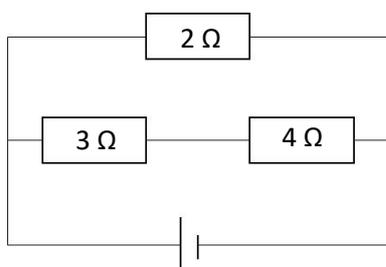
Energy is absorbed by the particles. At first, the particles only rolled over each other at random. Sometime later, the particles moved around very fast. Initially, the particles were close together. Then after a while, all the particles were far apart and widely spaced.

Which of following processes is described by the statements above?

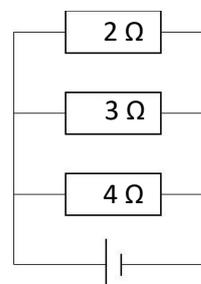
- A. boiling
- B. condensation
- C. sublimation
- D. freezing

4. Which of the following circuit diagrams below has the same effective resistance equivalent to  $2.0 \Omega$ ?

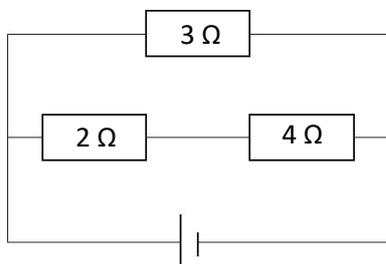
A.



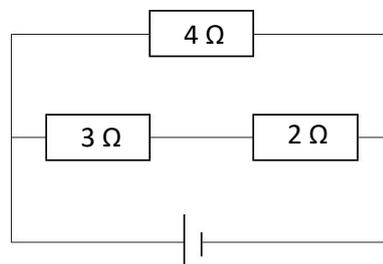
B.



C.



D.



5. An experiment was set-up where 1 g of sodium metal was placed into 10 g of water in a beaker. During the reaction, the sodium immediately caught fire and was extinguished when there was no more sodium metal left. The reaction was weighed afterwards. The result was not 11 g.

What could be the explanation for the difference in the weight of the products and the weight of the reactants?

- A. Fire contains mass.
- B. Energy from the fire is converted into atoms which contributes mass.
- C. The reaction that occurred released mass from the set-up into the surroundings.
- D. The weighing machine was faulty after the reaction.

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**Section B** (Question 6 to 10: +3 points for correct answer, 0 points for no answer or wrong answer.)

Each question has 4 numbered options. Response is based on the following table:

A	B	C	D
1 is correct only	1 and 3 correct only	2 and 4 correct only	1,2,3,4 are correct

6. The table below shows the properties of four different materials.

material	flexibility	electrical conductivity	melting point
E	slight	low	low
F	rigid	high	high
G	rigid	low	high

Which of the following statements is/are true?

1. E may be classified as a plastic.
2. E could be used as classroom chair seats.
3. F could be used as computer heat sinks.
4. G could be used as bricks to build a building.

7. Cobalt is a metallic element. One of the compounds of cobalt is vitamin B12, which has the formula  $C_{63}H_{88}CoN_{14}O_{14}P$ . Another compound of cobalt is cobalt (II) chloride, which has the formula  $CoCl_2$ . Vitamin B12 is a molecule, whereas cobalt (II) chloride is not molecule.

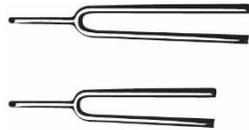
Which of the following statements is/are true?

1. The bond formed by the metallic element to the rest of the molecule in Vitamin B12 is ionic.
2. There are 6 elements found in vitamin B12, whereas there are only 2 elements in cobalt (II) chloride.
3. One mole of vitamin B12 contains 60 times the number of particles in one mole of cobalt (II) chloride.
4. There are 181 atoms in a molecule of vitamin B12, whereas there are only 3 atoms in the ionic formula of cobalt (II) chloride.

8. Which of the following will allow a swimmer to move faster underwater?

1. Putting on swimwear that mimics shark's skin.
2. Putting on flippers on both of the swimmer's feet.
3. Putting on weight such that he has a bigger waistline.
4. Putting his arms above the head in the direction of his movement.

9. The diagram below shows two tuning forks with different tine lengths.



Which of the following statements are true about the tuning forks?

1. Hitting the tuning fork harder will change the pitch produced by the tuning fork.
  2. Hitting the tuning fork harder will change the loudness of the sound produced by the tuning fork.
  3. The tuning fork with the longer tine will vibrate at a higher frequency compared to the tuning fork with the shorter tine.
  4. Tuning forks made from denser metals will produce a higher pitch compared to tuning forks made from less dense metals.
10. Which one of the following statements cannot be concluded using scientific thinking?
1. A block of metal can turn into gold using alchemy.
  2. Chlorophyll found in plant cells is the reason why leaves are green.
  3. Gases can be compressed.
  4. Water molecules contain a dipole moment.

**Section C:** (Question 11 to 20: +4 points for correct answer, 0 points for no answer or wrong answer.)

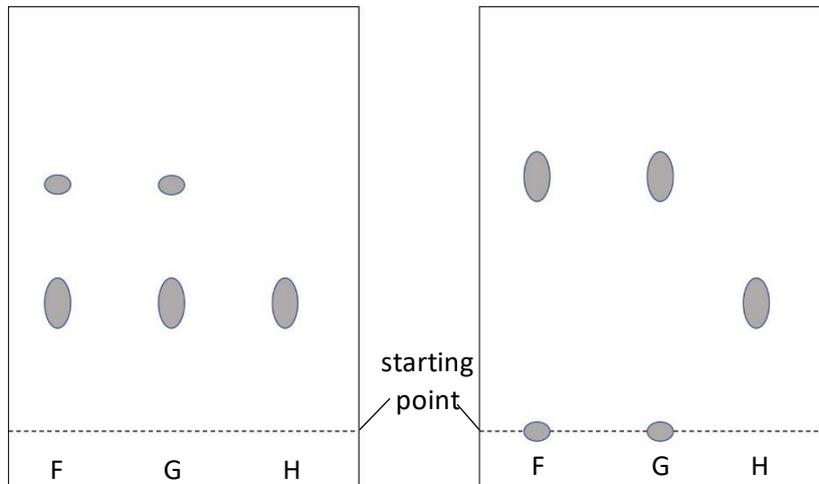
11. There has been a greater push recently for humanity to consume less meat. One example is the invention of the “Impossible burger”, which is a burger made completely from plant-based sources.

Which of the following statements best describes the reason behind this push?

- A. Crop plants provide more nutrients for humans.
- B. Plant-based products are digested most efficiently.
- C. A shorter food chain is less efficient to transfer energy.
- D. A greater proportion of energy in the ecosystem would be available to humans.

12. Two similar paper chromatography were set-up to test on three different substances. The only condition that was changed between the set-ups was the type of solvent used in the experiment.

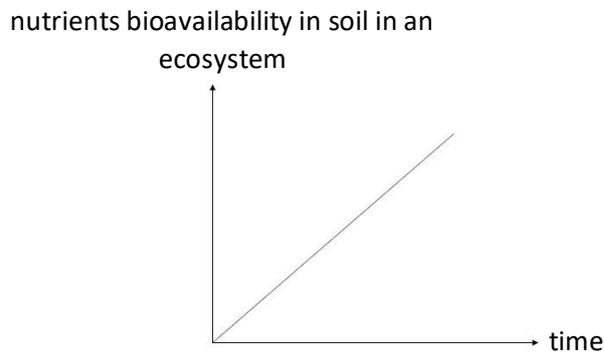
The diagram below shows the two chromatograms for three different substances.



Which of the following statements is not true?

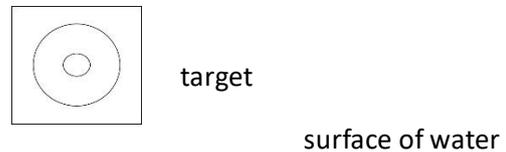
- A. G is not a pure substance.
- B. There is a substance in F that cannot be dissolved by one of the solvents.
- C. F and G will likely give the same chromatogram when a third solvent is used.
- D. F and H are the same substance since they have a spot on the same level above the starting point.

13. The graph below shows the amount of nutrients bioavailability in soil present in an ecosystem against time.



Which classification of organisms would contribute to the graph above?

- A. bacteria
  - B. ferns
  - C. moss
  - D. scavengers
14. A game was set-up where a stone was shot out of underneath the surface of a pool at an angle directly towards a target outside the water.



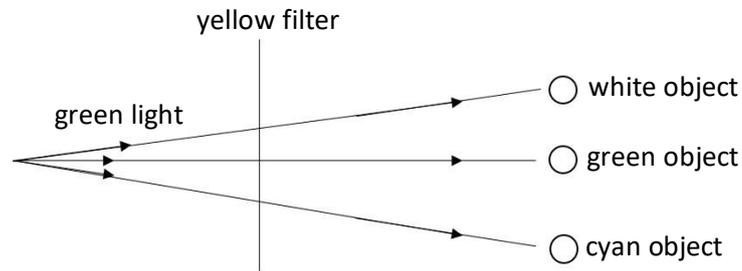
stone

The first shot misses.

How should the player correct his aim in order to hit the target?

- A. He should aim lower than the target because light travels faster when it enters water.
- B. He should aim lower than the target because light travels slower when it enters water.
- C. He should aim higher than the target because light travels faster when it enters water.
- D. He should aim higher than the target because light travels slower when it enters water.

15. Three objects were placed under white light. The colours were recorded as white, green and cyan respectively. An experiment was set-up where Jenny used green light with a yellow filter to shine on all three objects.

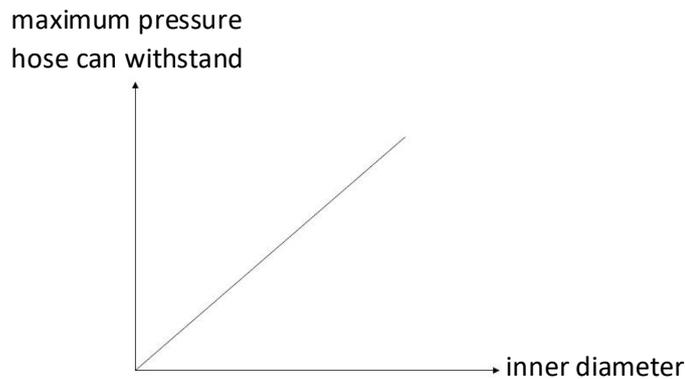


Which of the following shows the new colours in the set-up?

	under green light		
	white object	green object	cyan object
<b>A.</b>	red	black	black
<b>B.</b>	red	red	black
<b>C.</b>	yellow	yellow	black
<b>D.</b>	green	green	green

16. An experiment was conducted to test the maximum pressure a hose can withstand without breaking for different hoses with varying inner diameter.

The graph below shows the maximum pressure of the hose plotted against the inner diameter of the hose.



Only from the above information, which of the following statements can be inferred about the different blood vessels in our body?

- A.** Blood vessels with smaller inner diameter are mostly easily damaged from blunt force trauma.
- B.** Blood vessels with larger inner diameter can withstand higher amounts of blood flowing through them.
- C.** Blood vessels with smaller inner diameter increase the rate at which substances pass in and out of them.
- D.** The blood vessel with largest inner diameter requires secondary valves to keep blood pulsating through the blood vessel.

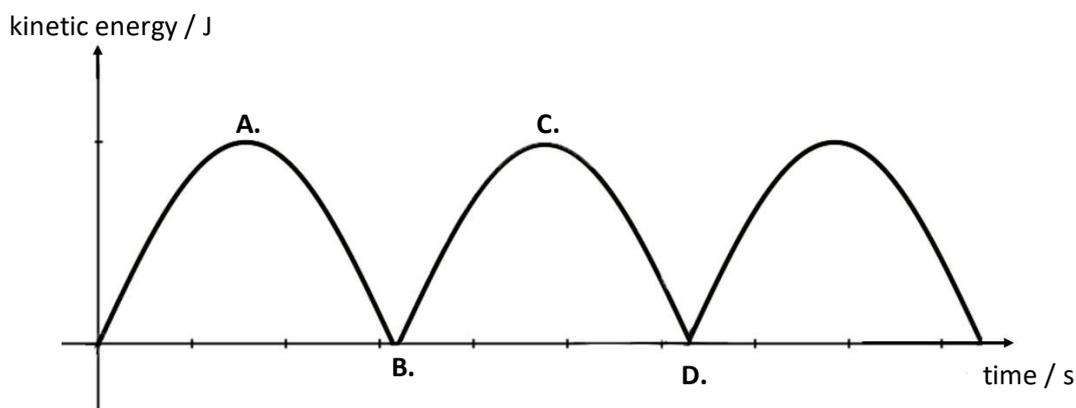
17. A piece of highly nutritious food was placed in a petri dish. Three enzymes, S, T and U, were added in succession to the piece of food. After each enzyme was added, experiments were carried out to measure the increase of products before the addition of the next enzyme. The table below shows the observations.

enzyme added	Observation
S	amount of glycerol increased
T	amount of glucose increased
U	amount of polypeptides increased

Which of the following is the order of enzymes S, T and U were added to the piece of food?

- A. protease, maltase, lipase
  - B. protease, salivary amylase, lipase
  - C. lipase, maltase, protease
  - D. lipase, polypeptidase, protease
18. A small weight is hung from a spring. The weight is first displaced downwards and let go.

The graph below shows the kinetic energy of the spring against time.



Which point of the graph would correspond to the first time when the weight went back to the position when the experiment started?

19. Some restaurants use cast iron pans to cook meat in order to achieve a 'crust' around the surface of the meat after the piece of meat is cooked. One way this 'crust' of meat can be achieved is with high cooking temperatures.

Why do these restaurants choose to use cast iron pans over non-stick pans?

- A. Cast-iron pans can store more heat than non-stick pans.
- B. Cast-iron pans can conduct heat to the piece of meat faster than non-stick pans can.
- C. Cast-iron pans are made with materials with a higher melting point than those made for non-stick pans.
- D. Cast-iron pans contain residual bits of food stuck from previous cooked food that impart flavour to the next piece of meat cooked on it.

20. The electrical power ( $P$ ) of a device is the amount of electrical energy used by the appliance per unit time, and can be calculated using the formula,  $P = IV$ , where  $I$  is the current flowing through the device and  $V$  is the potential difference across the device. The resistance ( $R$ ) of the same device can be calculated using the formula,  $R = \frac{V}{I}$ , where  $I$  and  $V$  have the same definition as described earlier.

Which of the following statements is/are true?

- A. If the current is doubled, while keeping the resistance constant, power will be doubled the initial measurement.
- B. If the potential difference is doubled, while keeping the resistance constant, power will be a quarter of the initial measurement.
- C. If the resistance is halved, while keeping the potential difference constant, power will be doubled the initial measurement.
- D. If the resistance is halved, while keeping the current constant, power will be a quarter of the initial measurement.

## **Rough Working**

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