

Vanda – Upper Secondary is held to encourage the study and appreciation of science beyond the Secondary School Science Curriculum. It is to encourage students to go beyond their comfort zones and take on new challenges with enthusiasm and fortitude.

This examination paper contains **25 MCQ**, broken up into 3 sections as described below.

**a. Section A: (15 MCQ)**

Question 1 to 10: +1 points for correct answer, 0 points for no answer and –1 point for wrong answer. All questions in this section increase in level of difficulty.

- i (i) Qn 1-5: In line with MOE syllabus. Questions that involve critical thinking and picking out hidden hints.
- ii (ii) Qn 6-10: In line with MOE syllabus but questions are inference base – Eg From a table or graph or diagram and questions in this section increase in level of difficulty.
- iii (iii) Qn 11-15: Questions that are out of syllabus but students can infer the answer from information given by using their problem-solving skills.

**b. Section B:**

Question 16 to 20: +2 points for correct answer, 0 points for no answer or -1 point wrong answer. Questions in this section are experiment based. Questions may be in and out of syllabus.

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

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>1 is correct only</b>	<b>1 and 3 correct only</b>	<b>2 and 4 correct only</b>	<b>1,2,3,4 are correct</b>

**c. Section C:**

Question 21 to 25: +3 points for correct answer, 0 points for blank and -1 point for wrong answer.

**Questions in this section are Application Based Questions.**

Sample Questions – Secondary 3

Question 1 (Chemistry)

A mixture of  $100 \text{ cm}^3$  of methane and  $50 \text{ cm}^3$  of ethane was fully burnt with an excess of oxygen gas. After cooling to room temperature, the residual gas was passed through aqueous potassium hydroxide. What volume of gas was absorbed by the alkali?

- a)  $150 \text{ cm}^3$
- b)  $200 \text{ cm}^3$
- c)  $250 \text{ cm}^3$
- d)  $300 \text{ cm}^3$

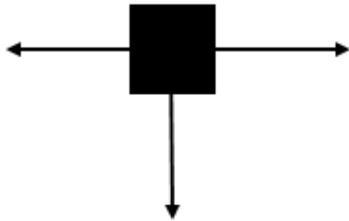
Answer is b)

One mole of methane gas burnt will produce one mole of carbon dioxide gas. However, one mole of ethane gas burnt will produce two moles of carbon dioxide gas. Hence, the total volume of carbon dioxide gas that will be produced and absorbed by the alkali will be  $100 + 2(50) = 200 \text{ cm}^3$

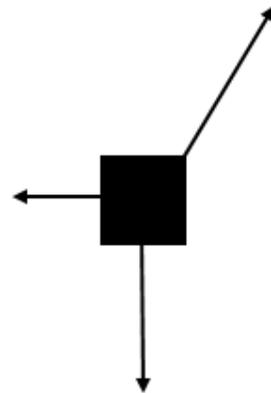
Question 2 (Physics)

The following options shows a system of forces acting on an object. Which of the following shows the correct vector diagram of an object in equilibrium?

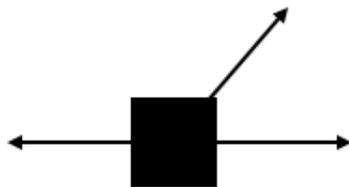
a)



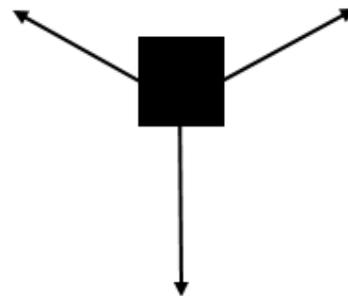
b)



c)

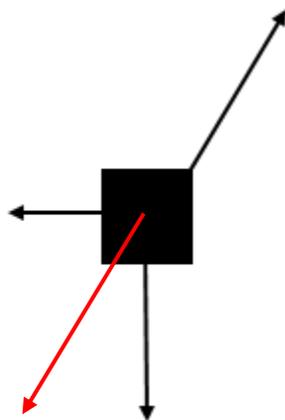


d)



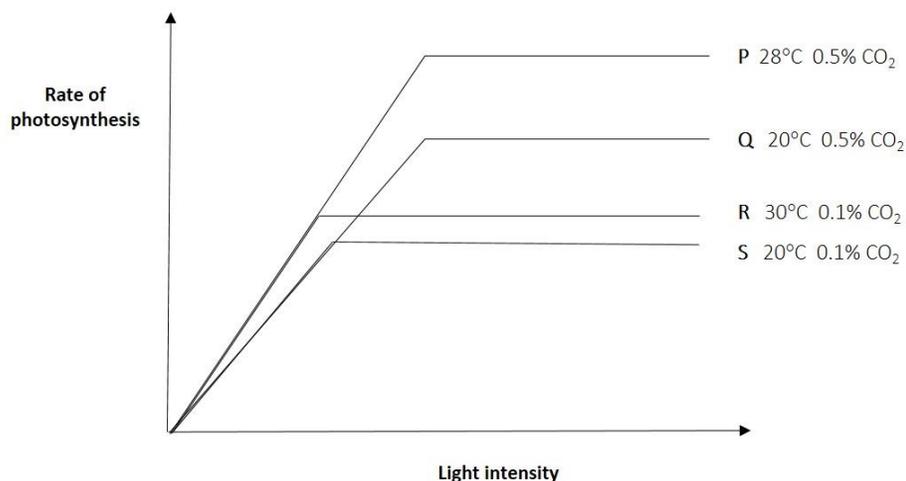
Answer: b).

The forces acting on the box are in equilibrium as all the forces cancel each other out.



Question 3 (Biology)

1. The graph shows the results of an experiment investigating the effect of light intensity on the rate of photosynthesis at two different temperatures and two different carbon dioxide concentrations.



At high light intensity, which factor is limiting the rate of photosynthesis shown on curve X and which curve supports this?

- Carbon dioxide concentration, curve S supports as the photosynthetic rate becomes constant at lower light intensities.
- Carbon dioxide concentration, curve R supports as a decrease in carbon dioxide concentration decreases the photosynthetic rate.
- Temperature, curve S supports as the photosynthetic rate becomes constant at lower light intensities.
- Temperature, curve P supports as an increase in temperature increases the photosynthetic rate.

Answer (d)

Sample Questions (Secondary 4)

Question 1 (Chemistry)

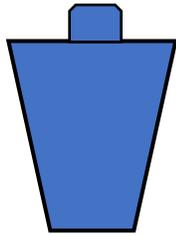
In which of the following changes does water molecules increase in volume?

- When ice at 0°C melts to form water at 0°C.
- When water at 0°C freezes to form ice at 0°C.
- When the temperature of water increases from 0°C to 4°C.
- When steam condenses to form liquid water.

Answer is (b). When water changes state from liquid to solid state, the hydrogen bonds between water molecules become stronger and this causes water to expand, taking on a more defined six-sided crystalline structure that is about 9% less dense than water in its liquid form.

Question 2 (Physics)

The diagram below shows a cup of water filled to the brim and an ice cube is floating on top.



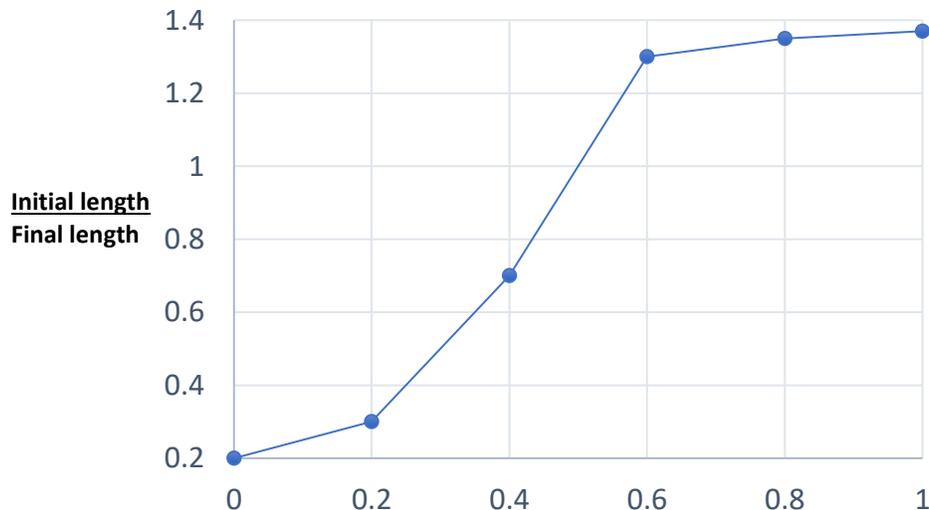
After the ice has melted, water in the cup will

- a) overflow.
- b) stay at the same level.
- c) decrease in water level.
- d) freeze.

Answer is (b). Initially, as the ice is floating on top of the water, it displaces water that is equivalent in volume to support its own weight; after the ice melts completely, the displaced volume is replaced by the volume of the amount of water present in the ice cube. Hence, the water level does not change and remains at the same level.

Question 3 (Biology)

Beetroot strips were immersed in sucrose solutions of differing concentrations. Their lengths were measured before immersion and 20 minutes after immersion in the different concentrations. The graph shows the ratio of initial length to final length of the beetroot strips.



Which of the following statements is true?

- a)** Energy is required to produce a change in length of the beetroot strips.
- b)** The change in length of the beetroot strips is due to diffusion of sucrose across the cell membrane.
- c)** The water potential of the beetroot cell sap is the same as that of the sucrose solution at  $0.50 \text{ mol dm}^{-3}$  of sucrose.
- d)** At  $1.0 \text{ mol dm}^{-3}$  of sucrose, the limiting factor is the number of sucrose transport proteins in the cell membrane.

Answer (a)