

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

තාක්ෂණවේදය සඳහා විද්‍යාව I
தொழினுட்பவியலுக்கான விஞ்ஞானம் I
Science for Technology I

67 E I

පැය දෙකයි
இரண்டு மணித்தியாலங்கள்
Two hours

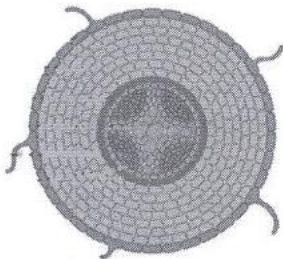
Instructions:

- * Answer **all** the questions.
- * Write your **Index Number** in the space provided in the answer sheet.
- * Read the instructions given on the back of the answer sheet carefully.
- * In each of the questions **1** to **50**, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct** or **most appropriate** and mark your response on the answer sheet with a cross (X) in accordance with the instructions given on the back of the answer sheet.
- * Use of non-programmable calculators is allowed.

1. An example for a tropical evergreen primary rainforest in Sri Lanka is
 (1) Ritigala. (2) Piduruthalagala. (3) Haggala.
 (4) Kanneliya. (5) Horton plains.
2. All bacteria
 (1) are unicellular.
 (2) are pathogenic.
 (3) have flagella.
 (4) have nuclei.
 (5) comprise of cell walls made up of cellulose.
3. A main type of sugar contained in bee honey is
 (1) fructose. (2) galactose. (3) glycogen.
 (4) lactose. (5) maltose.
4. Consider the hydrolysis of disaccharide X.

$$X \longrightarrow \text{Glucose} + \text{Fructose}$$

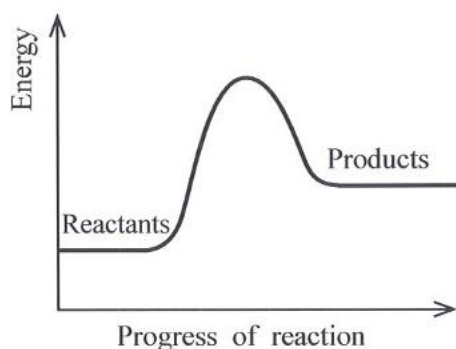
 What is X?
 (1) Lactose (2) Sucrose (3) Maltose
 (4) Cellobiose (5) Galactose
5. Consider the picture given below.



The plant cross section given in the above picture is a

- (1) root of a dicotyledon plant.
- (2) root of a monocotyledon plant.
- (3) stem of a dicotyledon plant.
- (4) stem of a monocotyledon plant.
- (5) vein of a dicotyledon plant leaf.

6. Polarity of a molecule depends on
- (1) its shape.
 - (2) its molecular weight.
 - (3) the number of atoms contained in it.
 - (4) the number of carbon atoms contained in it.
 - (5) its boiling point and freezing point.
7. The reaction energy of the reaction between NaOH and H_2SO_4 is equal to the amount of energy released, when
- (1) 1 mol of NaOH is fully reacted with H_2SO_4 .
 - (2) 1 mol dm^{-3} solution of NaOH is fully reacted with H_2SO_4 .
 - (3) 1 mol dm^{-3} solution of NaOH is fully reacted with 1 mol dm^{-3} solution of H_2SO_4 .
 - (4) 1 mol of H_2SO_4 is fully reacted with NaOH.
 - (5) 1 mol dm^{-3} solution of H_2SO_4 is fully reacted with NaOH.
8. Which of the following statements accurately describes the nature of reaction illustrated by the graph?

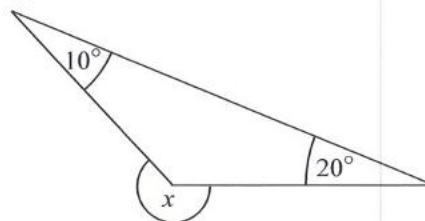


- (1) The reaction is exothermic.
 - (2) It is a multistep reaction.
 - (3) Increasing temperature decreases the rate of reaction.
 - (4) Energy of the activated complex is less than that of the products.
 - (5) Activation energy of the backward reaction is less than that of the forward reaction.
9. What is a conjugate protein?
- (1) A protein bound to another protein
 - (2) A protein bound to another biomolecule
 - (3) A protein containing more than 100 nucleotides
 - (4) A protein that helps to build up biological structures
 - (5) A protein formed by the conjugation of several primary proteins
10. Consider the reaction given below.
- $$3\text{Ba}(\text{OH})_2 + 2\text{H}_3\text{PO}_4 \longrightarrow \text{Ba}_3(\text{PO}_4)_2 + 6\text{H}_2\text{O}$$
- Which of the following statements is correct regarding the above reaction?
- (1) Rate of reaction is equal to the rate of production of water.
 - (2) Rate of reaction is six times greater than the rate of production of water.
 - (3) Rate of production of water is six times greater than the rate of reaction.
 - (4) Rate of consumption of H_3PO_4 is equal to the rate of reaction.
 - (5) Rate of consumption of H_3PO_4 is equal to half the rate of reaction.
11. What is the correct statement regarding thin-layer chromatography (TLC)?
- (1) TLC can be used to separate large scale samples.
 - (2) In TLC, the mobile phase travels due to gravity.
 - (3) In TLC, the mobile phase travels due to capillary action.
 - (4) TLC is an experiment method that takes longer time.
 - (5) For any mobile phase, R_f value of a compound is a constant.

12. A crystalline polymer
- (1) contains cross linking bonds.
 - (2) shows elastic properties.
 - (3) can be soften under heat.
 - (4) comprises of polymeric molecules arranged in one direction.
 - (5) comprises of several types of monomers linked by cross-linking bonds.
13. What is the correct statement regarding natural products?
- (1) Natural products are chemical compounds that are produced by living organisms.
 - (2) Primary metabolites are not essential for growth and survival.
 - (3) Secondary metabolites are mainly used for energy storage.
 - (4) Secondary metabolites are essential for growth and survival.
 - (5) All organisms produce all secondary metabolites.
14. Which of the following statement/s regarding alkaloids is/are correct?
- A - They contain nitrogen.
B - They are usually volatile.
C - They usually have medicinal properties.
- (1) A only
 - (2) B only
 - (3) A and B only
 - (4) A and C only
 - (5) All A, B and C
15. What is the main reason for the higher yield of pulp in mechanical methods compared to chemical methods in paper manufacturing?
- (1) Lignin is not removed in mechanical methods.
 - (2) Wood used in mechanical pulping contains more fibres.
 - (3) Filling agents are added in the mechanical methods.
 - (4) Mechanical methods can cause oxidation of the pulp.
 - (5) No water is used in mechanical methods.
16. Why are plant oils containing low free fatty acids (FFAs), more suitable for biodiesel production?
- (1) FFAs increase the pH of plant oils.
 - (2) FFAs decrease the pH of the plant oils.
 - (3) Formation of soap is promoted by FFAs.
 - (4) Formation of methyl ester is promoted by FFAs.
 - (5) FFAs have a lower ignition temperature than biodiesel.
17. Which of the following is proven to be the most effective strategy to reduce the use of single-use polythene grocery bags in supermarkets?
- (1) Making thinner bags to reduce polythene consumption
 - (2) Imposing a special environmental tax on supermarkets
 - (3) Charging a fee on polythene bag usage followed by a public awareness
 - (4) Allowing only larger size bags to reduce the number of bags used
 - (5) Imposing a total ban on the usage of polythene bags
18. Which of the following statements is correct regarding environmental issues?
- (1) Acid rains are caused by human activities only.
 - (2) UV rays are essential for natural ozone generation.
 - (3) Use of fresh plant oil to produce biodiesel is common in many countries.
 - (4) All gases produced from the combustion of fossil fuels are greenhouse gases.
 - (5) Fertilizers produced by industrial fixation add new nitrogen to the environment.
19. One end of a straight wire is connected to the top end of a pole of height 63 cm, fixed perpendicular to the horizontal ground and the other end is tied to the ground. The wire is 65 cm long. What is the distance from the lower end of the wire to the lower end of the pole?
- (1) 16 cm
 - (2) 20 cm
 - (3) 35 cm
 - (4) 43 cm
 - (5) 60 cm

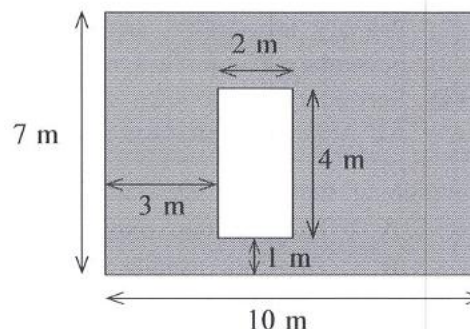
20. In radians, how much is the angle marked as 'x' in the diagram.

- (1) $\frac{5\pi}{3}$ (2) $\frac{5\pi}{6}$
 (3) $\frac{7\pi}{3}$ (4) $\frac{7\pi}{6}$
 (5) $\frac{8\pi}{3}$



21. An architect is developing a blueprint for one floor of a house which is shown in the diagram. The shaded area represents the floor area that needs to be fully tiled. How many square tiles of 20 cm $\times$ 20 cm will be needed to cover the shaded area?

- (1) 15.5
 (2) 155
 (3) 1550
 (4) 15500
 (5) 155000



22. A swimming pool is 8 m long, 6 m wide, and 1.5 m deep. The water-resistant paint required to paint the pool costs Rs. 120 per square meter. What is the cost of paint required to cover the interior surfaces of the pool?

- (1) Rs. 10800 (2) Rs. 10900 (3) Rs. 11000 (4) Rs. 11500 (5) Rs. 11700

23. A cone shaped ice sculpture with a base radius of 0.5 m and a height of 1.2 m, melts at a rate of 0.002 m³ per minute. How many hours will it take the sculpture to completely melt? (Approximate π as 3)

- (1) 2 (2) 2.25 (3) 2.5 (4) 3 (5) 3.5

24. At a certain time of day, a vertical post casts a shadow that is 6 m long, on the horizontal ground. At this time, the angle between the solar rays and the ground is 20°. How tall is the post? ($\sin 20^\circ \approx 0.34$ and $\cos 20^\circ \approx 0.94$)

- (1) 20.2 m (2) 20.4 m (3) 22.4 m (4) 24.2 m (5) 24.8 m

● The questions 25 and 26 are based on the following description:

A student throws a ball upwards at an angle at time $t = 0$, from a balcony. The height h of the ball from the ground in meters after t seconds is modelled by $h = -2t^2 + 6t + 8$.

25. What is the maximum height the ball reaches in meters?

- (1) 10.75 (2) 12 (3) 12.5 (4) 13 (5) 14.5

26. After throwing the ball, how many seconds does it take to hit the ground?

- (1) 1.5 (2) 2 (3) 2.75 (4) 3.5 (5) 4

27. The majority of employees in a company draws a low salary that is roughly the same while the rest draws a very high salary. Consider the following statements regarding descriptive statistics of the salary distribution of employees.

A - The mode and mean are likely to be close.

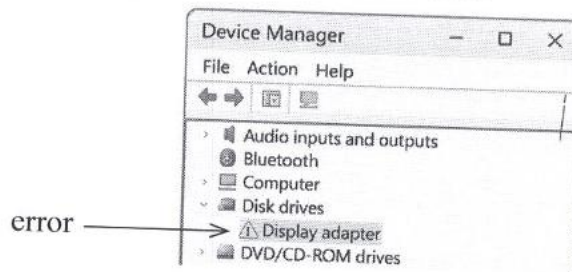
B - The median is less than the mean.

C - The median is a more appropriate measure of central tendency compared to the mean.

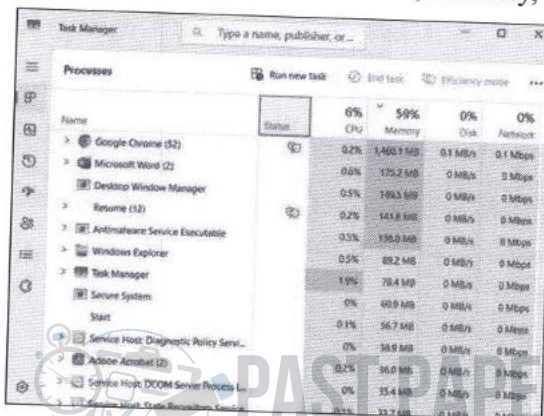
Of the above, the correct statement/s is/are

- (1) A only. (2) A and B only. (3) A and C only.
 (4) B and C only. (5) all A, B and C.

28. The interquartile range (IQR) of a data set is the
- (1) range between the lowest and highest values in the data set.
 - (2) range of the middle 50% of the data set that is arranged in ascending order.
 - (3) range between the mean and the mode when they are different from each other.
 - (4) numerical difference between the maximum value and the first quartile (Q_1).
 - (5) numerical difference between the second quartile (Q_2) and the third quartile (Q_3).
29. A user has a laptop with a pre-installed operating system. He wants to boot the computer using a different operating system stored on a bootable USB drive. For that, what is the correct step he should take?
- (1) Formatting the USB drive
 - (2) Scanning the USB drive for errors
 - (3) Disconnecting and reconnecting the USB drive
 - (4) Copying the content of the USB drive to the hard disk and booting from the hard disk
 - (5) Changing the boot order settings to prioritize the USB drive
30. The Device Manager of a computer displays the error shown in the diagram. What is the most appropriate troubleshooting action to resolve this error?



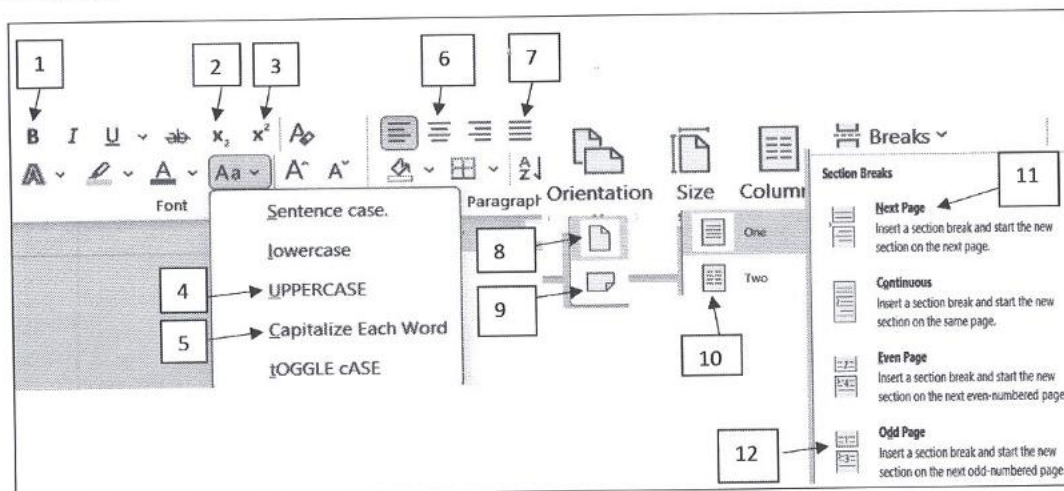
- (1) Formatting the hard disk
 - (2) Checking for driver updates
 - (3) Upgrading display adapter
 - (4) Performing disk defragmentation
 - (5) Reinstalling the operating system
31. The image below shows the Task Manager of a computer when it is open. Consider the following statements made by a student regarding the use of Task Manager.
- A - It is used to install updates.
- B - It shows all running applications.
- C - It provides the real-time status of the CPU, memory, and network.



Which of the above statement(s) is/are true?

- (1) A only
- (2) B only
- (3) A and B only
- (4) A and C only
- (5) B and C only

- Questions 32 and 33 are based on the tools numbered 1 to 12 of a word processing software shown below.



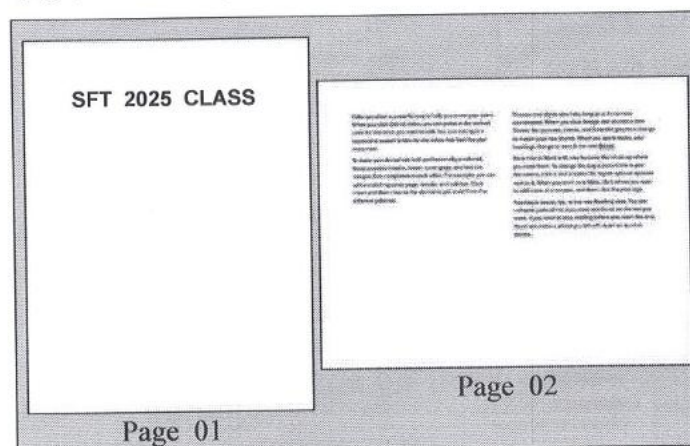
32. What is the set of tools required to change the following original text to revised text?

Original text	Revised text
CH ₃ CO ₂ – is the chemical formula for acetate ion.	CH ₃ CO ₂ [–] is the chemical formula for acetate ion .

- (1) 1 and 2 only.
- (2) 1 and 3 only.
- (3) 2 and 3 only.
- (4) 1, 2 and 3 only.
- (5) 1, 2 and 4 only.

33. Students are assigned to prepare an assignment in the following format.

- The first page, in portrait orientation, should have a centered title in all capital letters.
- The second page, in landscape orientation, should have the text arranged in two columns.



What is the set of tools required to prepare the assignment?

- (1) 6, 4, 11, 9 and 10 only.
- (2) 6, 4, 12, 8 and 11 only.
- (3) 6, 5, 11, 8 and 10 only.
- (4) 7, 4, 11, 9 and 7 only.
- (5) 7, 5, 12, 9, 11 and 10 only.

- Questions 34 and 35 are based on the spreadsheet given below.

	A	B	C	D
1	First Name	Last Name	Full Name	Marks
2	John	Paul	John Paul	10
3	Joe	Cool	Joe Cool	50
4	Mark	Paul	Mark Paul	65
5	Mary	Jack	Mary Jack	80
6	Mac	Donald	Mac Donald	20
7	Jill	Jones	Jill Jones	Absent
8	Jack	Filler	Jack Filler	45
9			Average	

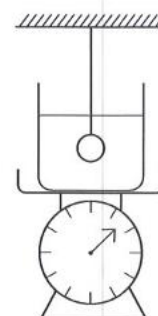
34. A student completed column C (Full Name) with a space between the first name and the last name as shown in the spreadsheet, by combining the names in columns A and B using a formula. What is the formula used to obtain the output appears in cell C2?
- (1) =A2 & B2 (2) =A2 + " " + B2
 (3) =TEXTJOIN(" ", A2, B2) (4) =JOIN(" ",A2,B2)
 (5) =CONCATENATE(A2," ",B2)
35. What is the output that the formula =AVERAGE(D2:D8) returns to cell D9?
- (1) #DIV/0 (2) #VALUE! (3) 38.57 (4) 39.00 (5) 45.00
36. A chart created in a spreadsheet needs to be pasted into a presentation slide. The chart needs to be updated automatically when the source data in spreadsheet changes, while keeping the slide's formatting unchanged. Which paste option should be used here?
- (1) Copy and Paste as a Picture
 (2) Use 'Destination Theme' and 'Link Data'
 (3) Use 'Destination Theme' and 'Embed Workbook'
 (4) Copy and Paste as a Text
 (5) Use 'Keep Source Formatting' and 'Embed Workbook'
37. Which protocol is primarily used for ensuring reliable data transmission over the Internet?
- (1) IP (2) HTTP (3) TCP (4) DNS (5) FTP
38. What is the benefit of providing a phone number when creating a new gmail account?
- (1) Locating the lost phone
 (2) Verifying the identity and recovering the account when needed
 (3) When receiving an email, ringing the phone
 (4) When receiving an email, receiving a call automatically
 (5) Receiving the mobile phone bill automatically via email
39. What is the physical quantity expressed by the unit A h?
- (1) Power (2) Energy (3) Resistance (4) Voltage (5) Charge
40. A 'starter motor' applies a constant torque of 10 N m to a flywheel with a moment of inertia of 0.5 kg m². If the flywheel starts from the rest, what is the time taken by it to reach a speed of 960 rpm? (Consider $\pi = 3$)
- (1) 3.8 s (2) 4.8 s (3) 5.8 s (4) 7.8 s (5) 9.8 s
41. A wooden block of mass 1 kg is placed on a horizontal table. The coefficient of static friction between the wooden block and the table is 0.4. When a horizontal force of 2.5 N is applied on the block, what is the frictional force acting on it? (Consider $g = 10 \text{ m s}^{-2}$.)
- (1) 2.5 N (2) 4.0 N (3) 4.2 N (4) 6.5 N (5) 12.5 N

42. Water in a household electric kettle reaches a temperature of 100°C in 3 minutes and the kettle is kept switched on for another 2 minutes. Consider the following statements.

A - The temperature of the water rises above 100°C during the last 2 minutes.
 B - Water evaporation begins when its temperature reaches 100°C only.
 C - The gas bubbles that emerge at the bottom of the kettle after 3 minutes, consist mostly of dissolved air in the water.

From the above statements,

- (1) only B is correct. (2) only C is correct.
 (3) only B and C are correct. (4) all A, B and C are correct.
 (5) all A, B and C are incorrect.
43. There is a horizontally balanced seesaw. A child of mass 15 kg sat on one side of the seesaw 2 m away from the pivot. How far from the pivot another child of mass 20 kg should sit on the opposite side of the seesaw so that it is horizontally balanced?
 (1) 0.7 m (2) 1.3 m (3) 1.5 m (4) 2.1 m (5) 2.6 m
44. What is the minimum energy required to pump 1000 kg of water from a well to an overhead tank situated 15 m above the water level of the well? (Consider $g = 10 \text{ m s}^{-2}$.)
 (1) 0.020 kW h (2) 0.042 kW h (3) 0.060 kW h (4) 0.080 kW h (5) 0.100 kW h
45. If an electric vehicle with a mass of 2000 kg accelerates from the rest to 20 m s^{-1} in 10 s, what should be the minimum power of the motor? (Ignore the energy losses.)
 (1) 20 kW (2) 40 kW (3) 80 kW (4) 100 kW (5) 150 kW
46. At the critical temperature of a material
 (1) its conductivity becomes zero. (2) it has its highest resistance.
 (3) it becomes a super conductor. (4) it becomes an electrical insulator.
 (5) it becomes a semiconductor.
47. A metal flask completely filled with 500 ml of oil is at 20°C . When the temperature is increased to 70°C , 3.5 ml of oil overflows. If the coefficient of volume expansion of oil is $9.5 \times 10^{-4}^{\circ}\text{C}^{-1}$, what is the coefficient of volume expansion of the metal?
 (1) $1.5 \times 10^{-4}^{\circ}\text{C}^{-1}$ (2) $6.2 \times 10^{-4}^{\circ}\text{C}^{-1}$ (3) $8.1 \times 10^{-4}^{\circ}\text{C}^{-1}$ (4) $9.5 \times 10^{-4}^{\circ}\text{C}^{-1}$ (5) $10.9 \times 10^{-4}^{\circ}\text{C}^{-1}$
48. A rectangular shaped canal narrows at a certain place from a width of 8 m and depth of 2 m to a width of 4 m and depth of 3 m. If the water flows at a speed of 3 m s^{-1} in the wider section, what is the speed that the water flows in the narrower section?
 (1) 2 m s^{-1} (2) 3 m s^{-1} (3) 4 m s^{-1} (4) 5 m s^{-1} (5) 6 m s^{-1}
49. A container with water, having a total mass of 5 kg is placed on a balance as shown in the figure. A sphere of mass 1 kg, suspended by a light string is immersed in water. The tension in the string is 5 N. What is the reading of the scale? (Consider $g = 10 \text{ m s}^{-2}$.)
 (1) 4.0 kg
 (2) 4.5 kg
 (3) 5.0 kg
 (4) 5.5 kg
 (5) 6.0 kg



50. An electrical appliance of power 6 W is connected to the secondary coil of a step-down transformer (240 V to 12 V). What is the current in the primary coil? (Assume that the transformer is ideal)
 (1) 0.3 mA (2) 25 mA (3) 50 mA (4) 125 mA (5) 500 mA

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

නාක්ෂණවේදය සඳහා විද්‍යාව II
தொழினுட்பவியலுக்கான விஞ்ஞானம் II
Science for Technology II

67 E II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීමේ කාලය - මිනිත්තු 10 යි
மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index No. :

Instructions :

- * This question paper consists of 13 pages.
- * This question paper comprises of **four Parts A, B, C and D**. The time allotted for all parts is **three hours**.
- * Use of non-programmable calculators is allowed.

Part A - Structured Essay
(Pages 2 - 8)

- * Answer **all** the questions **on this paper itself**.
- * Write your answers in the space provided for each question. Note that the space provided is sufficient for your answers and that extensive answers are not expected.

Parts B, C and D - Essay
(Pages 9 - 13)

- * Select minimum of **one** question from each of the **parts B, C and D** and answer **four** questions only. Use the papers supplied for this purpose. At the end of the time allotted for this paper, tie **all parts** together so that **Part A** is on the top of **Parts B, C and D** before handing over to the supervisor.
- * You are permitted to remove only **Parts B, C and D** of the question paper from the examination hall.

For Examiners' Use Only

Part	Question Nos.	Marks Awarded
A	1	
	2	
	3	
	4	
B	5	
	6	
C	7	
	8	
D	9	
	10	
Total	In Numbers	
	In Words	

Code Numbers

Marking Examiner 1	
Marking Examiner 2	
Checked by	
Supervised by	

Part A – Structured Essay*Answer all questions on this paper itself.*Do not
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1. (A) Microorganisms can be classified into two groups, prokaryotes and eukaryotes, based on their features. Answer the following questions with regard to the microorganisms given in the box below.

<i>Acetobacter</i>	<i>Aspergillus</i>	<i>Clostridium</i>	<i>Cyanobacteria</i>
<i>Lactobacillus</i>	<i>Nitrobacter</i>	<i>Saccharomyces</i>	<i>Streptococcus</i>

- (i) Name a microorganism that belongs to the eukaryotic group.

.....

Choose microorganisms with the characteristics given below, and fill in the table.

	The characteristic	Microorganism
(ii)	Rod-shaped	
(iii)	Performs photosynthesis	
(iv)	Performs obligate anaerobic respiration	
(v)	Most suitable for curd production	
(vi)	Used in several industries	

- (vii) Write **two** similarities between prokaryotic and eukaryotic cells.

(1)

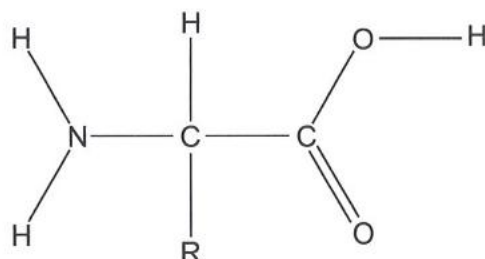
(2)

- (viii) Write **two** structural differences between prokaryotic and eukaryotic cells.

(1)

(2)

- (B) Answer the following questions referring the basic structure of an amino acid given below.



- (i) Circle and name the alpha (α) carbon atom of the above amino acid structure.

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- (ii) Draw the structures of any **two** functional groups of this amino acid and write the names of those **two** groups in the table below.

	Structure of the functional group	Name of the functional group
(1)		
(2)		

- (iii) Draw the molecule formed when the two amino acid molecules given in (B)(i) are bond together by a peptide bond. Show the peptide bond in that structure using an arrow.

- (iv) Write the name of an essential amino acid.

.....

- (v) Name a chemical test that can be used to identify amino acids.

.....

Q.1

100

2. A student designed an experiment to determine the amount of energy required and the reaction rate of the production process of biodiesel. In this experiment, 800 mL of used coconut oil is mixed with 1 g of KOH in 200 mL of ethanol. Then, the mixture is heated to 60°C.

- (A) (i) What is the function of KOH in this process?

.....

- (ii) Why is it **not** suitable to heat the mixture beyond 60°C?

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- (iii) A metal object with a heat capacity of $500 \text{ J}^\circ\text{C}^{-1}$ at 40°C is placed in the mixture. The temperature of the mixture increased from 30°C to 32°C . Calculate the heat capacity of the mixture in $\text{kJ}^\circ\text{C}^{-1}$.

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- (iv) Calculate the amount of heat required to raise the temperature of the mixture to 60°C , assuming the initial temperature of the mixture is 30°C .

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- (B) The reaction between coconut oil and ethanol in the production of biodiesel is as shown below.



- (i) The initial number of moles of ethanol in the mixture is 3.5. Calculate the concentration of ethanol in the mixture.
(Assume that the addition of KOH does not cause any change in volume.)

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- (ii) The amount of ethanol remains in the mixture after 100 minutes is 1.0 mol. Calculate the rate of ethanol consumption in mol min^{-1} .

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- (iii) Calculate the yield of biodiesel of this process in moles.

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- (iv) Calculate the rate of biodiesel production in mol min^{-1} .

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- (v) Calculate the amount of energy that can be produced by combusting the biodiesel generated during the first 100 minutes.

The heat energy released from the combustion of one mole of biodiesel is 2.5 MJ.

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Q. 2

100

3. Lipids are one of the main nutrients in food and are mainly composed of fats and oils. Coconut oil and palm oil are common edible oils used in cooking.

- (i) What is the main difference between fats and oils?

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- (ii) Name a chemical test that can be used to identify the presence of lipids in a coconut oil sample.

.....

- (iii) Write the test results in the presence and absence of lipids for the chemical test you mentioned in part (ii).

Test result when lipid is present :

.....

Test result when lipid is absent :

.....

- (iv) Two 1000 mL glass bottles, each separately filled with coconut oil and palm oil, were used to calculate the density of these two types of oils at 25°C. Using the information provided below, calculate the density of each type of oil in g mL⁻¹.

	Coconut oil	Palm oil
Mass of the 1000 mL glass bottle	800 g	800 g
Mass of the 1000 mL glass bottle with oil	1718 g	1692 g
Density of the oil/g mL ⁻¹		

- (v) Saturated fatty acid molecules are tightly packed together. Based on the calculated density values, determine the type of oil that contains more saturated fatty acids.

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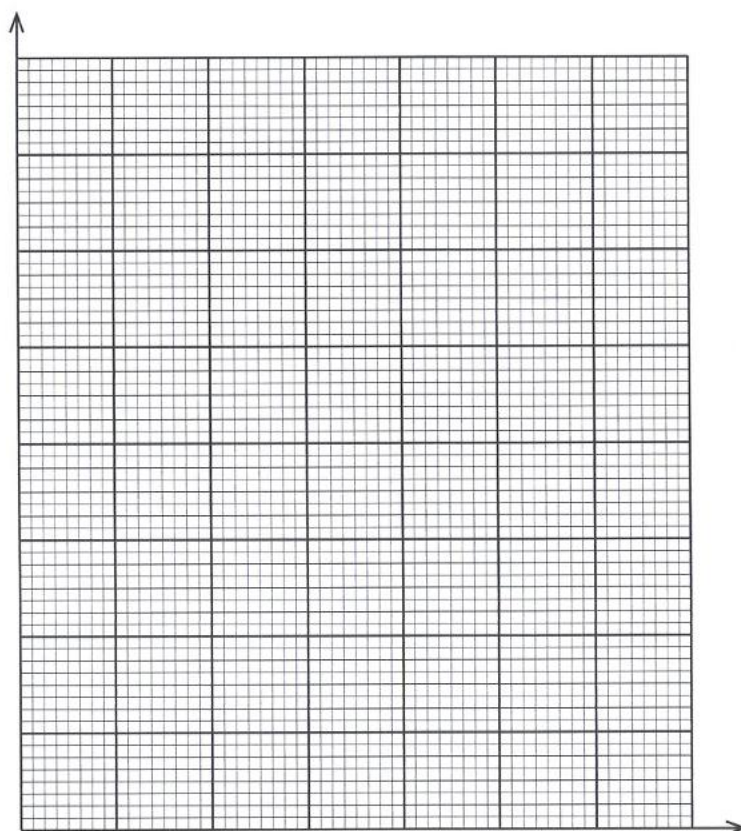
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- (vi) Masses of mixtures of coconut oil and palm oil mixed in different ratios are given in the table below. Plot the volume of coconut oil versus mass of each mixture in the grid given below.

Volume of Coconut oil/mL	Volume of Palm oil/mL	Mass/g
1000	0	918
800	200	912
600	400	907
400	600	902
200	800	897
0	1000	892



- (vii) A student bought 1000 mL of coconut oil from the market and its mass is 900 g. It is suspected that this coconut oil is adulterated with palm oil. Determine the possible volume of palm oil in this sample using the graph drawn in (vi) above.

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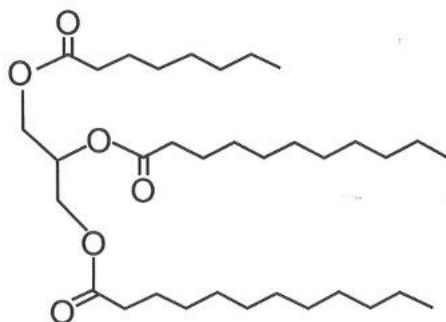
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(viii) A commonly found lipid molecule is shown below.

(1) Using an arrow, mark an ester bond in the lipid molecule.



(2) Identify and draw the structures of one of the fatty acid molecules and the glycerol molecule that the lipid molecule is made of, in the given boxes.

Fatty acid molecule

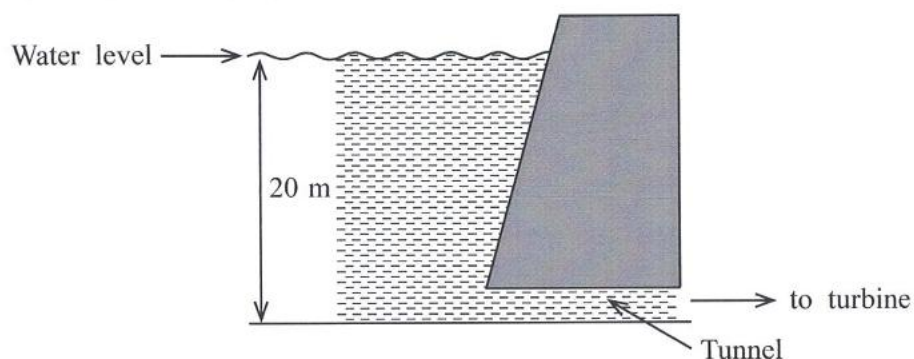
Glycerol molecule

Q.3

100

4. Water is directed to a turbine through a horizontal tunnel connected to a reservoir filled with water up to 20 m above from the bottom. This setup is shown in the diagram below.

[The density of water (ρ) = 1000 kg m^{-3} , Gravitational acceleration (g) = 10 m s^{-2} , the atmospheric pressure (P_{atm}) = $1.01 \times 10^5 \text{ Pa}$]



(i) Calculate the pressure at the bottom of the reservoir.

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- (ii) The horizontal tunnel releases an amount of $10 \text{ m}^3 \text{ s}^{-1}$ water to the turbine. Calculate the mass of the water that travels to the turbine in a second.

.....

.....

- (iii) The opening that takes water to the turbine is located 20 m below the water surface of the reservoir. Calculate the speed of water that flows towards the turbine.

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- (iv) Considering that the water enters to the turbine at a speed of 20 m s^{-1} and exits at a speed of 3 m s^{-1} , calculate the kinetic energy loss per second.

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- (v) Consider that the kinetic energy loss of water is fully transferred to the turbine. If the electrical output is of 1.5 MW, calculate the efficiency of the electricity generation process.

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Q.4

100
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

තාක්ෂණවේදය සඳහා විද්‍යාව II
தொழினுட்பவியலுக்கான விஞ்ஞானம் II
Science for Technology II

Essay

67 E II

Instructions:

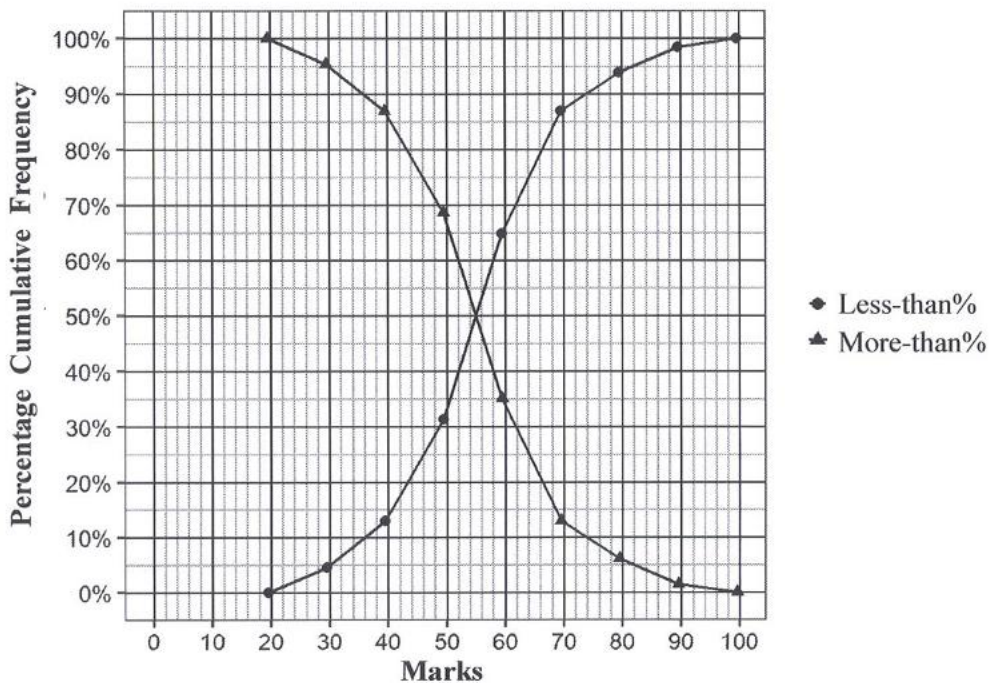
- * Select minimum of **one** question each from **parts B, C and D** and answer **four** questions only.
- * Each question carries **150** marks.
- * Use of non-programmable calculators is allowed.

Part B - Essay

5. In an examination, marks (out of 100) of 131 students studying Advanced Level 'Science for Technology' were recorded. These marks were rounded to the nearest whole number, and their grouped frequency distribution is given in the table below.

Class interval (marks)	Frequency
20 – 29	6
30 – 39	11
40 – 49	24
50 – 59	44
60 – 69	29
70 – 79	9
80 – 89	6
90 – 99	2
Total	131

The graph below shows the **more-than percentage cumulative frequency curve** and the **less-than percentage cumulative frequency curve** for these data. Use the graph to answer the following questions.



[see page ten

(a) Using the graph,

- (i) estimate the first quartile (Q_1), the median (Q_2), and the third quartile (Q_3) to the nearest whole number.
- (ii) calculate the interquartile range (IQR).

(b) Calculate the mean of the marks, to the nearest first decimal place, using the formula

$$\bar{x} = A + \frac{\sum f_i d_i}{\sum f_i} \text{ where,}$$

A (for this calculation, take $A = 54.5$) is the assumed mean,

f_i is the frequency of i^{th} class,

d_i is the deviation from the i^{th} class mark m_i to A , i.e. $d_i = m_i - A$.

(c) Let x be the mark of a student. This mark x can be standardized to y using the formula below.

$$y = \frac{x - Q_2}{\text{IQR}}$$

- (i) Calculate the value of y for a student who scored 91 marks.
- (ii) For a score that is exactly equal to the median mark, calculate the corresponding y value.
- (iii) Calculate corresponding y values when the value of x is Q_1 and Q_3 respectively.
- (iv) Special gifts are awarded to the students whose $y \geq 1.5$. Determine the minimum mark required to receive a gift.
- (v) Using the graph, calculate the maximum number of students receiving a gift as mentioned in part (iv).

6. A technique used to create characters in animated movies is transforming a rhombus into the required curve of the character. This question is based on that technique.

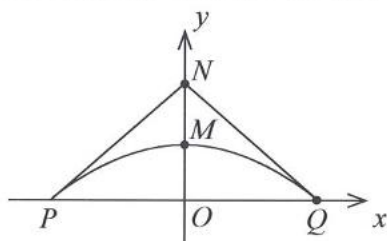


Figure 1

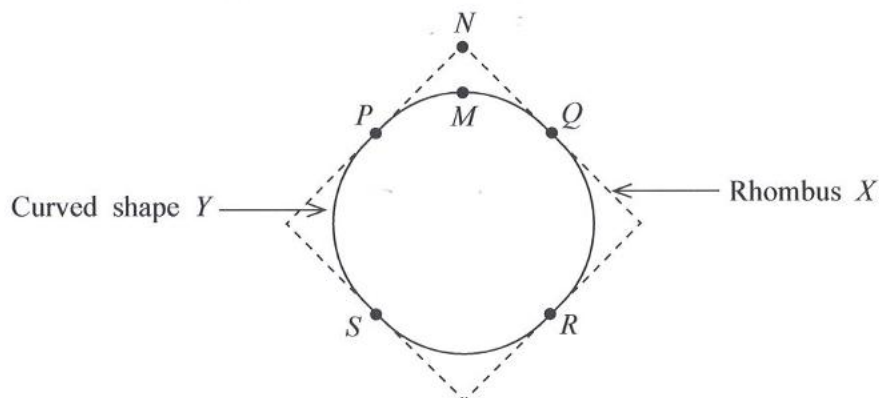
(a) The graph in Figure 1 above shows a parabola with x -intercepts at the points P and Q and the y -intercept at the point M . The equation of the parabola is $y = -\frac{1}{4}x^2 + 1$. O is the origin.

- (i) Show that the x -coordinates of P and Q are -2 and 2 respectively.
- (ii) **Hence**, write the pairs of coordinates of P and Q .
- (iii) Find the coordinates of M .
- (iv) Show that M is the maximum point of the parabola.

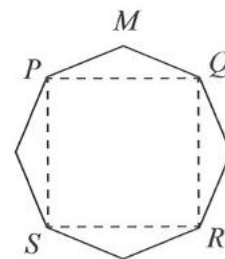
(b) Consider the two-line segments PN and NQ in the above graph. The coordinates of N are $(0, 2)$.

- (i) Find the equation of line PN in $y = mx + c$ form.
- (ii) The triangle PNO falls into two types of special triangles. Write their names.
- (iii) Find the angle $\hat{PNQ}$, giving reasons.
- (iv) **Hence**, write the equation of line NQ .
- (v) Find the length of lines PN , PQ and MO . Give your answer in surd form where necessary.

- (c) In one character creation, a rhombus X is transformed into a curvy shaped Y made of four identical parabolic segments, as shown below. P , Q , R , and S are the midpoints of the sides of the rhombus. The $PNQM$ section in the diagram below is identical to Figure 1.



- (i) X is a special rhombus. Write its specific name.
 - (ii) Calculate the perimeter of the rhombus X .
 - (iii) Calculate the area of the rhombus X .
- (d) The area of Y can be approximated by approximating its shape to a regular octagon $PMQRS$ (see adjoining figure).
- (i) Calculate the area of the triangle PMQ .
 - (ii) Calculate the area of $PQRS$ quadrilateral.
 - (iii) Calculate the approximate area of the curvy shaped Y , using the answers to (i) and (ii).

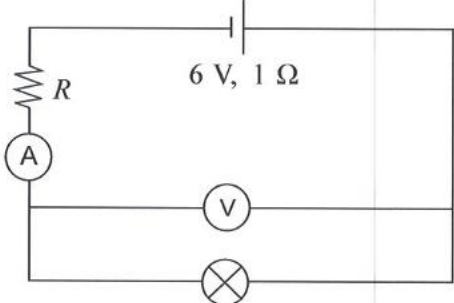


Part C - Essay

7. (a) A polymer made using natural chitosan, and synthetic polyvinyl alcohol has properties of natural and synthetic polymers. This semi-natural polymer is used in tissue engineering.
- (i) What is a polymer?
 - (ii) Why are synthetic polymers commonly used instead of natural polymers?
 - (iii) Chitosan is a thermosetting polymer. Write **two** characteristics of thermosetting polymers.
 - (iv) How is chitosan obtained naturally?
- (b) Phthalates are commonly used as additives in the production of plastics from polymers. However, many countries have banned the use of phthalates in children's toys.
- (i) Define an additive used in the plastic manufacturing process?
 - (ii) What is the reason for using phthalates during the plastic manufacturing process?
 - (iii) Explain the reason for banning the use of phthalates in the manufacturing of children's toys in many countries.
- (c) Exposure to sunlight and ozone can damage and degrade plastics.
- (i) Explain the natural processes of ozone formation and decomposition in the atmosphere.
 - (ii) Explain **one** of the main methods of ozone production at ground-level.
 - (iii) Why is the exposure of plastics to ozone and sunlight, harmful to the environment?
 - (iv) Explain how 3R concept can be used to reduce plastic usage.

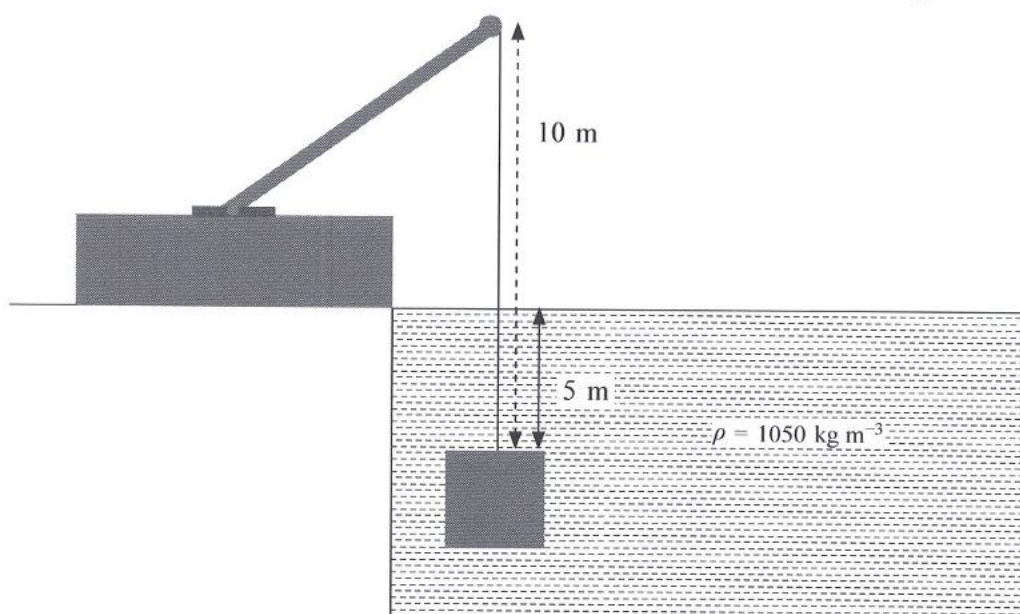
8. (a) A group of entrepreneurs extract various secondary metabolites from plant materials that are needed for herbal products. They use multiple distillation and solvent extraction methods to obtain these secondary metabolites.
- What are secondary metabolites?
 - Based on structural features, what are the **three** main groups that secondary metabolites can be classified?
 - Why is it more suitable to use extracted secondary metabolites as medicine instead of using the whole plant?
 - What are the **three** main methods of distillation? Write an advantage of each method.
 - Explain how thin-layer chromatography can be used to determine the purity of a secondary metabolite extracted using solvent extraction.
 - Write **three** factors that should be considered in selecting plant varieties for a secondary metabolite extraction.
 - The group of entrepreneurs decided to plan a solvent extraction process for a new plant according to cleaner production principles. Suggest **two** factors they should consider when planning the solvent extraction process.
- (b) A student developed a water quality meter for fish tanks. It monitors the conductivity and pH value of water.
- Name **two** water quality parameters that can be determined by measuring conductivity and pH?
 - Rainwater is used to fill the fish tank. Write **two** factors that determine the pH value of rainwater.
 - After filling the tank, the student keeps the air pump running for a few hours to aerate the water. Explain the reason for aeration.
 - The student places a few aquatic plants in the tank to control the increase of COD and BOD in it. Is this approach successful? Explain your answer.

Part D - Essay

9. (a) There is a filament bulb rated as 3 V and 0.9 W.
- Calculate the resistance of this bulb filament.
 - Calculate the current through the bulb filament, when the bulb lights up at its rated brightness.
- (b) To light up the bulb at its rated brightness, a resistor R and a 6 V battery with an internal resistance of $1\ \Omega$ are connected, in series with the bulb. An ammeter A and a voltmeter V were also connected to the circuit, as shown in the figure. (Assume that both instruments are ideal.)
- 
- Calculate the resistance of the resistor R to light the bulb at its rated brightness.
 - Calculate the readings of the ammeter and voltmeter when the bulb is lighting at its rated brightness.
 - Calculate the terminal voltage of the battery when the bulb is lighting at its rated brightness.
 - Calculate the heat energy generated by the battery during 30 minutes of lighting the bulb at its rated brightness.
 - The practically obtained ammeter and voltmeter readings are different from the theoretically calculated values. Write **two** possible reasons for this difference.

- (c) The bulb is filled with argon gas, and the filament is at a higher temperature when the bulb is lit up.
- Explain the main reason why the bulb is filled with argon gas instead of ordinary air.
 - What are the heat transfer methods from the hot filament to the surroundings?
 - If the bulb was filled with a vacuum instead of argon gas, write **one** main **disadvantage**.

- 10.(a) A crane is used to lift a concrete block of mass 1000 kg submerged in the sea. A steel cable attached to the crane holds the concrete block at rest as shown in the diagram.



- Draw the concrete block and mark the forces acting on it.
 - The volume of the concrete block is 0.8 m^3 and the density of seawater is 1050 kg m^{-3} . Ignoring the weight of the steel cable, calculate the tension in it.
 - The length of the steel cable is 10 m and the cross-sectional area is 50 mm^2 . Considering that Young's modulus is $2.0 \times 10^{11} \text{ N m}^{-2}$, calculate the extension of the steel cable. (Assume that the proportional limit of the cable is not exceeded.)
 - Calculate the elastic potential energy stored in the cable.
- (b) The crane lifts the block vertically upwards with a uniform acceleration of 0.20 m s^{-2} .
- Calculate the tension in the steel cable when the block is moving upwards while it is fully submerged in the sea. (Ignore viscous forces acting on the concrete block.)
 - Calculate the work done by the steel cable when lifting the concrete block 5 m upwards. The concrete block is 5 m below the water surface as shown in the diagram.
- (c) Calculate the maximum mass that the steel cable can lift at an acceleration of 0.20 m s^{-2} in the air. The maximum strain of the cable under its proportional limit is 2.55×10^{-3} .



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