AL/2019/67-E-I(NEW)

සියලු ම හිමිකම් ඇවිරිණි/முழுப் பதிப்புரிமையுடையது/All Rights Reserved]

නව නිර්දේශය/புதிய பாடத்திட்டம்/New Syllabus

NEW

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2019

16.08.2019 / 0830 - 1030

තාක්ෂණවේදය සඳහා විද්‍යාව I
தொழினுட்பவியலுக்கான விஞ்ஞானம் I
Science for Technology I

67 E I

පැය දෙකයි
இரண்டு மணித்தியாலம்
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** (×) **in accordance with the instructions given on the back of the answer sheet.***
- ✻ ***Use of calculators is not allowed.***

1. What is the stored food in plant cells?
(1) Glucose (2) Cellulose (3) Starch (4) Glycogen (5) Fructose

2. Between which atoms is a peptide bond formed?
(1) Carbon and carbon (2) Carbon and hydrogen
(3) Nitrogen and nitrogen (4) Hydrogen and nitrogen
(5) Carbon and nitrogen

3. *Nitrosomonas* is a
(1) chemoheterotrophic bacteria. (2) chemoautotrophic bacteria.
(3) photoautotrophic bacteria. (4) photoheterotrophic bacteria.
(5) heterotopic bacteria.

4. Which of the following comparisons is correct for monocotyledon and dicotyledon plants?

	Monocotyledon plants	**Dicotyledon plants**
(1)	Leaf veins are parallel.	Leaf veins are reticulated.
(2)	Stem is branched.	Stem is unbranched.
(3)	Root system is tap.	Root system is fibrous.
(4)	Petals in the flower are multiples of four or five.	Petals in flower are multiples of three.
(5)	Guard cells are bean shaped.	Guard cells are dumbbell-shaped.

5. Which pair of hormones is mainly used in tissue culture?
(1) cytokinin and ethylene (2) cytokinin and gibberellin
(3) cytokinin and abscisic acid (4) auxin and cytokinin
(5) auxin and ethylene

6. The average distances between two closest H_2O molecules in ice, water at room temperature, and steam are L(ice), L(water) and L(steam) respectively. What is the correct relationship of the average distances among them?
(1) L(ice) = L(water) = L(steam) (2) L(ice) > L(water) > L(steam)
(3) L(ice) = L(water) < L(steam) (4) L(ice) < L(water) < L(steam)
(5) L(ice) > L(water) < L(steam)

[See page two

7. Activation energy of a reaction depends upon
(1) heat supplied.
(2) presence of radiations.
(3) reactant concentration.
(4) mixing speed of reactants.
(5) presence of catalysts.

8. Consider the following statements.
(A) Polymers are made of a large number of monomers (simple molecules).
(B) Polymers and monomers have similar physical properties.
(C) All natural polymers are biodegradable and some are edible.
Of the above, the correct statement/s would be
(1) (A) only.
(2) (A) and (B) only.
(3) (A) and (C) only.
(4) (B) and (C) only.
(5) all (A), (B) and (C).

9. Consider the following statements.
(A) Natural products are compounds produced in living organisms.
(B) Natural products are produced only in some organisms.
(C) All natural products are directly associated with the growth of organisms.
Of the above, the correct statement/s would be
(1) (A) only.
(2) (B) only.
(3) (C) only.
(4) (A) and (C) only.
(5) (B) and (C) only.

10. In column chromatography, what is the main reason to have a layer of sand to cover the stationary phase?
(1) To fill the column to the top
(2) To fill the spaces in the stationary phase
(3) To filter the solvent.
(4) To remove coloured compounds.
(5) To avoid disturbances to the stationary phase.

11. An inventor should apply for a patent
(1) soon after identifying the novelty of the invention.
(2) after exposing the invention to an investor.
(3) before testing the invention at the laboratory level.
(4) after introducing the invention to the market.
(5) after publishing a newspaper article about the invention.

12. Which of the following is a recommended approach when starting a chemical manufacturing industry?
(1) Use of an unreliable but a cheap power source
(2) Use of a fast but an inefficient chemical process
(3) Use of a slow but an efficient chemical process
(4) Use of locally available expensive raw materials
(5) Use of a fast but environment unfriendly chemical process

13. Which of the following is most correct statement regarding renewable resources?
(1) Available in the nature
(2) Used in many industries
(3) Available in the nature and use for the industries
(4) Used in many industries and biodegradable
(5) Used repeatedly and regenerate naturally

14. What are the two major processes that contribute for the removal of carbon dioxide gas from the atmosphere?
(1) Photosynthesis and industrial use
(2) Photosynthesis and dissolution in water
(3) Photosynthesis and chemical reactions
(4) Industrial use and reaction with soil
(5) Industrial use and dissolution in water

[See page three

15. Which of the following air pollutant produces acid rains?
(1) O_3 (2) SO_2 (3) CH_4 (4) CO (5) NH_3

16. Which of the following is correct regarding NO_2 gas in the atmosphere?
(1) NO_2 is not considered as a greenhouse gas.
(2) NO_2 does not absorb IR radiations.
(3) NO_2 does not produce acid rains.
(4) NO_2 does not contribute to the formation of photochemical smog.
(5) NO_2 contributes to produce ozone at low levels in the atmosphere.

17. What is the conversion that can only be occurred industrially?
(1) Proteins $\rightarrow$ NH_3 (2) Nitrogen gas $\rightarrow$ NO_2^-
(3) NO_3^- $\rightarrow$ nitrogen gas (4) NH_4^+ $\rightarrow$ NO_3^-
(5) Nitrogen gas $\rightarrow$ NH_3

18. An antioxidant can
(1) destroy cancer cells.
(2) destroy or slow down the growth of virus.
(3) destroy or slow down the growth of fungus.
(4) inhibit the oxidation inside the living cells.
(5) slow down the production of histamine inside the living cells.

19. There is a sphere in the bottom of a cylindrical-shaped container with 25 cm radius and 100 cm height. What is the radius of the sphere if 155.5 l of water is needed to fill this container? (Consider as, 1 ml = 1 cm^3 and $\pi = 3$.)
(1) 20 cm (2) 40 cm (3) 80 cm (4) 160 cm (5) 320 cm

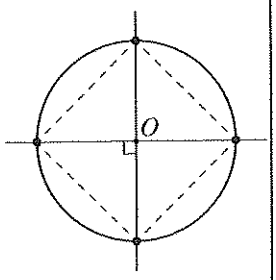
20. A person in a parachute observes two points on the earth surface with the horizontal distance of 5 km with 30° and 60° angles of depression respectively. What is the height from the earth surface to the person? (Consider as $\sin 30° = \frac{1}{2}$ and $\cos 30° = \frac{\sqrt{3}}{2}$.)
(1) 5 km (2) $5\sqrt{3}$ km (3) $\frac{5\sqrt{3}}{2}$ km (4) $\sqrt{3}$ km (5) $\frac{\sqrt{3}}{2}$ km

21. A, B and C are the corners of a triangular-shaped land. Distance from A to B is 6 km, and distance from A to C is 2 km and the angle of $C\hat{A}B$ is 30°. What is the area of the land? (Consider as $\sin 30° = \frac{1}{2}$ and $\cos 30° = \frac{\sqrt{3}}{2}$)
(1) 2 km^2 (2) 3 km^2 (3) 6 km^2 (4) 12 km^2 (5) 18 km^2

22. A line passing through the intersection of two lines $y=2x+3$ and $y=3x+2$ also perpendicular to the line $y = x - 4$. What is the intercept of this line?
(1) -6 (2) 0 (3) 4 (4) 5 (5) 6

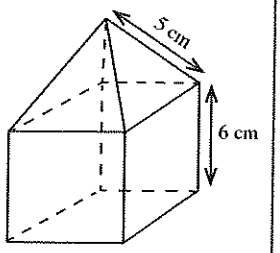
23. A line segment AB of length $\sqrt{8}$ units is on the line $y=x+1$. If the coordinates of point A are (2,3), what are the coordinates of point B?
(1) (–1,0) (2) (3,4) (3) (1,0) (4) (4,5) (5) (5,6)

24. Four flagpoles are fixed in a circular ground of centre O and radius 50 m as shown in the figure. What is the shortest distance between two adjacent flagpoles?
(1) $5\sqrt{2}$ m (2) $10\sqrt{5}$ m (3) 50 m
(4) $50\sqrt{2}$ m (5) $500\sqrt{2}$ m



[See page four

25. A combined object is made by joining a cube and a square base right pyramid as shown in the figure. What is the surface area of the object?



(1) 144 cm^2 (2) 192 cm^2 (3) 228 cm^2
(4) 240 cm^2 (5) 276 cm^2

26. How many times is the area of a sector increased if the radius and the angle at the centre of the sector are doubled?
(1) 2 (2) 4 (3) 8 (4) 16 (5) 32

27. The maximum temperature recorded in Centigrade during the winter in nine European cities in year 2018 are given below.

−3, −4, −8, −9, −9, −11, −11, −12, −15

What is the first quartile (Q_1) of the above temperature distribution?
(1) −4.0 (2) −5.5 (3) −6.0 (4) −8.0 (5) −11.5

28. Amal and Bimal play a game. If Amal wins he scores one point and Bimal loses one point. Similarly, if Bimal wins he scores one point and Amal loses one point. If the game is ended in a draw each of them scores one point each. They played the game 40 times and Amal won 20 times, Bimal won 12 times and the rest were ended in draws. What is the mean of the scores of Amal?
(1) 0.00 (2) 0.20 (3) 0.25 (4) 0.40 (5) 0.70

29. Out of the given units, what is the largest unit used to measure the storage capacity of a computer?
(1) Gigabyte (GB) (2) Terabyte (TB) (3) Kilobyte (kB)
(4) Megabyte (MB) (5) Byte (B)

30. What is the correct statement regarding computer monitors?
(1) LCD and LED monitors are known as flat panels.
(2) LED monitors are not used in computers.
(3) LCD monitors are not used in computers.
(4) LCD and CRT are called flat panels.
(5) Quality of images of CRT monitors are higher than LED monitors.

31. Consider the following statements.
(A) Non-volatility feature of RAM is useful to store application software.
(B) Multitasking feature of an operating system allows a user to perform more than one task simultaneously.
(C) Problems in hardware devices can be detected by using diagnostic software.

Of the above, the correct statement/s would be
(1) (B) only. (2) (A) and (B) only. (3) (A) and (C) only.
(4) (B) and (C) only. (5) All (A), (B) and (C).

The following text is a part of an assignment drafted by a student using a word processing software. Questions **32** and **33** are based on it.

"National Water Supply and Drainage Board (NWS&DB) distributes drinking water. Details of activities done by NWS&DB in purification of water is given in Section 2."

32. What can be used to find a synonym for the word 'distributes'?
(1) Spelling and Grammar (2) Translate (3) Find and Replace
(4) Format painter (5) Thesaurus

33. The student found that 'NWSDB' is more accurate to use instead of 'NWS&DB'. What is the best function to do this edit for the entire assignment?
(1) Change case (2) Find and Replace
(3) Spelling and Grammar (4) Sort
(5) Drag and Drop

[See page five

34. Consider the following statements.

(A) When sending e-mails, the recipients listed under 'Cc' are visible to all the other recipients whereas that under 'Bcc' are not visible to the other recipients.

(B) 125.214.169.218 could be a correct IP address.

(C) A search engine is a tool that enables users to locate information on the World Wide Web.

Of the above, the correct statement/s would be

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

35. In a typical software on presentations CTRL + N shortcut key is used

(1) to add a hyperlink. (2) to save the presentation.
(3) to create a new presentation. (4) to find a text.
(5) to add a new slide.

36. Consider the following statements regarding computer viruses.

(A) Computers cannot be infected by viruses when they are not connected to networks.

(B) Keeping the virus guard up-to-date is important to protect computers from viruses.

(C) Computer viruses are usually hidden in the operating system and application programs.

Of the above, the correct statement/s would be

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

37. What is the incorrect function in spreadsheet?

(1) =SUM(marks)-A3 (2) =SUM(B1:B5)-5 (3) =SUM(B1:B5)*0.5
(4) =SUM(B1:B5)/(5-1) (5) =SUM(B1:B5)*(5-1)

38. National Water Supply and Drainage Board has studied the variation of daily raining for a period of one month. What is the most appropriate chart type to present the variation of the collected data?

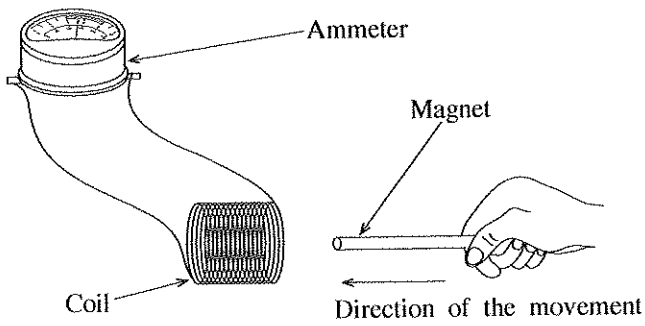
(1) Column chart (2) Line chart (3) Flow chart (4) Pie chart (5) Area chart

39. Which one of the followings **does not** affect the rate of heat convection from an object to the environment?

(1) Surface area of the object
(2) Nature of the surface of the object
(3) Position of the center of mass of the object
(4) Flow rate of fluid flowing over the object
(5) Temperature difference between the environment and the object

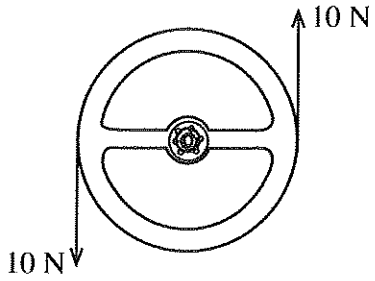
40. A rectangular-shaped magnet is moved towards a conducting coil as shown in the figure. Then, which one of the following **does not** influence the magnitude of the electromotive force induced in the coil?

(1) Strength of the magnet
(2) Speed of the motion of the magnet
(3) Cross sectional area of the coil
(4) Number of turns of the coil
(5) Magnetic pole directed towards the coil



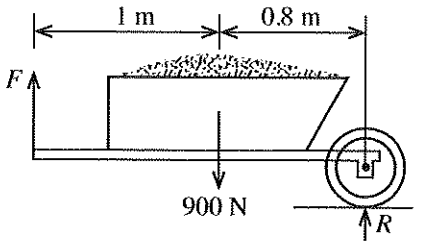
[See page six

41. The two hands of a motorist apply equal and opposite forces of 10 N each to the steering wheel of a car as shown in the figure. If the circumference of the steering wheel is 1.2 m, what is the moment of couple applied to the steering wheel? (Consider $\pi = 3$)



(1) 4 N m (2) 8 N m (3) 12 N m
(4) 16 N m (5) 24 N m

42. Three vertical forces acting on a stationary wheelbarrow are shown in the figure. The force, F applied to keep the lifted handles of the wheelbarrow horizontally and the force R acting on the axle of the wheel are respectively,



(1) 180 N and 180 N. (2) 400 N and 500 N.
(3) 800 N and 200 N. (4) 2025 N and 1125 N.
(5) 4050 N and 2250 N.

43. The mass of a man wearing a pair of shoes is 52.8 kg. The total sole area of the pair of shoes is 176 cm^2. What is the pressure exerted by the man on the floor?
(1) 9 Pa (2) 30 Pa (3) 528 Pa (4) 9 kPa (5) 30 kPa

44. A solid cylinder having moment of inertia 0.36 kg m^2 rotates about its axis with angular velocity 100 rad s^{-1}. What is the kinetic energy of the rotating cylinder?
(1) 18 J (2) 36 J (3) 1800 J (4) 3600 J (5) 7200 J

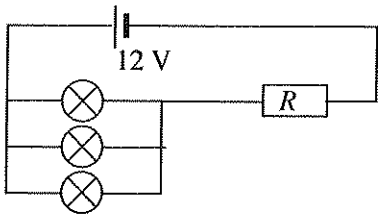
45. The moment of inertia of an object is 2.5 kg m^2. What is the torque required to create an angular acceleration of 18 rad s^{-2} on the object?
(1) 1.8 N m (2) 25 N m (3) 45 N m (4) 90 N m (5) 180 N m

46. A piece of wood with the relative density of 0.27 floats on oil of relative density of 0.81. What is the volume of the piece of wood that appears above the level of oil as a precentage of its total voulme?
(1) 21% (2) 33% (3) 67% (4) 81% (5) 93%

47. An electric pump raises water to a vertical height of 48 m at the rate of 5 kg per minute. What is the power of the pump? (g = 10 N kg^{-1})
(1) 20 W (2) 40 W (3) 60 W (4) 120 W (5) 240 W

48. A hot water tank contains 170 kg of water at 20 °C. How long will it take to heat the water to 60 °C by using an electric immersion heater which operates at the power of 5 kW? (The specific heat capacity of water is 4200 J kg^{-1} K^{-1}.)
(1) 1700 s (2) 2856 s (3) 3800 s (4) 5712 s (5) 6100 s

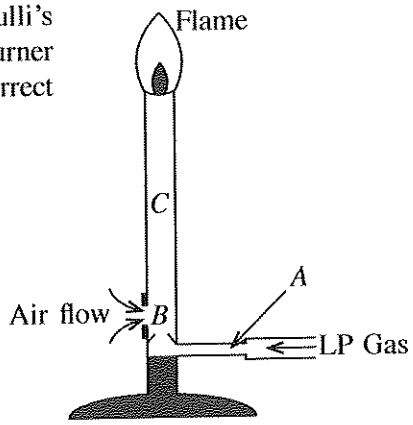
49. Three bulbs, each rated as 1.5 V, 0.5 A and a resistor R are connected to a 12 V battery as shown in the figure. In order to light the bulbs at the rated value, what should be the value of R?



(1) 1 Ω (2) 3 Ω (3) 5 Ω
(4) 7 Ω (5) 8 Ω

[See page seven

50. Function of the Bunsen burner can be described by using the Bernoulli's principle. If the pressures at points A, B and C of the Bunsen burner shown in the diagram are p_A, p_B and p_C respectively, what is the correct relationship among them?



(1) $p_A = p_B = p_C$

(2) $p_A < p_B > p_C$

(3) $p_A > p_B < p_C$

(4) $p_A < p_B < p_C$

(5) $p_A > p_B > p_C$

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AL/2019/67-E-II(NEW)

සියලු ම හිමිකම් ඇවිරිණි/முழுப் பதிப்புரிமையுடையது/All Rights Reserved]

නව නිර්දේශය/புதிய பாடத்திட்டம்/New Syllabus

NEW

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2019

තාක්ෂණවේදය සඳහා විද්‍යාව II தொழினுட்பவியலுக்கான விஞ்ஞானம் II **Science for Technology II**	**67**	**E**	**II**

19.08.2019 / 0830 - 1140

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීම් 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 and decide on the questions that you give priority in answering.

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 calculators is not allowed.***

Part A - Structured Essay (Pages 2 - 7)

* *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 8 - 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	Q. No.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
C	7	
	8	
D	9	
	10	
Total		

Total

In Numbers	
In Words	

Code Numbers

Marking Examiner 1	
Marking Examiner 2	
Checked by	
Supervised by	

[see page two

Part A — Structured Essay

*Answer **all questions on this paper itself**.*

Do not write in this column

1. (a) Biogas production is one of the best alternative solution to overcome the energy crisis.

(i) What is the main hydrocarbon presents in biogas?

.....

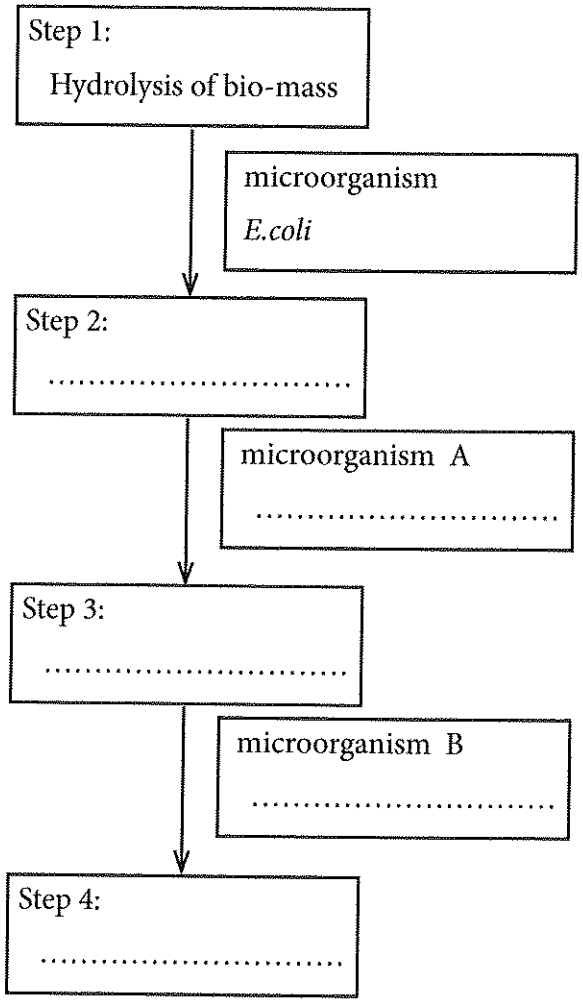
(ii) Name a non-hydrocarbon gas produced by microorganisms in the process of biogas production?

.....

(iii) The first step of the biogas production process is given in the flow chart below. Write the remaining **three** main steps of that process in the flow chart.

(iv) Out of the microorganisms given below, select the most appropriate microorganism for A and B in the given flow chart.

Microorganisms:	*Lactobacillus, Acetobacter, Methanococcus, Saccharomyces*



(v) Name the respiratory group of the main bacteria involves in the biogas production.

.....

(vi) Supplying an alternative energy source is the main advantage of the process of biogas production. Write another advantage of the process.

.....

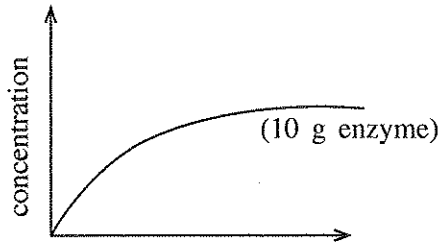
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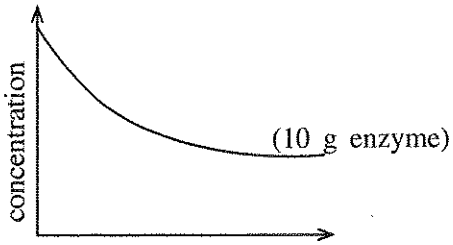
(b) Write an industry that uses each enzyme given in the table below and state its function.

Enzyme	Industry	Function of the enzyme
Cellulase		
Pectinase		

(c) Variations of concentration of the reactant and the product with time of an industrial process catalysed by 10 g of enzyme are illustrated in the graphs given below.



Graph A



Graph B

(i) Out of the above graph A and B identify the graph that represents the variation of reactant concentration and product concentration with time during the industrial process, and write down in the table below.

	Illustrated Graph
Concentration of reactant	
Concentration of product	

(ii) The above industrial process was repeated under the same conditions using 20 g instead of 10 g of enzyme. Draw the variation of reactant and product concentrations with time in presence of 20 g of enzyme on the relevant graph given above.

Q.1

100

2. (a) Rate of a chemical reaction used in an industrial process is optimized to produce a maximum yield using a minimum amount of resources.

(i) Name **three** physical factors that affect the rate of a reaction.

(1) .....

(2) .....

(3) .....

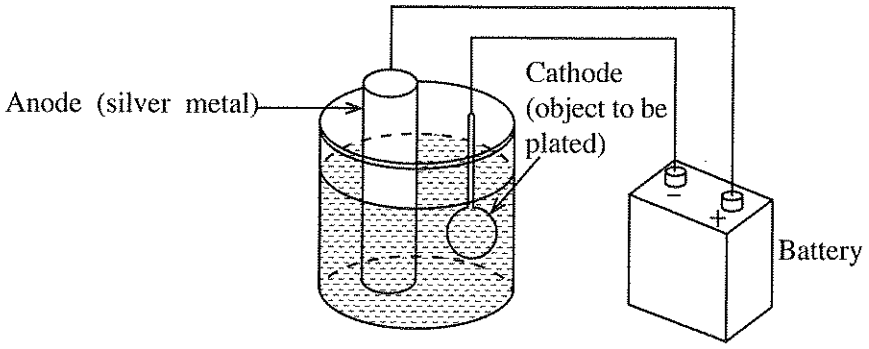
(ii) Reactants must collide with each other to produce products. Name **one** more requirement that must be fulfilled to convert reactants to products.

.....

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(b) Electroplating is a process used to coat a thin layer of metal on a surface. Efficiency of a silver electroplating process can be determined using the following experimental setup.



A silver rod is used as the anode to plate a metal coin. The initial weight and the weight after 30 minutes of the silver rod and the coin are given in the table below.

Object	Initial weight (mg)	Weight after 30 minutes (mg)
Silver rod	2800	2500
Metal coin	750	850

(i) Calculate in milligrams, the weight reduction of the silver rod and the weight gained by the metal coin in the electroplating process.

Weight loss of the silver rod

.....

Weight gained by the metal coin

.....

(ii) Calculate the rate of weight gained by the metal coin in mg min^{-1}.

.....

.....

(iii) Calculate the efficiency in terms of weight of the metal coating process.

.....

.....

(iv) Name a possible water polluting agent that can be accumulated in the solution as a result of the coating process.

.....

(v) During the electroplating process, the temperature of the solution increases. What is the main reason for the temperature increase?

.....

(vi) Electroplating of zinc on steel or iron parts is a common practice in vehicle manufacturing industry. What is the main reason for this?

.....

Q.2

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[see page five

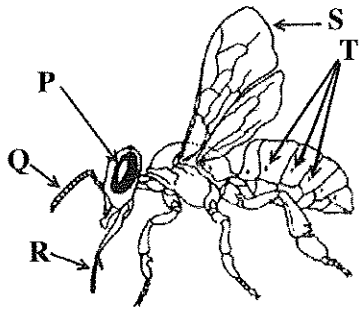
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3. (a) Among many invertebrate organisms, honeybee is an economically important invertebrate.

(i) What phylum does honeybee belong to?

.....

(ii) Write the Names of **P**, **Q**, **R**, **S** and **T** shown in the diagram in the table given below.



P	
Q	
R	
S	
T	

(iii) What is the main function of the appendage labelled as '**R**'?

.....

(iv) (1) Name the appendage of honeybee which is adapted to collect pollens?

.....

(2) Indicate the appendage that is used to collect pollen with the label 'W' on the above diagram.

(v) What is the main benefit that the plants get as a result of pollen collection by honeybees?

.....

(vi) What is the main carbohydrate present in the exoskeleton of honeybee?

.....

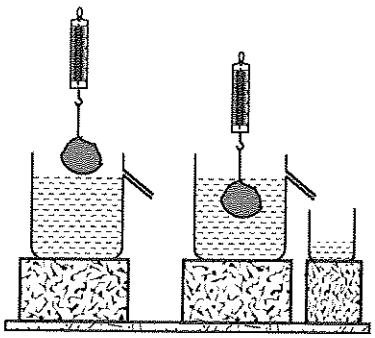
(vii) Following tests were carried out to identify biomolecules in a sample of bee honey. State the tests that produce a positive result with 'Yes' and that produce a negative result with 'No'.

Name of the Test	**Result**
Benedict	
Iodine	
Biurets	
Ninhydrin	
Sudan III	

[see page six

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(b) As shown in the figure, a student used a 10 N weight stone in an experiment that determined the relative density of bee honey. The apparent weight of the stone when completely immersed in water is 6 N. Gravitational acceleration, $g = 10\,N\,kg^{-1}$.



(i) What is the mass of the stone?

.....

(ii) What is the weight of the displaced water?

.....

(iii) What is the upthrust on the stone, when it is completely immersed in water?

.....

(c) When the stone was completely immersed in bee honey, the reading of the spring balance was 4.1 N.

(i) What is the apparent weight of the stone when it is completely immersed in bee honey?

.....

(ii) What is the uptrust on the stone when it is completely immersed in bee honey?

.....

(d) In the experiment, the weight of the bee honey collected in the small beaker was 5.8 N. However, the expected value is greater than this value.

(i) What is the weight of bee honey expected to be collected in the beaker?

.....

(ii) Due to which property of bee honey the above difference occurred?

.....

(e) Calculate the relative density of the bee honey.

.....

.....

Q.3

100

4. (a) Electric power generated at power stations in Sri Lanka is transmitted to regional centers as alternating current at 110 kVA. What is the advantage of transmitting power over a long distance,

(i) at a very high voltage?

.....

(ii) as an alternating current?

.....

(b) During recent power cuts in Sri Lanka, a student used a 24 V battery and an inverter to obtain alternating current to light his house.

(i) State **two** technical reasons which led to the recent power cuts in Sri Lanka.

(1) .....

(2) .....

[see page seven

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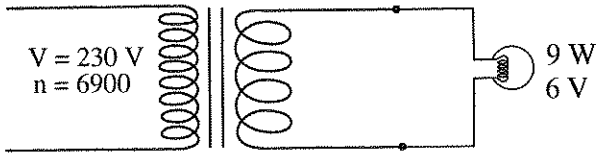
(ii) Name the type of transformer required to obtain a 230 V supply from the 24 V battery.

.....

(iii) State the major **disadvantage** of using an inverter based power supply.

.....

(c) A lamp rated as 6 V, 9 W lights at full brightness when it is connected to the output of a transformer as shown in the figure.



(i) Calculate the number of turns in the secondary coil, if the voltage of secondary circuit is 12 V.

.....

.....

(ii) Calculate the power loss in the wire, if the secondary circuit is connected by a wire of total resistance 4 Ω to the aforementioned lamp.

.....

.....

.....

(iii) What is the power consumed by the lamp?

.....

(d) (i) Calculate the number of turns in the secondary coil needed to light three 6 V lamps at full brightness, when they are connected in series.

.....

.....

(ii) Calculate the number of turns in the secondary coil needed to light three 6 V lamps at full brightness, when they are connected in parallel?

.....

.....

(e) A transformer used to step down from 110 kVA to 230 VA is immersed in synthetic oil. What is the main reason for using the oil?

.....

Q.4

100

* *

සියලු ම හිමිකම් ඇවිරිණි/முழுப் பதிப்புரிமையுடையது/All Rights Reserved]

නව නිර්දේශය/புதிய பாடத்திட்டம்/New Syllabus

NEW ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2019 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2019 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2019

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.*
- *Graph sheet for question number **5** **in part B** is provided with the question paper.*

Part B - Essay

5. An entrepreneur who plans to buy a rubber estate, selected a random sample of 50 rubber trees to estimate the mean rubber latex production per tree.

Following grouped frequency table shows the results.

Table 1: Grouped frequency distribution of rubber latex obtained from 50 trees on a selected day.

Rubber latex per tree in grams (to the nearest integer)	Frequency (Number of trees)
31 - 35	3
36 - 40	3
41 - 45	5
46 - 50	9
51 - 55	13
56 - 60	10
61 - 65	5
66 - 70	2
Total	**50**

(a) (i) Complete the above **Table 1** by adding columns for class boundary, class mark, cumulative frequency and percentage cumulative frequency.

(ii) Find the mean weight of rubber latex collected from trees per day.

(iii) There are 1,790 rubber trees in this estate. On average every rubber tree is tapped 15 days per month. Calculate in kilograms, the expected yield of rubber latex from this estate per month.

(iv) The current price of one kilogram of rubber is Rs. 278.00. What would be the expected income per month from this rubber estate?

(b) Draw the percentage cumulative frequency curve for the above distribution in **Table 1** on the graph paper provided.

(c) Based on the above percentage cumulative frequency curve, find the followings for the sample.

(i) The median rubber latex obtained per day.

(ii) The inter quartile range of the rubber latex obtained per day.

(iii) The number of rubber trees provided more than 58 grams of rubber latex per day.

[see page nine

(d) To motivate the rubbers tappers, the owner decided to give an incentive for the workers. Following table (**Table 2**) shows the introduced incentive scheme when the rubber latex obtained is calculated based on per rubber tree per day.

Table 2: Incentive payment for rubber latex obtained per tree per day.

Rubber latex in grams	Incentive (Rs.)
31 – 40	2.00
41 – 50	3.00
51 – 60	4.00
61 – 70	5.00

Using **Table 2** above, calculate the total incentive to be paid for the obtained rubber latex from the sample in **Table 1**.

6. The aerial view of a linear section of an aircraft is given in **figure I**. This linear section is depicted in *xy*-plane and the necessary distances can be obtained by using the given coordinates. This aerial view is symmetric about *y*-axis.

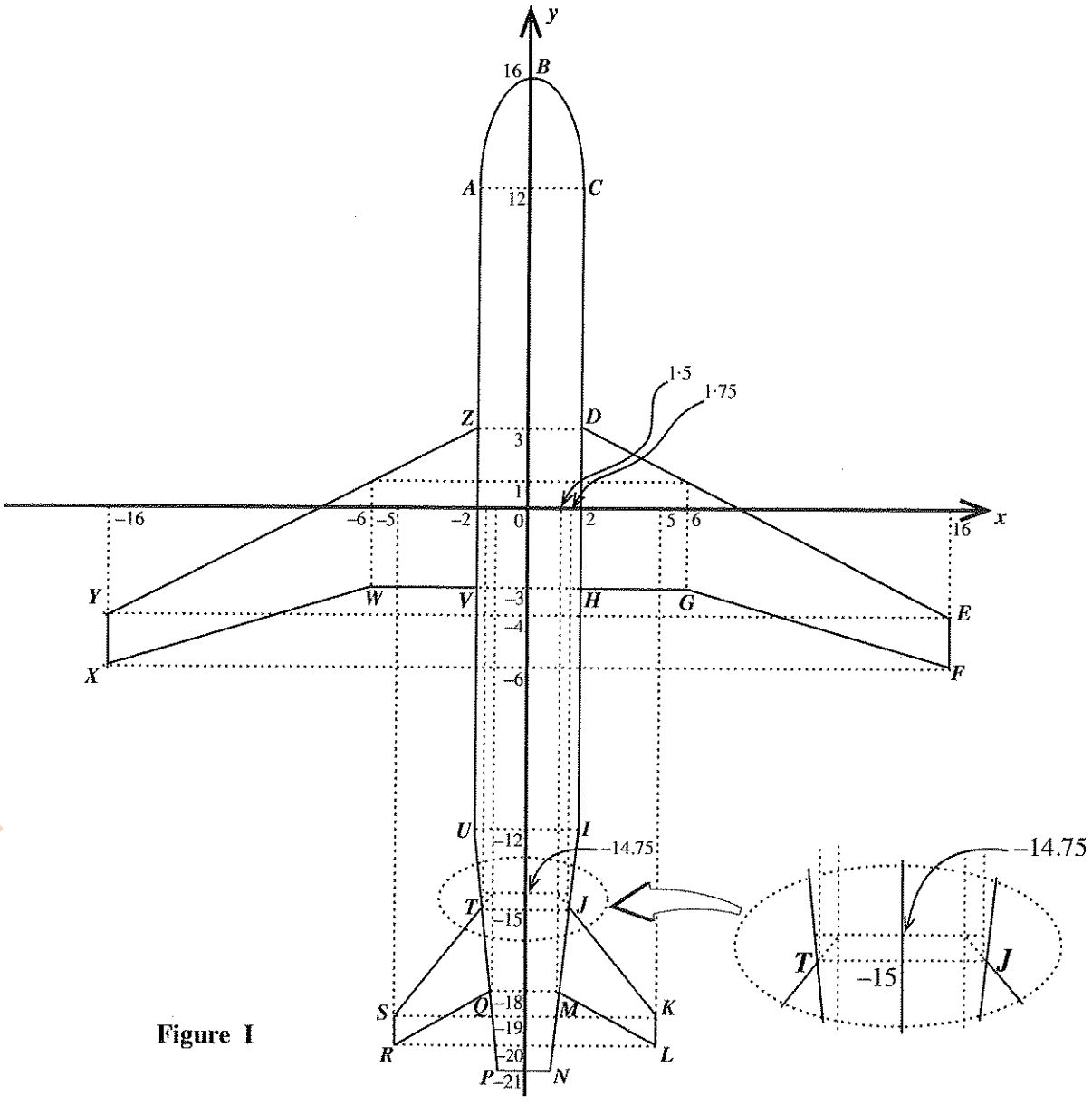


Figure I

[see page ten

(a) Calculate the following using the coordinates marked in the figure.

(i) Trunk area of *ACIU*

(ii) Front wing area of *DEFGH*

(iii) Rear wing area of *JKLM*

(iv) Taking the area of *ABC* as 10 square units and the area of *UINP* as 18 square units, total area of the linear section of aircraft.

(b) Consider that *ABC* curved section in the diagram represented by the quadratic function of $y = ax^2 + bx + c$.

(i) What are the coordinates of the vertex of the quadratic function?

(ii) What is the sign of the value of a in the quadratic function? Give reason for your answer.

(iii) Obtain the quadratic equation of the curve using the given coordinates in the figure.

(c) There are two similar fuel tanks symmetrically placed inside the wings of the aircraft as shown in **Figure II**.

(i) What is the volume of a fuel tank in **Figure II**?

(ii) Hence, find the amount of fuel in litres that can be stored in the aircraft.
(Consider $1000\ l = 1\ m^3$)

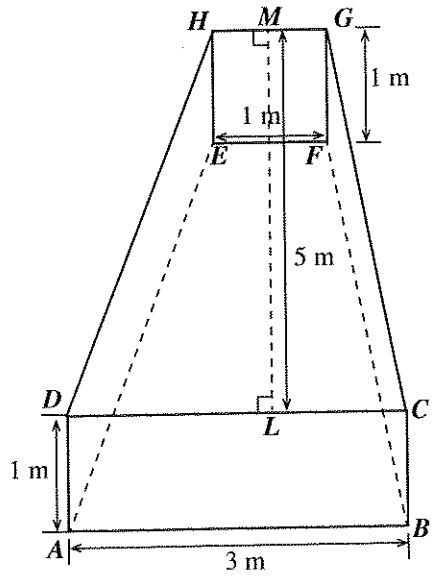


Figure II

Part C - Essay

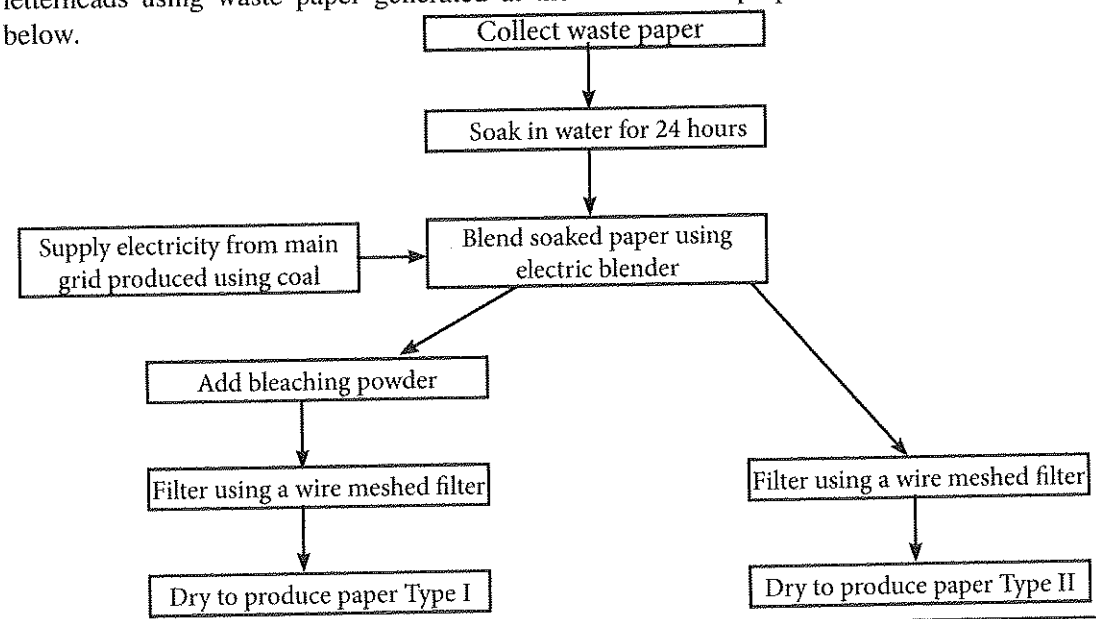
7. Chemical industries are important to produce many consumer products used in day-to-day life. A chemical industrial process used for an industry can be based on one or more chemical reactions.

(a) (i) What are the **five** main resources required for an industrial process?

(ii) Briefly explain the term, 'chemical industrial process'.

(iii) List **three** main factors need to be considered in selecting a raw material for an industrial process.

(b) A group of school students is planning to produce recycle paper to manufacture envelops and letterheads using waste paper generated at the school. The proposed industrial process is shown below.



[see page eleven

(i) What is the purpose of blending soaked papers?

(ii) What is the purpose of adding bleaching powder?

(iii) What is the key difference between the appearance of Type I and Type II papers?

(iv) Name **three** chemicals that can be used as bleaching agents in paper industry.

(v) A student proposed to mix dry straw at the blending step to increase the yield of pulp. However, this produce poor quality paper. Explain the reason for this failure.

(vi) State **one** economic benefit and **one** environmental benefit of recycling materials.

(vii) Write a social benefit of introducing a recycling program at the school level.

(c) Chemical industries can produce adverse effects on environment if waste materials are not managed properly.

(i) Explain a method to reuse the waste water generated at the end of this production process.

(ii) School principal advised to make the recycling process greener. Propose a method to minimize the impact on environment.

(iii) What are the possible standards the school can apply for in Sri Lanka to maintain the quality of the production process and the product?

8. (a) Hydrosphere is the total amount of water on the earth. Water quality is determined using various physical, chemical and microbiological parameters.

(i) Name **five** main components of the hydrosphere.

(ii) State **two** chemical parameters used to determine the water quality.

(iii) Why it is important to examine the water quality?

(b) A modern fluorescent bulb contains 4 milligrams of mercury. Therefore, broken fluorescent bulbs release mercury in to the environment that can be accumulated in soil and then leach into the groundwater. Water contaminated with more than 0.002 mg l^{-1} of mercury is not suitable for drinking.

(i) Calculate the maximum volume of water which become not suitable for drinking due to contamination of water by one broken fluorescent bulb.

(ii) Name **two** methods that can be used to remove heavy metals in the water to make them suitable for drinking.

(iii) List **two** main adverse effects of using soil contaminated with heavy metals for agricultural work.

(c) Some scientists suspect some pottery industries use clay contaminated with heavy metals for the production of cooking pots.

(i) What is the adverse effect of using clay pots for cooking that produced using clay contaminated with heavy metals?

(ii) Before using, boiling salt water in clay pots for a longer period may reduce the adverse effects of clay pots built using clay contaminated with heavy metals. Explain the scientific reason behind this.

(d) Thin layer chromatography (TLC) can be used to detect the adulteration in ghee with vegetable oil. A pure sample of ghee, a ghee sample suspected to be adulterated with vegetable oil and a vegetable oil sample were tested using TLC.

(i) Explain the reason to use pure ghee and vegetable oil samples in this TLC test.

(ii) Explain the expected TLC result for an adulterated ghee sample.

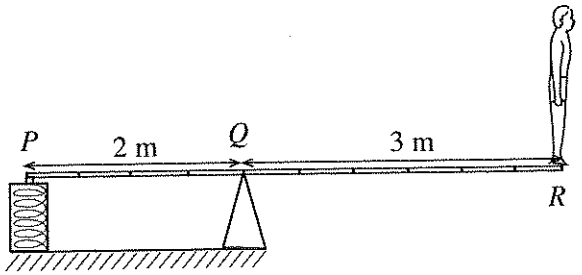
(iii) Price of ghee adulterated with vegetable oil is less than the price of pure ghee. Explain **two** expectations of a producer selling adulterated ghee.

[see page twelve

Part D - Essay

9. (a) The moment of a force (or torque) is a measure of the tendency of the force to rotate an object about a specific point or an axis. Write down the standard equation for the moment of force and define each term.

(b) As shown in the figure a diver of mass 60 kg stands upright at the end of a horizontal uniform springboard PQR with a mass of 50 kg and a length of 5 m. The other end P of the springboard is clamped to a rigid support and the springboard rests on a fulcrum support at Q, which is 2 m from P. Consider the acceleration due to gravity as 10 N kg^{-1}.



(i) Sketch the above figure in your answer script, mark the point C, where the centre of mass of the springboard (without the diver) lies. What is the distance between the points C and Q?

(ii) In your sketch, mark the directions of forces F_C, F_P, F_Q and F_R acting on the springboard respectively at C, P, Q and R.

(iii) Calculate the torques T_R and T_C about the fulcrum due to F_R and F_C respectively.

(iv) Calculate the torque, T_P about the fulcrum due to F_P.

(v) Calculate the force F_P.

(vi) Based on the forces acting in the system, calculate the force F_Q.

(vii) If the clamped support can withstand 2750 N, calculate the maximum weight that can be permitted at R.

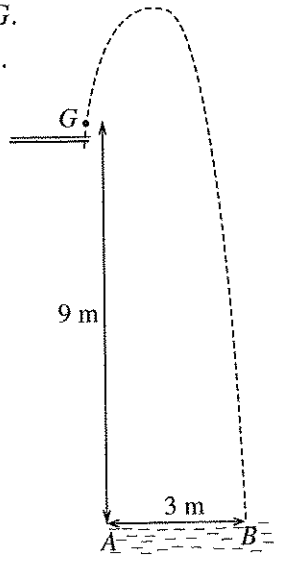
(c) The path of motion of the center of gravity (G) of the diver from the spring board to the water level of the pool is shown in the figure. The diver takes 3 s to reach the water surface at B. The initial height of G from the water level is 9 m. The horizontal displacement of the G from its initial position is 3 m (AB = 3 m). Neglecting the air resistance, calculate the following physical quantities.

(i) The horizontal and vertical components of initial velocity of the G.

(ii) The maximum height reached by the G from the water surface.

(iii) The potential energy of the diver at the maximum height.

(iv) The kinetic energy of the diver at the maximum height.



[see page thirteen

10. (a) In an experiment, the strain of a polymer rod which is subjected to a tensile stress was observed.

(i) Sketch a graph showing the variation of Tensile stress *versus* Strain of the polymer rod.

(ii) Mark the following points on your graph.
A – Proportional limit
B – Elastic limit
C – Breaking point

(iii) In which region of the curve a higher increase in strain per unit increment in stress is observed?

(b) A cylindrical rod named P is made of a polymer material and has a length of l and cross-sectional area of A. Under a tensile force F applied along its length-wise direction it registers an extension of e. Write down the expressions for the following quantities.

(i) Tensile stress

(ii) Strain

(iii) Young's modulus of elasticity

(c) If the extension of the rod P has to be increased to $2e$, find the required force in terms of F.

(d) Two more rods named P_1 and P_2 made of the same polymer material above mentioned have different dimensions and they are compared with those of rod P in the following table. Forces required to produce the same extension e in each of them are F_1 and F_2 respectively.

Polymer rod	Length	Cross-sectional area	Extension	Required force
P	l	A	e	F
P_1	l	$2A$	e	F_1
P_2	$2l$	A	e	F_2

(i) Find F_1 in terms of F.

(ii) Find F_2 in terms of F.

(e) The initial length of a cylindrical polymer rod is 30 cm and the radius of the cross section is 1 cm. When the rod is hung vertically, and a mass of 2 kg is attached to the free end, it registers an extension of 4 mm, which is within the proportional limit of the rod. Assuming that the gravitational acceleration $g = 10\,N\,kg^{-1}$ and the value of $\pi = 3$, calculate the following.

(i) Initial length, l in metres

(ii) Cross-sectional area A, in square metres

(iii) Force, F due to the hung mass in Newton

(iv) Extension e, in metres

(v) Young's modulus of elasticity, Y of the polymer material

(vi) Elastic potential energy, E stored due to the extension of the rod in Joule

* * *

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Separate from here