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නව නිර්දේශය/புதிய பாடத்திட்டம்/New Syllabus

NEW

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இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2020
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2020
General Certificate of Education (Adv. Level) Examination, 2020

තාක්ෂණවේදය සඳහා විද්‍යාව II
தொழினுட்பவியலுக்கான விஞ்ஞானம் II
Science for Technology II

67 E II

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 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 - 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	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	

[see page two

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Part A – Structured Essay

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

Do not write in this column

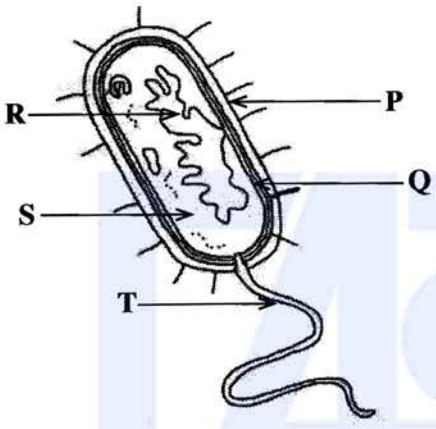
1. (A) The cell is the basic unit of all living organisms. Based on the structure and organization, cells can be divided into two main groups.

(i) Name these **two** main groups of cells.

....

....

(ii) What is the group of microorganisms shown in the following diagram? Name the parts labelled as **P**, **Q**, **R**, **S** and **T**.



(a) The group of microorganisms

....

(b) **P** : ....

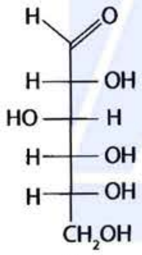
Q : ....

R : ....

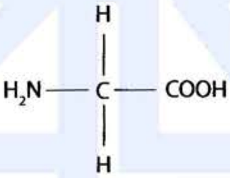
S : ....

T : ....

(B) Four types of biomolecules that are used in different industries are given below. Answer the following questions based on the given biomolecules.



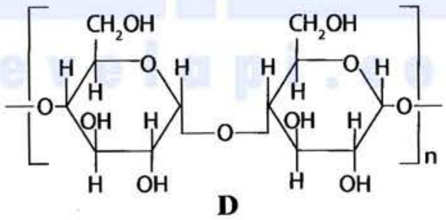
A



B

$CH_3(CH_2)_{14}COOH$

C



D

(i) What biomolecule/s contains/contain an aldehyde group as a functional group?

....

(ii) What biomolecule/s contains/contain a carboxylic acid group as a functional group?

....

(iii) Which biomolecule/s provides/provide a positive result for the iodine test?

....

[see page three

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Do not write in this column

(iv) Name a suitable test to identify biomolecule **B**.

....

(v) Identify what biomolecule or its derivative given above contains in each industrial product mentioned in the table. Write the letter that represents each identified biomolecule in the following table.

Industrial product	Letter that represents the biomolecule
cotton thread	
soap	
sugar	

(C) Bread is one of the most commonly produced products in the bakery industry. If the required ingredients are available, bread can also be produced at home.

(i) What is the microorganism used in the bakery industry?

....

(ii) What is the raw material added to accelerate the growth of the microorganism in the process of bread production?

....

(iii) Explain why the dough rises along with the activity of microorganism.

....

....

....

(iv) The bread develops a sour taste when the dough is kept for a long time for rising prior to baking. Explain the reason for this.

....

....

....

Q.1

/100

[see page four

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උසස් පෙළ විද්‍යා/ගණිත/කලා/වාණිජ හා තාක්ෂණ විෂය ධාරාවන්ට අදාළ සියලුම ප්‍රශ්න පත්‍ර/සටහන් හා තවත් බොහෝ දෑ ලබා ගැනීමට පිවිසෙන්න www.alevelapi.com වෙත .

Do not write in this column

2. (A) An experiment was conducted to determine the drying speed of an emulsion paint. Here a paint sample of 5.05 g was spread evenly on a plate and the mass of the paint sample was measured at 60 minute intervals. The results are given in the table, and the reason for the mass loss with the time is vaporization of water in the paint.

Time/min	Mass/g (30 °C)
0	5.05
60	4.71
120	4.50
180	4.35
240	4.24
300	4.18
360	4.15
420	4.15

(i) What is meant by vaporization?

....

(ii) After 360 minutes, a constant mass of the paint sample was observed in the experiment. Calculate the mass of water evaporated from the paint sample.

....

(iii) Give the mass of water in the paint sample as a percentage.

....

(iv) Write **one** benefit of using water to produce emulsion paint.

....

(B) The physical transformation of water during the drying process of paint can be shown as below.

Water (liquid) $\longrightarrow$ Water vapour (gas)

Four statements regarding the above physical transformation are given in the table below. Put a tick (✓) in front of the correct statements and a cross (×) in front of the incorrect statements.

	Statements	✓ or ×
(i)	The physical transformation of liquid water to water vapour is exothermic.	
(ii)	Energy of water molecules in the vapour phase is higher than that of the water molecules in the liquid phase.	
(iii)	Water molecules in the liquid phase are closely packed compared to the water molecules in the vapour phase.	
(iv)	Average speed of water molecules in the vapour phase is greater than that of the water molecules in the liquid phase.	

(C) (i) Write **two** factors that affect the vaporization rate of water in the paint sample.

....

....

[see page five

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Do not write in this column

(ii) Calculate the average rate of vaporization of water in the first six hours.

....

....

....

....

(iii) Polymers are a group of raw materials used for the production of paint. Write **two** other groups of raw materials used in the paint industry.

....

....

(iv) It is not suitable to apply a paint containing polyester as the polymeric material on a cement surface. Explain the reason for this?

....

....

Q.2

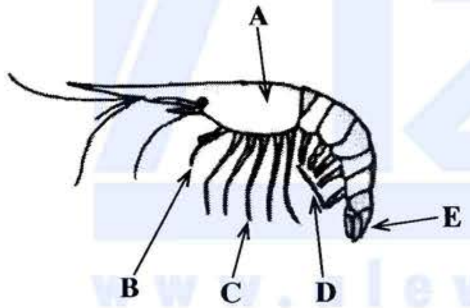
100

3. (A) Prawn is an invertebrate animal that belongs to the phylum Arthropoda. Prawn farming is a profitable business in Sri Lanka.

(i) Write **one** structural feature that is used to classify prawn as an invertebrate.

....

(ii) Name the parts labelled as **A**, **B**, **C**, **D** and **E** in the given diagram of a prawn.



Part	Name
A	
B	
C	
D	
E	

(iii) Write **one** reason for classifying the prawn under the phylum Arthropoda.

....

(iv) Mention an economically important raw material that can be extracted from the prawn's exoskeleton.

....

(v) Write **one** geographical feature that must be considered in establishing a prawn farm.

....

(vi) Write **one** method of value addition that can be done in the processing of prawns for the international market.

....

[see page six

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Do not write in this column

(B) Water is pumped at the rate of 5.4 $m^3 h^{-1}$ from a well to a tank.

(i) What is the rate of water pumping in the unit $m^3 s^{-1}$?

....

....

(ii) Calculate the mass of water pumped per second. (Density of water = 1000 kg m^{-3})

....

....

....

(iii) Calculate the work done per second (power) by the pump in lifting water to a height of 6 m from the well to fill the tank. (Gravitational acceleration = 10 N kg^{-1})

....

....

....

(iv) Can you practically use a pump driven by a motor having exactly the same power calculated in part (iii) to pump water to the tank? Briefly explain your answer.

....

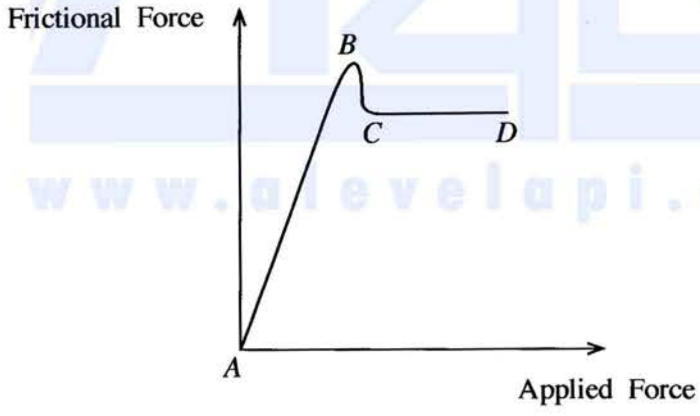
....

....

Q.3

100

4. (A) The following graph shows the variation of the frictional force with the force applied on an object.



(i) What segment of the graph represents each of the following force?

(a) Dynamic frictional force ....

(b) Static frictional force ....

(ii) What is meant by limiting friction?

....

....

....

[see page seven

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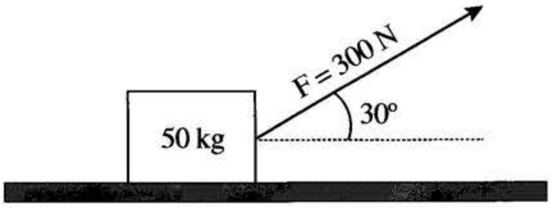
Do not write in this column

(iii) Which point represents the limiting friction on the graph?

....

(B) A person pulls a box of mass 50 kg along a frictionless horizontal floor using a non-extendable light rope which is inclined at an upward angle of 30° with the horizontal as shown in the figure. The person exerts a constant force of magnitude 300 N on the rope. (Consider sin 30° = 0.50 and cos 30° = 0.87)



(i) Mark on the above figure, the normal reaction and the gravitational force acting on the box.

(ii) Calculate the acceleration of the box.

....

....

....

(iii) Calculate the work done by the applied force when the box is moved by 2 m.

....

....

....

(iv) Consider that the above box is pulled with a light metal wire. If the metal wire is extended by 2 mm due to the applied force 300 N, calculate the elastic potential energy stored in the wire.

....

....

....

Q.4

100

* *

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

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NEW
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இலங்கைப் பரீட்சைத் திணைக்களம்
Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2020
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2020
General Certificate of Education (Adv. Level) Examination, 2020

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 required for question number **5 in part B** is provided with the question paper.*
* ***Use of non-programmable calculators is allowed.***

Part B - Essay

5. **Table 1** shows the distribution of the incubation period (time period between the exposure to the virus and the appearance of the first symptom) of randomly selected 200 individuals who were infected by the Corona virus. The third column of the table indicates the **average** age of the infectants for each class interval.

Table 1: Grouped frequency distribution for the incubation period and the **average** age of 200 infectants

Incubation period (days)	Number of infectants	Average age (years)
2 - 3	6	88.5
4 - 5	90	72.5
6 - 7	78	78.0
8 - 9	12	68.5
10 - 11	4	54.5
12 - 13	4	50.0
14 - 15	4	24.5
16 - 17	2	20.0
Total	**200**	

(a) (i) Copy the **Table 2** given below to the answer booklet and complete the columns of class boundary, class mark, less than cumulative frequency and less than percentage cumulative frequency.

Table 2: Grouped frequency distribution for the incubation period of 200 infectants

Class limit	Number of infectants (frequency)	Class boundary	Class mark	Less than cumulative frequency	Less than percentage cumulative frequency
2 - 3	6				
4 - 5	90				
6 - 7	78				
8 - 9	12				
10 - 11	4				
12 - 13	4				
14 - 15	4				
16 - 17	2				

[see page nine

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(ii) Calculate the **mean** incubation period of the infectants participated in the study.

(b) Draw the less than percentage cumulative frequency curve for the distribution given in **Table 2** on the graph paper provided with the question paper in page 14, and attach it to the answer script.

(c) Based on the less than percentage cumulative frequency curve drawn in part (b), find the following.

(i) Median of incubation period of the infectants

(ii) Lower boundary and upper boundary of the middle 90% data of the incubation period of the infectants

(d) Assume that the quarantine period for the infectants is decided based on their incubation periods. Based on the less than percentage cumulative frequency curve drawn in part (b), answer the following questions.

(i) Find the minimum quarantine period required to identify 99% of the infectants.

(ii) Suppose that there are 3000 Corona suspects in the quarantine centres and they are kept there up to a maximum period of 14 days. If these suspects are infected by the virus, then how many infectants are expected to show up symptoms during the quarantine period?

(e) Using **Table 1**, find the **average** age of the Corona infectants participated in the study.

6. This question is based on a basic concept of a technology used to make judgments in Cricket. **Figure 1** shows the top view of a cricket ground. *A* and *B* are positions of two fielders. The dotted line *CD* shows the straight path of the ball hit by the batsman. A Cartesian coordinate system is placed on the image, so that its origin coincides with the centre of the circular ground. (This diagram is not drawn to scale.)

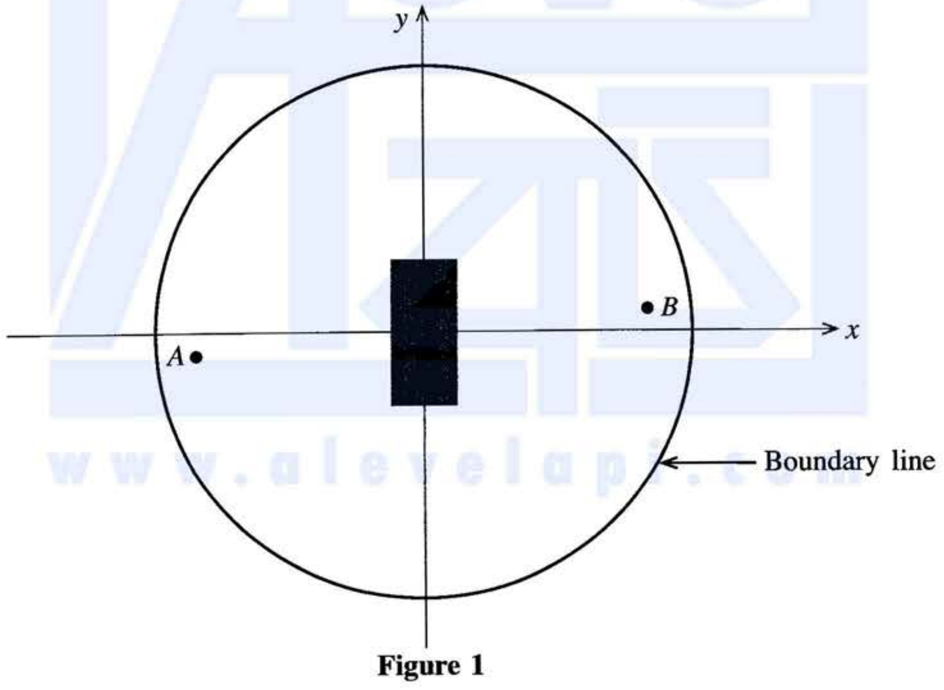

Figure 1

(a) The midpoint of straight line *AB* is the origin (0, 0). The coordinates of point *B* are (30, 0.2). Find the following.

(i) Coordinates of point *A*

(ii) Gradient of line *AB*

(b) The coordinates of point *C* are (0, 8). Line *CD* is perpendicular to the line *AB*. Find the following of the straight line *CD*.

(i) Gradient

(ii) *y* Intercept

(iii) Equation

[see page ten

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(c) Along the *CD* line, the ball travels towards the opposite wicket. Given that the coordinates of a stump are (0.12, –10), determine whether the ball hits this stump.

(d) The sector *CMN* in **Figure 2** indicates the strongest batting region of a batsman batting at *C*. It is given that the angle $M\hat{C}N$ is 30° and the radius *CM* is 62 m. Calculate the following.

(i) Angle $M\hat{C}N$ in radians

(ii) The arc length *MN* (Consider $\pi = 3$)

(iii) The area of sector *CMN* (Consider $\pi = 3$)

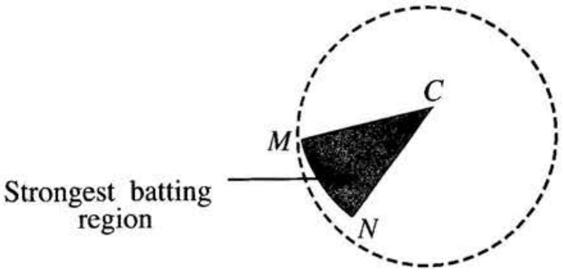


Figure 2

(e) The play area of the ground is confined by the circular boundary line. Given the coordinates of a point on the boundary line are (16, 63), calculate the following of the playing area. (Consider $\pi = 3$)

(i) The radius

(ii) The area

Part C - Essay

7. A group of students in the technology stream started a project to produce reusable face masks.

(a) (i) What is expected by using a face mask?

(ii) Why is it not recommended to use a face mask during sports activities?

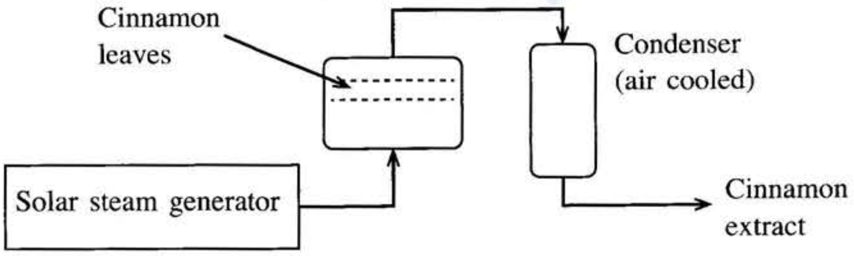
(iii) According to the 3R concept, write **two** objectives of producing a reusable face mask?

(b) School Technology Club is planning to produce the face mask in a large-scale to generate funds.

(i) What are the **five** main resources required to start a production process?

(ii) Write **two** factors that must be considered in selecting a natural raw material for a production process.

(c) It is planned to improve the quality of the face mask by treating (soaking) its outer layer with a diluted extract of cinnamon leaves containing many secondary metabolites. The process used to produce cinnamon extract is shown by the flow chart given below.



(i) What is the main secondary metabolite extracted from cinnamon?

(ii) Write **one** property that can be introduced to the face mask by treating its outer layer with the cinnamon extract.

(iii) State **two** renewable resources used to produce the cinnamon extract in the above process.

(iv) Write **one** environmental advantage and **one** economical advantage of using a solar steam generator for the above extraction process.

(v) State **two** issues arise in producing steam by using solar energy.

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(vi) The parabolic surface area which directs solar radiation to the steam generator is 3 m^2. The energy supply from this surface to the steam generator is 1 kJ m^{-2} s^{-1}. Calculate the amount of energy collected in an hour by the steam generator.

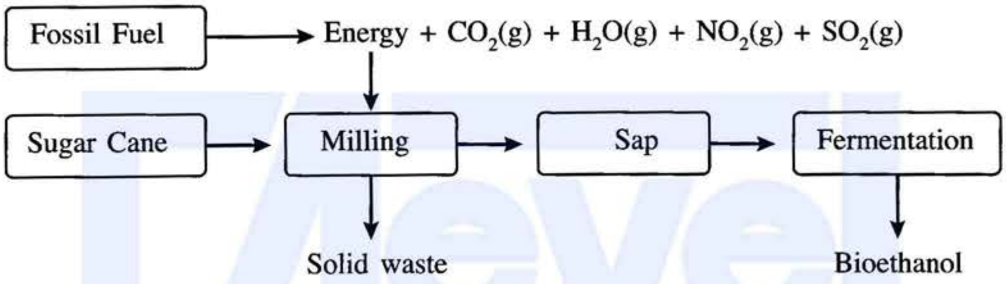
(vii) Calculate the time required to produce 1 g of steam after starting the production of steam by receiving energy at the above rate. (The latent heat of vaporization of water is 2.26 MJ kg^{-1})

8. (a) Sucrose is a disaccharide.

(i) Name the **two** monosaccharides contained in sucrose.

(ii) What is the main biological function of sucrose?

(b) Sucrose is a primary metabolite produced in sugar cane. The extracted sugar cane sap can be converted to ethanol by using microorganisms. The production process of bioethanol by using sugar cane is shown below.



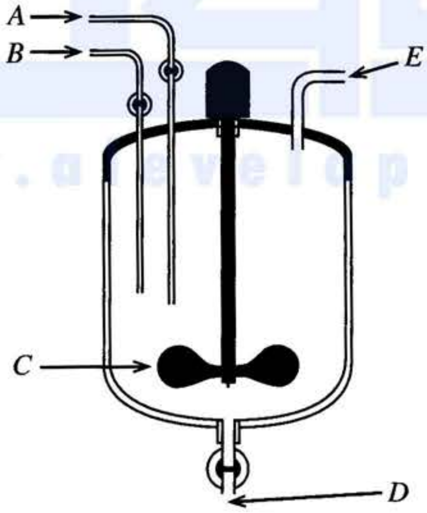
(i) What are the gasses produced in the above process that contribute to acid rain?

(ii) Name the greenhouse gasses produced in this process.

(iii) State **two** advantages and **two** disadvantages of using bioethanol as a fuel.

(iv) Write **two** main advantages of chemical synthesis of ethanol.

(c) Ethanol, hydrogen peroxide, glycerol and distilled water are the main ingredients of a hand sanitizer formula recommended by the World Health Organization (WHO). The reaction chamber used for the production of hand sanitizer is shown below.



(i) What is the function of each part labelled as *A*, *B*, *C*, *D* and *E* in the diagram?

(ii) It is recommended to perform the above production process at low temperatures. Explain the reason for that.

(iii) What is the main function of hydrogen peroxide in the sanitizer?

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Part D - Essay

9. (a) Consider an object executing uniform circular motion in a circular path of radius r. The equation $v = r\omega$ can be used to calculate its angular velocity.

(i) Name the physical quantities represented by v and ω.

(ii) An object executing a circular motion is always associated with an acceleration, even though the object moves with a constant speed. Explain the reason for that.

(b) Awaiting clearance for landing at an airport, an aircraft is circling in the sky with the speed of 100 m s^{-1}. If the radius of circular path of the aircraft is 4 km, calculate its,

(i) angular velocity, in rad s^{-1} and

(ii) periodic time, in minute.

(Consider $\pi = 3$)

(c) You are provided with sufficient number of identical resistors, each with the resistance of 80 Ω. Using **minimum number** of given resistors, draw separate circuit diagrams to obtain following equivalent resistance.

(i) 40 Ω

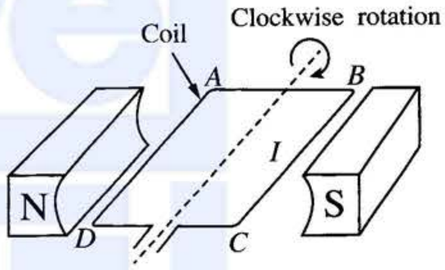
(ii) 400 Ω

(iii) 460 Ω

(d) (i) The figure shows a sketch of a dynamo. What is the direction of each of the following parameters?

(1) The magnetic field between magnetic poles N and S.

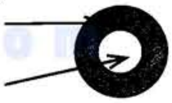
(2) The current (I) between B and C?



(ii) Write down the **three** major factors that affect the amount of current generation in the dynamo.

10. Hot water entering at one end of a straight tube PQ which is placed in air, leaves at the other end as cold water. Heat is transfered across the tube material of the tube wall.

Tube



Cross section of the tube

(a) Does the heat transfer in the above tube occur from water to air or air to water?

(b) Which method out of conduction, convection and radiation is the main mode of heat transfer between each of the following pairs?

(i) Hot water inside the tube and the material of the tube wall

(ii) Material of the tube wall and surrounding air

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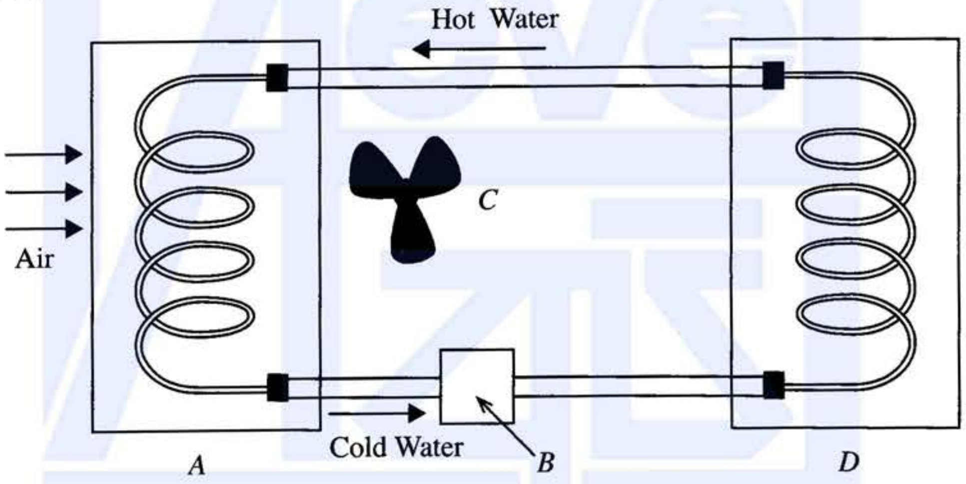
(c) The heat transfer between the hot water in the tube and the surrounding air of the tube has to be made more efficient. In order to do so, five factors are to be changed. With regard to the change in each factor, suggestions given by student A and student B are shown below.

	Factors to be changed	**Suggestion made by Student A**	**Suggestion made by Student B**
(1)	Material of the tube	Use rubber	Use copper
(2)	Outer surface of the tube	Keep non-insulated	Keep insulated
(3)	Nature of the outer surface of the tube	Make it rough	Make it polished
(4)	Nature of the tube	Keep it short and straight	Keep it lengthy and spiral
(5)	Surrounding air of the tube	Maintain as a fast air flow	Maintain as a slow air flow

(i) From the above suggestions given by students **A** and **B** for each factor from (1) to (5), write the more suitable suggestions?

(ii) Give reasons for each of your decision given in (i) above.

(d) When a motor-car-engine runs, as it gets heated continuously, the engine has to be cooled using a cooling system. The block diagram of such a cooling system with basic components *A*, *B*, *C* and *D* is shown below. Engine and the cooling unit (radiator) are represented by two spiral tubes.



Name the component out of *A*, *B*, *C* and *D* which contributes to each of the functions given below.

(i) Heat generation

(ii) Cooling

(iii) Circulation of water

(iv) Circulation of air

(e) Hot water at temperature 90 °C flows into the radiator at the rate of 0.5 kg s^{-1}. If the temperature of the exit water is 40 °C, calculate the rate of heat loss.
(Specific heat capacity of water is 4200 J kg^{-1} $°C^{-1}$.)

* * *

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