17.0 AVIATION TECHNOLOGY (450)

The year 2007 KCSE examination for Aviation Technology (450), as in the previous years, comprised a theory paper and a practical paper. Both papers were marked out of 100 but the former was scaled down to 60% while the latter was scaled down to 40%. The format for both papers was the same as in the previous years.

17.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows the candidates' performance in both papers for the year 2007. Performance statistics for the years 2006, 2005 and 2004 have also been given in the table for comparison.

Table 20: Candidates' Overall Performance in Aviation Technology for the Last Four Years

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2004	1		60	42.17	7.00
	2		40	26.09	3.09
	Overall	**35**	**100**	**68.26**	**5.00**
2005	1		60	36.81	8.07
	2		40	28.19	3.57
	Overall	**75**	**100**	**65.00**	**10.00**
2006	1		60	36.22	7.42
	2		40	29.59	3.23
	Overall	**46**	**100**	**65.80**	**8.00**
2007	1		60	31.87	6.27
	2		40	22.17	2.32
	Overall	**53**	**100**	**54.04**	**7.00**

From the table above, the following observations can be made:

17.1.1 The number of candidates rose slightly from ***46*** in the year 2006 to ***53*** in the year 2007, an increase of ***seven (07)*** candidates.

17.1.2 There was a remarkable drop in performance in both papers resulting in a very drastic decrease in the overall mean score from ***65.80*** in the year 2006 to ***54.04*** in the year 2007.

17.2 PAPER 1 (450/1)

This paper was composed of two sections: ***section A*** where candidate were required to answer all the ten questions and ***section B*** where candidates were required to answer question 11 and any other three questions out of four equally weighted questions.

The overall performance was quite good, but it was observed that most candidates performed poorly in questions ***3, 5, 7, 11*** and ***13***. The following part of the report will focus on these questions which were poorly done and will specifically address the weaknesses portrayed and present the expected responses.

Question 3

(a) Explain the effects of headwind and tailwind on an aircraft during gliding.

(b) Outline the functional differences between wing flaps and slats.

(c) Illustrate the difference between symetrical and cambered aerofoil.

The candidates were required to have knowledge on ***headwind, tailwind*** and ***gliding*** to be able to answer part (a) of the question. In part (b) of the question, the candidates were expected to know the functions of wing flaps and slots to be able to differentiate them while in part (c) of the question, they were required to indicate the difference in construction between the symmetrical and cambered aerofoil.

Weaknesses

Most of the candidates displayed very limited knowledge of the basic theory of flight required to answer this question.

Expected Responses

(a)

Effects of Headwind

- Reduces or decelerates forward speed of aircraft.
- Increases generated lift.
- Reduces the flight range.

Effects of Tailwind

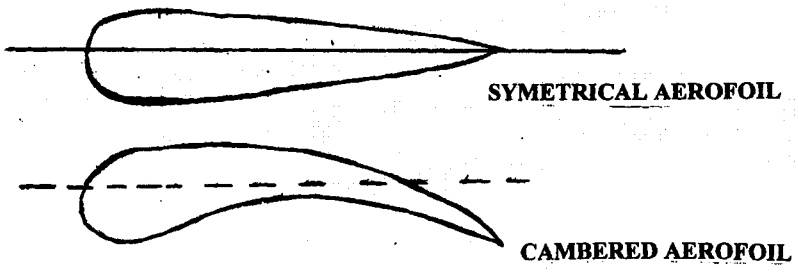
- Increases the forward speed of aircraft.
- Decreases generated lift.
- Lengths the flight range.

(b)

- **Function of Flaps:** to change the camber of the wing and/or increase wing area to allow aircraft to operate at lower speed during landing and take off.

- **Function of Slats:** used to reduce stalling speed and increase lift at comparatively low or high angle of attack.

(c)



Question 5 (a)

Explain how each of the following factors affects the thrust of a turbo-jet engine:

(i) revolutions per minute
(ii) aircraft forward speed.

Candidates were expected to know how thrust is generated in a turbo-jet engine in order to explain how RPM and aircraft forward speed can affect the thrust.

Weaknesses

Some candidates confused ***turbo-jet*** with ***turbo-prop*** engine and gave the wrong effects while others had no idea how a turbo-jet engine generates thrust.

Expected Responses

(i) The jet will operate best at maximum RPM because at low RPM there is very little increase in thrust while at very high RPM a little variation of thrust will produce a significant increase in thrust.

(ii) Increase in aircraft forward speed reduces thrust in direct proportion. Due to ram air intake, mass flow and velocity of the jet and increased airspeed, the resultant net thrust is practically constant.

Question 7

(a) Explain the term flashback as applied in oxy-acetylene gas welding.
(b) State **four** causes of flashback.

This question tested the candidates' understanding of the gas welding equipment particularly how it should be handled and adjusted. Among other things, candidates should be able to light the torch and set different welding flames safely.

Expected Responses

(a) Flashback is the burning of gases within a torch and is a dangerous situation which should be avoided.

(b)

- Loose connections.
- Improper pressure.
- Overheating of torch
- Touching the tip.
- Incorrect pressure.

Question 9

With the aid of a sketch, describe three methods of station numbering on an aeroplane.

This question required the candidates to explain the conventional methods used to locate components on airframe or aircraft structures.

Weaknesses

Most candidates had no idea what station numbering is.

Expected Responses

- ***Fulselage Stations***: these are system numbers in inches from a reference datum.
- ***Buttline:*** this is the width measurement left and right from a reference datum.
- ***Waterline:*** this is the measurement of height (perpendicular) in inches from a horizontal plane located at fixed reference datum.

Advice to Teachers

Teachers should ensure that the entire syllabus topics are covered adequately.

Question 13

(a) Sketch and label a basic aircraft electrical generating system to power a dc wiper motor.

(b) Explain the operation of the circuit.

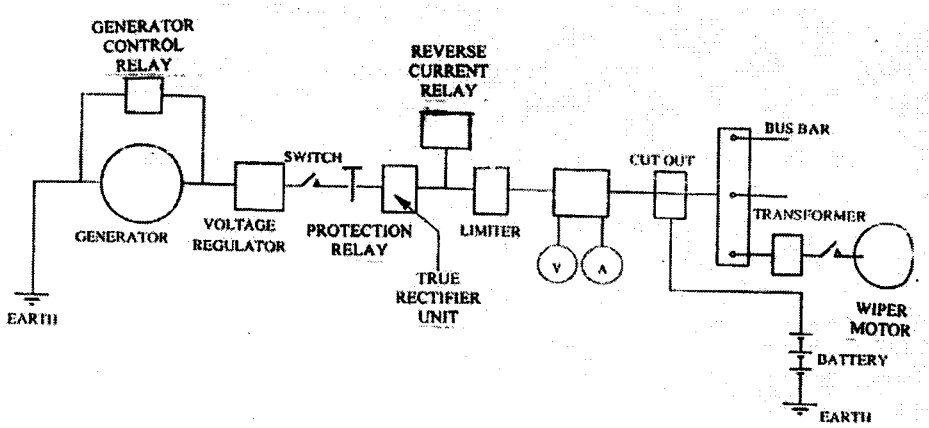
This was a specific question where candidates were expected to sketch an electrical system for a dc wiper motor used in an aircraft and also explain how it works.

Weaknesses

Most of the candidates could not identify all the components used in the circuit, show how they are connected and explain how the complete system operates.

Expected Responses

(a)



(b)

The engine drives the generator which has a switch and a control relay for protection. The circuit has a voltage regulator to control the generator output. Then there is a rectifier to convert the DC to AC and a reverse current relay to prevent current flow backwards. The circuit has a transformer to step up or step down the voltage. The current which is generated, regulated, rectified and transformed drives the wiper motor.

17.3 PAPER 2 (450/2)

The general performance in this paper was reported to have dropped quite remarkably. The mean score for this paper dropped from *29.59* in the year 2006 to *22.17* in the year 2007. Candidates performed poorly in questions *1, 5, 7, 8,* and *10*, which are discussed here below.

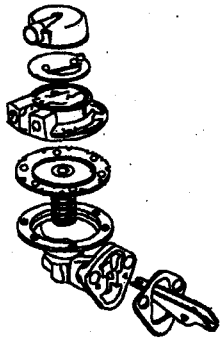
Question 1

INSTRUCTIONS

The figure below shows an exploded view of an aeropiston engine driven pump. On the drawing paper provided:

(a) **Sketch in good proportion a section view of an assembled unit along the vertical plane.**

(b) **Name four parts which are not visible when the pump is assembled.**

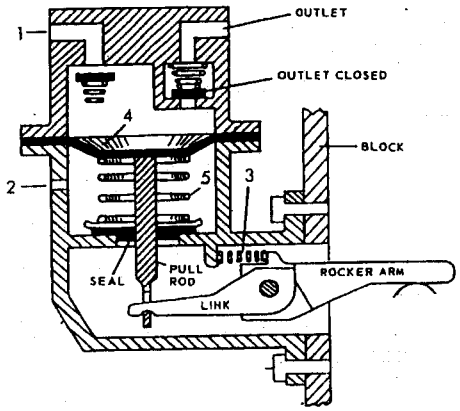


This was a related drawing exercise where candidates were required to sketch a section view of an assembled pump presented in exploded form. The candidates were also expected to name four internal parts of the pump.

Weaknesses

Some candidates could not visualize how the component looks like when it is assembled while others misinterpreted the question and presented the sketch for an assembled pump instead of its sectioned view. Sketching neatly and in correct proportion was also a problem to most candidates.

Expected Responses



Question 5

INSTRUCTIONS

(a) (i) Fill the bottle labelled J with water and turn it upside down into the bowl provided. Record your observations.

(ii) Repeat (a)(i) above with the hole marked Q covered. Record your observations.

(iii) Relate the observations in (a)(i) and (a)(ii) above to the operation of an aircraft system.

(a) (i) .....

(a) (ii) .....

(b) (i) Repeat experiment (a)(i) above using the bottle marked K. Records your observations.

(ii) Lift the bottle slightly above the water level. Record your observations.

(iii) Relate the observations in (b)(i) and (b)(ii) above to the operation of an aircraft hydraulic system.

(b)(i) .....

(b)(ii).....

(c) Give **one** limitation and **one** remedy of operations of an aircraft in flight in relationship to the experiments in (a) and (b) above.

	Limitation	Remedy
(a)	.....	.....
(b)	.....	.....

This question required the candidates to carry out three different experiments and make the necessary observations and conclusions in each case.

Weaknesses

Most candidates did not follow the instructions as stipulated in each step of this exercise but they assumed, probably from the apparatus provided, that the question was testing aircraft pressurization and proceeded to draw wrong conclusions without doing the experiment.

Expected Responses

(a) (i) The water flows to the bowl continuously.

(ii) Initially the water flows into the bowl with bubble but eventually stops flowing.

(iii)

- The hole represents a vent in a fuel tank which allows free flow of fuel.
- The blocked vent does not allow flow of liquid from the tank to the system.

(b) (i) The water flows to the bowl continuously.

(ii) There is introduction of air bubble, the water flows and eventually stops.

(iii) System does not have a vent to allow for continuous flow of hydraulic fluid.

(c) Introduction of air charge allows the system to operate.

Limitation	*Remedy*
(a)The a/c system does not operate effectively at high altitude.	Fly at low altitude.
(b)System starvation.	Pressurize the reservoir.

Question 7

INSTRUCTIONS

The pilot for the aircraft marked A has been cleared to taxi and encounters each of the scenario 1, 2, 3, 4 and 5 as shown on the aerodrome plan provided.

Study each scenario and in the table below state the expected immediate action and the reason for the action. **(10 marks)**

SCENARIO	IMMEDIATE ACTION	REASON FOR THE ACTION
1		
2		
3		
4		
5		

In this question, the candidates were required to state the immediate action a pilot is expected to take when faced with each of the situations illustrated in a given aerodrome plan.

Weaknesses

The majority of the candidates seemed not to be safety conscious especially with regard to procedures when ground handling and marshalling aircrafts. The candidates were expected to base their responses on the fact that in aerodromes, priority is always given to aircrafts which are landing and those that are reported to have problems.

Expected Responses

Scenario	*Immediate Action*	*Reason for the Action*
1	Stop, check judge and decide.	Depends on situation on runway.
2	Overtaking aircraft must keep out of way by overtaking on the left.	Aircraft being overtaken has the right of way.
3	The aircraft A must stop.	The aircraft B has the right of way.
4	Each aircraft to turn to the right.	So that both pilots can see each other.
5	Aircraft A must give way or stop or pass behind aircraft B.	Aircraft B has the right of way being on the left side.

Question 8

INSTRUCTION

Study the dial test indicator provided and carry out the following tasks:

(a) Push the plunger gently and describe what happens.

(b)(i) Set the dial indictor plunger on the bar provided at the point marked **X** and take the reading. Move the bar under the indicator plunger and take the readings at points **Y** and **Z** respectively.

(ii) From the results in (b)(i) above determine the state of the surface of the bar.

(c) (i) With the dial indicator plunger still at point **Z**, insert the plate labelled **N** between the plunger and the bar. Record the dial indicator reading .....

(ii) Determine the thickness of the plate labelled **N** from the readings obtained.

(iii) Using the micrometer screw gauge provided measure and record the thickness of the plate labelled **N**.

(iv) Comment on the results obtained in (c)(ii) and (c)(iii)

This question required the candidates to demonstrate how a dial gauge indicator works and how it can be used to take measurements and also determine irregularities on surfaces which naked eyes cannot detect. The use of micrometer was also included for comparison of the measurements taken.

Weaknesses

Most of the candidates were not able to interpret the scales in a dial gauge indicator and relate the information to the surfaces being tested. The reading of a micrometer and correct interpretation of its scale was also a major challenge to the candidates.

Expected Responses

(a) The big pointer rotates very fast and the small pointer rotates very slowly.

Question 10

INSTRUCTIONS

Using the materials, apparatus and equipment provided:

(a) By tabulation, determine:

(i) upthrust of the materials labelled **A** and **B**
(ii) density of the materials **A** and **B**
(iii) volume of the materials **A** and **B**

(b) State the principle behind your observations in (a).

(c) State the relevance of this experiment to an aircraft in flight.

(d) Relate the results of the experiment in (a)(i) and (a)(ii) above to an aircraft during take-off and landing.

This question required the candidates to determine the upthrust, density and volume of two different wooden blocks. They were also required to state the principle behind the experiment and relate the experiment to an aircraft in flight.

Weaknesses

Candidates lacked adequate knowledge in proper use of the apparatus given to obtain the required data in order to calculate the values indicated. According to the syllabus, candidates are expected to define various physical concepts and laws and perform basic calculations from given data.

Expected Responses

			A	B
(a)	(i)	**UPTHRUST**		
		Weight of collector can	Wc	Wc
		Weight of water collected	Wwa	Wwb
		Upthrust	Wc – Wwa	Wc – Wwb
	(ii)	**DENSITY**		
		Calculation of mass (m)	m ÷ 10	m ÷ 10
		Density $\frac{M}{V}$	$\frac{M}{V}a$	$\frac{M}{V}b$
	(iii)	**VOLUME**		
		Calculation of volume (L x B x H)	a x b x c	a x b x c

(b) Principle: Bouyancy/Archimedes

(c) Relevance: When aircraft is flying it displaces air equal to its weight to sustain flight.

(d) ***Take-Off:*** There will be more upthrust and density because of all the upweight.
Landing: There will be less upthrust and density during landing because of fuel consumption.

17.4 ADVICE TO CANDIDATES AND TEACHERS

Although most candidates had vague ideas of what was required in each exercise, there is need to improve in the following areas:

- Freehand sketching of various shapes and sizes of objects and also ability to convert figures to various forms like pictorial, assembled, exploded e.t.c
- Reading and understanding of questions and responding appropriately to any instructions and tasks given. This being a practical paper, the candidates have no option but to follow each instruction given in the questions.
- Taking accurate measurements using precision tools like micrometers and vernier calipers. Where scales need to be interpreted like in a dial gauge, the candidates are expected to do it accurately.

Teachers should ensure that the entire syllabus is adequately covered including minor topics like materials, fabrication, related drawing and measurements. There should be adequate time provided for students to apply the theoretical concepts covered and relate them to real life situations. Use of appropriate teaching aids like models and actual aircraft components should be upheld in order to enhance sound subject mastery and skill acquisition.

23.15 AVIATION TECHNOLOGY (450)

23.15.1 Aviation Technology Paper 1 (450/1)

450/1
AVIATION TECHNOLOGY
Paper 1
Oct./Nov. 2007
$2\frac{1}{2}$ hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
AVIATION TECHNOLOGY
Paper 1
$2\frac{1}{2}$ hours

INSTRUCTIONS TO CANDIDATES

Candidates should have the following for this examination.

Answer booklet
Drawing instruments
Drawing paper size A3

SECTION A: *Answer* ***all*** *the questions.*
SECTION B: *Answer* ***question 11*** *and any other* ***three*** *questions.*
All dimensions are in millimetres unless otherwise stated.

This paper consists of 4 printed pages

Candidates should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.

SECTION A (60 marks)

Answer ALL the questions in this section.

1. (a) List **four** precautions to be observed when towing a wide-body aeroplane from the apron. (2 marks)

   (b) State **four** entries made by the flight engineer in an aircraft technical log book after landing. (2 marks)

2. (a) Differentiate between the terms anti-icing and de-icing as applied to an aircraft in flight. (2 marks)

   (b) List **four** parts of an aircraft that require anti-icing. (2 marks)

3. (a) Explain the effects of headwind and tailwind on an aircraft during gliding. (2 marks)

   (b) Outline the functional differences between wing flaps and slats. (2 marks)

   (c) Illustrate the difference between symetrical and cambered aerofoil. (2 marks)

4. Explain why the following properties are considered when selecting aircraft construction materials:

   (a) malleability
   (b) conductivity
   (c) hardness (3 marks)

5. (a) Explain how each of the following factors affects the thrust of a turbo-jet engine:

   (i) revolutions per minute
   (ii) aircraft forward speed. (3 marks)

   (b) Differentiate between firing order and timing as applied to a four stroke aeropiston engine. (2 marks)

6. (a) Differentiate between a bolt and a screw as applied in aviation industry. (1 mark)

   (b) State **four** factors that determine the selection of bolts and screws for use in an aircraft. (2 marks)

7. (a) Explain the term flashback as applied in oxy-acetlylene gas welding. (1 mark)

   (b) State **four** causes of flashback. (2 marks)

8. Explain **three** prevailing weather conditions which would make a pilot change from visual to instrumental flying. (3 marks)

9. With the aid of a sketch, describe **three** methods of station numbering on an aeroplane. (5 marks)

10. Sketch in good proportion a hacksaw and label **two** parts. (4 marks)

SECTION B (60 marks)

*Answer **question 11** and any other **three** questions from this section.*
Candidates are advised to spend not more than 25 minutes on question 11.

11. Figure 1 shows three views of an aircraft bracket drawn in first angle projection. Draw in good proportion an isometric projection of the part taking Z as the lowest point.
(15 marks)

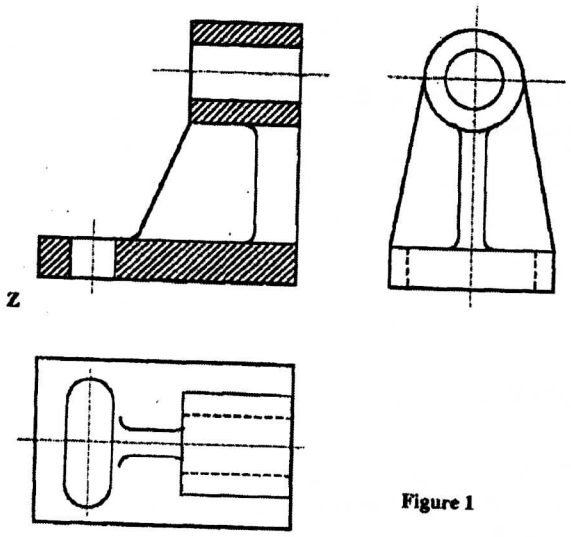


Figure 1

12. Explain **three**:

(a) classes of fuel (3 marks)
(b) types of aircraft fuel tanks (6 marks)
(c) methods of measuring fuel quantities in fuel tanks. (6 marks)

13. (a) Sketch and label a basic aircraft electrical generating system to power a dc wiper motor. (9 marks)

(b) Explain the operation of the circuit. (6 marks)

14. (a) Explain **two** purposes of using aero engine thrust reversal. (3 marks)

(b) With the aid of sketches, describe each of the following means of thrust reversal on aero engines:

(i) cold stream
(ii) hot stream
(iii) negative pitch. (12 marks)

15. (a) Outline **five** maintenance checks normally carried out on aircraft pitot static systems. (5 marks)

(b) With the aid of a labelled sketch, explain the construction and operation of an aircraft machmeter. (10 marks)

23.15.2 Aviation Technology Paper 2 (450/2)

450/2
AVIATION TECHNOLOGY
Paper 2
PRACTICAL
Oct./Nov. 2007
$2^1/_2$ hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
AVIATION TECHNOLOGY
Paper 2
PRACTICAL
$2^1/_2$ hours

INSTRUCTIONS TO CANDIDATES

There are ten stations in this examination.
*Candidates are allowed **15 MINUTES** at each station.*
*Candidates are **NOT** allowed to either review the previous station's work or read instructions for other stations.*
*Write your **NAME** and **INDEX NUMBER** on all projects.*
*Attempt **ALL** exercises in each station.*
All dimensions are in millimetres unless otherwise stated.

For Examiner's Use Only

Questions	1	2	3	4	5	6	7	8	9	10	**TOTAL**
Marks											

This paper consists of 11 printed pages

Candidates should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.

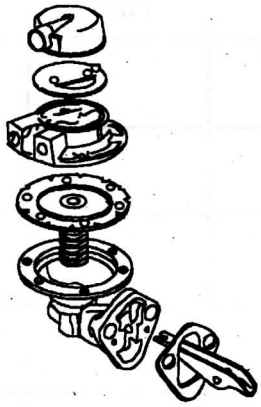
STATION 1

INSTRUCTIONS

The figure below shows an exploded view of an aeropiston engine driven pump. On the drawing paper provided:

(a) Sketch in good proportion a section view of an assembled unit along the vertical plane.

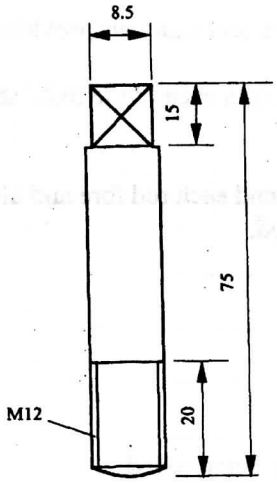
(b) Name **four** parts which are not visible when the pump is assembled. (10 marks)



STATION 2

INSTRUCTIONS

Using the tools, materials and equipment provided, make the square head bolt as shown in the drawing below. (10 marks)



STATION 3

INSTRUCTIONS

The beakers labelled 1 to 5 contain samples of oil obtained from various aeropiston engine lubrication systems.

Determine the possible causes of contamination in each sample by visual inspection, viscosity test and magnetic chip test. Record your observations in the table below. (10 marks)

SAMPLE	VISUAL INSPECTION	VISCOSITY	MAGNETIC CHIP	POSSIBLE CAUSE
1				
2				
3				
4				
5				

STATION 4

INSTRUCTIONS

Carry out the following tasks using the tools and materials provided.

(a) (i) Hold vertically and at midlength each of the rods labelled **K, L, M** and **N** in a bench vice.

(ii) Using the tube labelled **P**, bend each rod fore and aft until it breaks. Record the number of bends for each rod.

K .....

L .....

M .....

N .....

(iii) State the mechanical property being tested.

(iv) Comment on the relationship between the number of bends each rod takes to break to the mechanical property tested.

(b) Cut each of the rod labelled K, L, M and N to determine the hardest material.

Hardest material .....
(1 mark)

(c) State one application and one reason of selecting each of the materials labelled K, L and M in an aircraft.

Material	Application	Reason
K	.....	.....
L	.....	.....
M	.....	.....

(3 marks)

STATION 5

INSTRUCTIONS

(a) (i) Fill the bottle labelled J with water and turn it upside down into the bowl provided. Record your observations.

(ii) Repeat (a)(i) above with the hole marked Q covered. Record your observations.

(iii) Relate the observations in (a)(i) and (a)(ii) above to the operation of an aircraft system.

(a) (i) .....

(a) (ii) .....
(4 marks)

(b) (i) Repeat experiment (a)(i) above using the bottle marked K. Records your observations.

(ii) Lift the bottle slightly above the water level. Record your observations.

(iii) Relate the observations in (b)(i) and (b)(ii) above to the operation of an aircraft hydraulic system.

(b)(i) .....

(b)(ii).....
(4 marks)

(c) Give one limitation and one remedy of operations of an aircraft in flight in relationship to the experiments in (a) and (b) above. (2 marks)

	Limitation	Remedy
(a)	.....	.....
(b)	.....	.....

STATION 6

INSTRUCTIONS

Study the components marked **A, B, C, D, E** and **F** and carry out the following tasks:

(a) Identify items **A** to **F** and for each item draw the symbol and state its use. (9 marks)

ITEM	NAME	SYMBOL	USE
A			
B			
C			
D			
E			
F			

(b) Record the value of items **A** and **D**.

A .....

D ..... (1 mark)

STATION 7

INSTRUCTIONS

The pilot for the aircraft marked **A** has been cleared to taxi and encounters each of the scenario **1, 2, 3, 4** and **5** as shown on the aerodrome plan provided.

Study each scenario and in the table below state the expected immediate action and the reason for the action. (10 marks)

SCENARIO	IMMEDIATE ACTION	REASON FOR THE ACTION
1		
2		
3		
4		
5		

STATION 8

INSTRUCTION

Study the dial test indicator provided and carry out the following tasks:

(a) Push the plunger gently and describe what happens.

(b)(i) Set the dial indictor plunger on the bar provided at the point marked **X** and take the reading. Move the bar under the indicator plunger and take the readings at points **Y** and **Z** respectively.

(ii) From the results in (b)(i) above determine the state of the surface of the bar.

.....

(4 marks)

(c) (i) With the dial indicator plunger still at point **Z**, insert the plate labelled **N** between the plunger and the bar. Record the dial indicator reading .....

(ii) Determine the thickness of the plate labelled **N** from the readings obtained.

(iii) Using the micrometer screw gauge provided measure and record the thickness of the plate labelled **N.**

(iv) Comment on the results obtained in (c)(ii) and (c)(iii)

.....

(4 marks)

STATION 9

INSTRUCTIONS

Using the tools equipment and materials provided, perform the following patch repair activities:

(a) On the perspex piece labelled **R**;

(i) trim all the edges
(ii) chamfer one of the longer edges
(iii) round all the corners. (5 marks)

(b) Use the piece labelled **R** to patch the area painted red on the perspex piece labelled **S** using the two capscrews provided. (5 marks)

Write your index number on a piece of masking tape and fix it to your workpiece.

STATION 10

INSTRUCTIONS

Using the materials, apparatus and equipment provided:

(a) By tabulation, determine:

(i) upthrust of the materials labelled **A** and **B**
(ii) density of the materials **A** and **B**
(iii) volume of the materials **A** and **B** (6 marks)

UPTHRUST

A B

DENSITY

A B

VOLUME

A B

(b) State the principle behind your observations in (a). (1 mark)

(c) State the relevance of this experiment to an aircraft in flight. (1 mark)

(d) Relate the results of the experiment in (a)(i) and (a)(ii) above to an aircraft during take-off and landing. (2 marks)

24.15 AVIATION TECHNOLOGY (450)

24.15.1 Aviation Technology Paper 1 (450/1)

1. (a)
   - Ensure ground lock pins are installed.
   - Disconnect the steering.
   - Ensure hydraulic pressure is available in accumulator.
   - Ensure ground to cockpit communication - oral and visual.
   - Tow at large angles.
   - Tow at low speed.
   - Follow manufacturer's instructions. ***(Any 4 x $^{1}/_{2}$= 2 marks)***

   (b)
   - Aircraft defects during flight.
   - Oil uplifts.
   - Accumulated flight hours.
   - Flight number.
   - Centre of gravity.
   - Number of landings.
   - Remaining fuel. ***(Any 4 x $^{1}/_{2}$= 2 marks)***

2. (a)
   - ***Anti-icing***: prevention of ice formation on the aircraft surface.
   - ***De-icing***: removal of ice that has already formed on the aircraft surface.

   (2 x 1= 2 marks)

   (b)
   - Engine intakes.
   - Pitot static head.
   - Leading edge of wing, tail plane.
   - Wind screens.
   - Carburettor.
   - Propeller blade. ***(Any 4 x $^{1}/_{2}$= 2 marks***

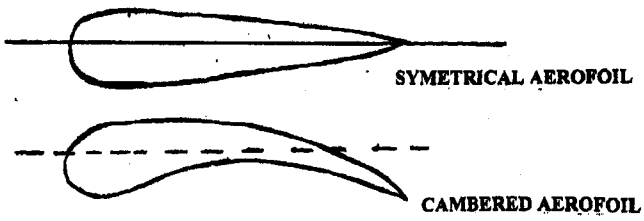
3. (a)

   Headwind
   - Reduces or decelerates forward speed of aircraft.
   - Increases generated lift.
   - Reduces the flight range. ***(Any 2 x $^{1}/_{2}$= 2 marks)***

   Tailwind
   - Increases the forward speed of aircraft or accelerates aircraft.
   - Decreases generated lift.
   - Lengthens the flight range. ***(Any 2 x $^{1}/_{2}$= 2 marks)***

   (b)
   - ***Function of Flap***: to change the camber of the wing and/or increase wing area to allow a/c to operate at lower flight speed during landing and take off.***(1 mark)***
   - ***Function of Slats***: are on the leading edge of high performance a/c wing and are used for reducing stalling speed and increasing lift at comparatively low or high angle of attack. ***(1 mark)***

   (c)



(2 marks)

4.

(a) ***Malleability:*** the ability of metal to be rolled into thin sheets without fracture.

(b) ***Conductivity***: the physical property of a material to conduct both heat and electricity, makes copper best suited for manufacture of wires and plates.

(c) ***Hardness***: ability of a metal to withstand scratching, wear and abrasion.

(3 x 1= 3 marks)

5. (a) (i) Revolutions per minute (RPM)

- At low RPM there is very little increase in thrust compared to high RPM.
- At very high RPM a very little variation of throttle will produce an increase in thrust.
- The jet will operate best at maximum RPM. ***(Any 3 x $^{1}/_{2}$=1$^{1}/_{2}$ marks)***

(ii) Aircraft Forward Speed

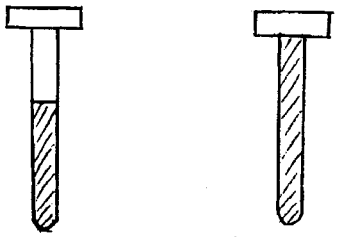
- Increase in a/c speed reduces thrust in direct proportion.
- Due to ram air intake, mass flow and velocity of the jet also increases with airspeed.
- Resultant net thrust is practically constant with airspeed.

(Any 3 x $^{1}/_{2}$= 1$^{1}/_{2}$ marks)

(b)

- ***Firing Order:*** the sequence in which the power stroke occurs in different cylinders to provide balance and eliminate vibration.
- ***Timing***: means of ensuring that the engine distributor releases the spark when the piston is at TDC after completion of compression stroke. ***(2 x 1= 2 marks)***

6. (a)



BOLT (PARTIALLY THREADED) **SCREW (FULLY THREADED)**

(2 x $^{1}/_{2}$ = 1 mark)

(b)

- Material.
- Thread type.
- Size (diameter and length).
- Type of finish.
- Shape of head. ***(Any 4 x $^{1}/_{2}$ = 2 marks)***

7. (a) ***Flashback*** is the burning of gases within the torch and is dangerous.

(1 mark)

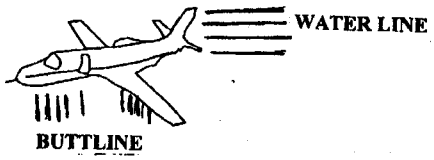
(b)

- Loose connections.
- Improper pressure.
- Overheating of torch.
- Touching the tip.
- Incorrect mixture. ***(Any 4 x $^{1}/_{2}$= 2 marks)***

8.

- Visibility: if its less than 10 km.
- Time: if after dusk or before dawn.
- Clouds: if below 7,000 ft from highest obstacle.
- Heavy precipitation: rain, haze snow mist, dust, smoke, etc.
- Heavy storm. ***(Any 3 x 1 = 3 marks)***

9.

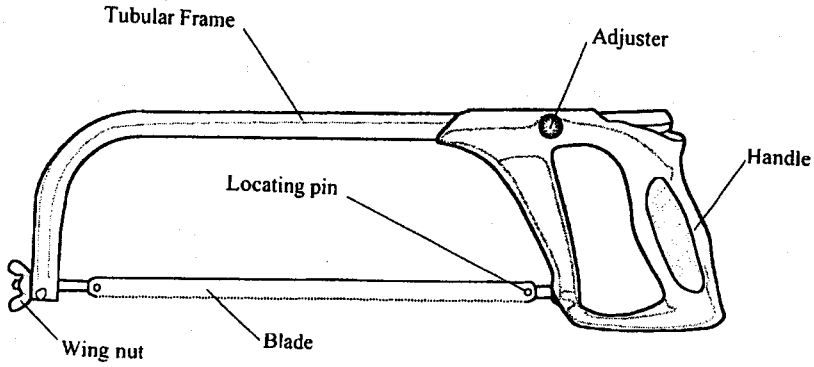


(2 marks)

Station Numbering

- ***Fuselage Stations***: These are systems numbers in inches from a reference datum.
- ***Buttock Line/Buttline:*** - This is the width measurement left and right from a reference datum
- ***Water Line***: This is the measurement of height in inches perpendicular from a horizontal plane located at a fixed reference datum. ***(3 marks)***

10.

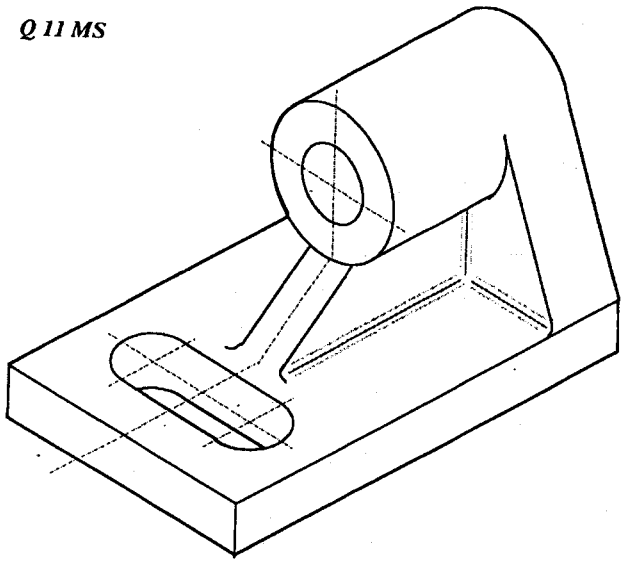


HACKSAW

(4 marks)

11.

Q 11 MS



(15 marks)

12. (a)

- ***Solid Fuel***: such as wood or coal used for external combustion engines.
- ***Liquid Fuels***: such as kerosene and gasoline used for internal combustion engines.
- ***Gaseous Fuels***: such as methane and cooking gas used for either internal or external combustion engines of the static nature. ***(3 marks)***

(b)

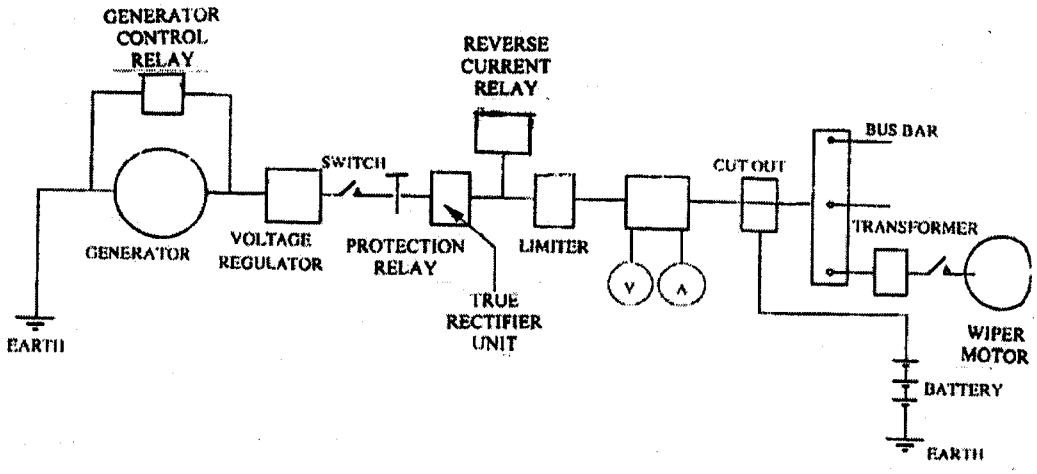
- ***Rigid Fuel Tank***: This is a fuel tight removable tank fitted in a compartment which is not fuel-tight and made of aluminium plates welded together.
- ***Bladder Fuel Cells:*** This tank is essentially a reinforced rubberized bag placed in a non-fuel tight compartment designed to structurally carry the weight of the fuel.
- ***Intergral Fuel Tank:*** This is a tank that is part of the basic structure of a wing or fuselage in that the walls of the tank form the main structure members. ***(6 marks)***

(c)

- ***Capacitance:*** The fuel quantity indicating system incorporate electric capacitance tank probes mounted internally in each fuel tank. The probes have a compensator for fuel density variations and feed signals to the cockpit panel.
- ***Drip Stick:*** This consists of a calibrated hollow stick and when the cap in the wing lower surface is drawn out fuel enters the open top of the stick when it reaches the fuel level and can be observed at a small drip hole near the cap base.
- ***Magnetic Stick***: This consists of a magnet floating on fuel and another magnet inserted in a stick. When the stick is withdrawn from the bottom of the wing surface and the level of fuel is reached the float magnet attracts the stick magnet and the quantity of fuel can be observed since the stick in calibrated in gallons.

(6 marks)

13. (a)



(9 marks)

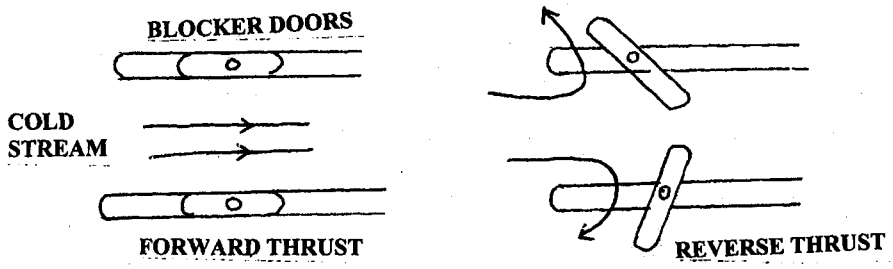
(b) ***Operation***

- Engine driven generation: A coil is rotated in a strong magnet to generate A.C. current.
- The generator control relay protects the generator from feed back.
- Voltage regulator: controls the generator output to within the close limits
- Switch to bring the generator on line.
- Protection relay to isolate in case of a fault in the system.
- True rectifier to convert the D.C. to A.C.
- Reverse current relay to prevent any current flow backwards.
- Cut out to provide battery with charge.
- Transformer to step up or step down the voltage.
- Wiper motor where current is fed to a coil placed in a strong magnet to create rotating moment known as torque. ***(6 marks)***

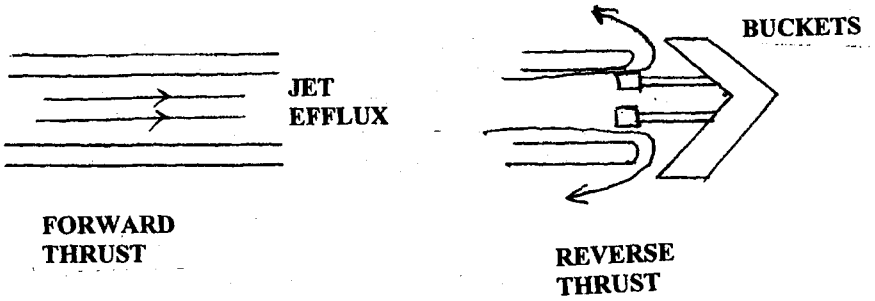
14. (a) Thrust Reverse is a means of reversing the direction of thrust on aircraft engine for the following:

- To decelerate the aircraft after landing so as to bring the aircraft to rest within remaining end of the runway without excessive use of breaks.
- To reduce the speed of the aircraft in flight, thereby allowing a rapid rate of descent during pressurization failure or combat. ***(3 marks)***

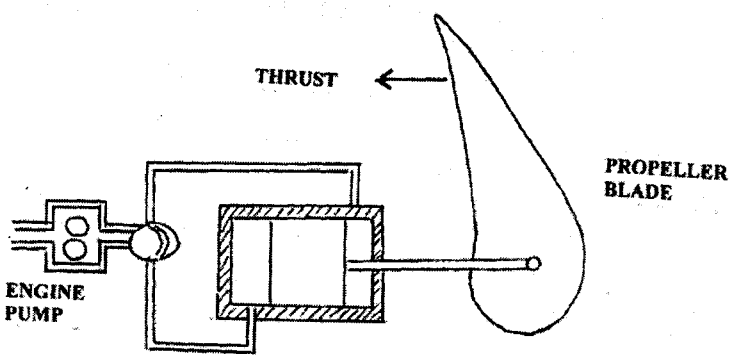
(b) (i) ***Cold Stream:*** This is achieved on front fan engines where the reverse thrust is obtained by reversing the fan (cold stream) airflow by blocker doors. When the engine is operating in forward thrust the blocker doors will flush on both sides of the engine intake. On selection of reverse thrust the actuation system moves the translating cowl rearwards and at the same time folds the blocker doors to blank off the cold stream final nozzle thus diverting the airflow through the cascade valves. ***(4 marks)***



(ii) ***Hot Stream:*** This is achieved on pure jet engines where the thrust reverse is obtained by reversing the jet efflux (hot stream) by clamshell doors. Normal operation of the engine is not affected by the system because the duets through which the exhaust gases are deflected remain closed by the doors until the reverse thrust is selected by the pilot. On selection of reverse thrust the doors rotate to uncover the ducts and close the normal as stream exit. Cascade vanes then direct the gas stream in a forward direction so that the jet thrust opposes the aircraft motion. ***(4 marks)***



(iii) ***Negative Pitch:*** This is achieved on propeller powered aircraft where the reverse thrust reversal is obtained by changing the pitch of the propeller blades. During normal operation the propeller blades accelerates large mass of air rearwards to generate thrust. On selection of the reverse thrust the propeller blades directs the oil from the control system to the propeller mechanism to reduce the blade angle to zero, the then through to negative (reverse) pitch to accelerate the large mass of air forwards to oppose the aircraft forward motion.
(4 marks)



NEGATIVE PITCH

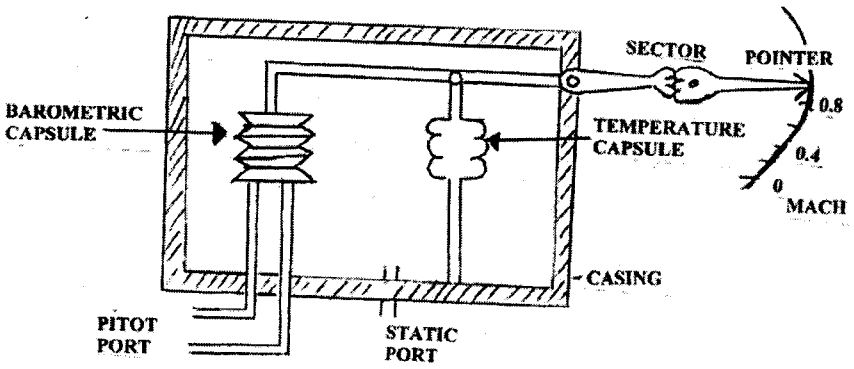
15. (a)

- Leakage test to ensure the system is air tight.
- Carry out regular system drainage checks.
- Plug to ensure no entry of foreign objects.
- Check functionality of anti-icing system.
- Ensuring there are no bends and kinks. ***(5 marks)***

(b) Machmeter consists of:

- Barometer capsule vented to pitot pressure.
- Semi-evacuated capsule sensitive to change in temperature.
- Casing vented to static pressure.
- Linkages sensitive to expansion and collapsing of both barometric and semi-evacuated capsules.
- Sector that is moved by linkages.
- A pointer that moves on a dial calibrated in mach numbers.

(3 marks)

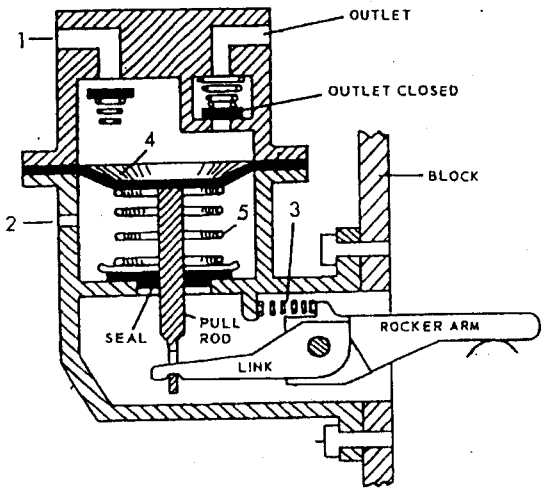


When the aircraft is stationary the capsule pressure and casing pressure are equal and the instrument reads zero. When the aircraft moves forward the pitot pressure increases because of ram effect for the capsule pressure to overcome casing pressure to expand the capsule.

Expansion of the capsule moves the linkage to move the sector to rotate the pointer to indicate forward speed. However the temp capsule adjusts the linkage to compensate for temperature. Since the temp change is directly proportional to the speed of sound the instrument reads the ratio of speed of aircraft to the speed of sound. ***(3 marks)***

24.15.2 Aviation Technology Paper 2 (450/2)

Station 1



(10 marks)

Station 3

1. Oil with copper chipping, low viscosity, no effect on magnetic chip.
2. Engine oil mixed with rubber chippings no effect.
3. Engine oil with iron filing, ferrous magnetic chips.
4. Engine oil mixed with water.
5. SAE 40 engine - no contamination. ***(10 marks)***

Station 4

(a) (ii) **K:** Mild steel.
L: Brass.
M: Aluminium.
N:Copper. ***(4 x 1 =4 marks)***

(iii) Turfness. ***(1 mark)***

(iv) The higher the number of bends, the tougher the material. ***(1 mark)***

(b) The hardest material. ***(1 mark)***

(c)

	Material	***Application***	***Reason***
	K: Mild steel	Fasteners	Turf & Malleable
	L: Brass	Bushes	Self lubrication Non-corrosive Machineable
	M: Aluminium	a/c skin	light Corrosion resistant

(3 x 1=3 marks)

Station 5

(a) (i) The water flows to the bowl continuously. ***(1 mark)***

(ii) Initially the water flows into the bowl with bubble but eventually stops flowing. ***(1 mark)***

(iii) The hole represents a vent in a fuel tank which allows free flow of fuel. ***(1 mark)***

The blocked vent does not allow flow of liquid from the tank to the system.
(1 mark)

(b) (i) The water flows to the bowl continuously. *(1 mark)*

(ii) There is introduction of air bubble, the water flows and eventually stops.
(1 mark)

(iii) System does not have a vent to allow for continuous flow of hydraulic fluid.
(1 mark)

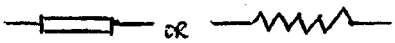
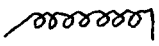
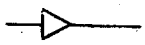
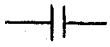
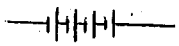
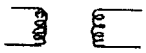
(c) Introduction of air charge allows the system to operate. *(1 mark)*

	Limitation	*Remedy*
(i)	The a/c system does not operate effectively at high altitude.	Fly at low altitude.
(ii)	System starvation.	Pressure the reservoir

(4 x $\frac{1}{2}$ = 2 marks)

Station 6

(a)

ITEM	NAME	SYMBOL	USE
A	Fixed resistor		Control of current.
B	Inductor		Acts as Rectifier
C	Silicon diode		Allow flow of current in one direction.
D	Capacitor		Stores electrical energy.
E	Battery		Provides circuit source of power.
F	Transformer		Steps current up or down.

(6 x 1$\frac{1}{2}$ = 9 marks)

(b) **A** 100Ω

D 1μF

(2 x $\frac{1}{2}$ = 1 mark)

Station 7

SCENARIO	IMMEDIATE ACTION	REASON FOR THE ACTION
1	Stop, check judge and decide	Depends on situation on runway.
2	Overtaking aircraft must keep out of way by overtaking on the left	Aircraft being overtaken has the right of way.
3	The aircraft A must stop	The aircraft B has the right of way
4	Each aircraft to turn to the right.	So that both pilots can see each other.
5	Aircraft A must give way or stop or pass behind aircraft B.	Aircraft B has the right of way being on the left side.

(2 x 5 = 10 marks)

Station 8

(a)

- The big pointer rotates very fast.
- The small pointer rotates very slowly. ***(2 x 1= 2 marks)***

(b) (i) X, Y, Z — Correct reading ***(3 x 1= 3 marks)***

(ii) Determining state of bar. ***(1 mark)***

(c) (i) Correct dial indicator reading.
(ii) Correct thickness of N by determination.
(iii) Correct thickness of W by measurement.
(iv) Correct comment. ***(4 x 1= 4 marks)***

Station 10

		Upthrust	A	B
(a)	(i)	Weight of collector can	Wc	Wc
		Weight of water collected	Wwa	Wwb
		Upthrust	Wc – Wwa	Wc – Wwb

(6 x $\frac{1}{2}$ = 3 marks)

(ii) **Density**

Calculation of volume (L x B x H)	a x b x c	a x b x c
Calculation of mass (m)	m ÷ 10	m ÷ 10
Density $\frac{M}{V}$	$\frac{M}{V}a$	$\frac{M}{V}b$

(6 x $\frac{1}{2}$ = 3 marks)

(b) ***Principle***: Buoyancy/ Archimedes. ***(1 mark)***

(c) ***Relevance***: When aircraft is flying it displaces air equal to its weight to sustain flight. ***(1 mark)***

(d) ***Take-Off:*** There will be more upthrust and density because of all the upweight.
Landing: There will be less upthrust and density during landing because of fuel consumption. ***(2 x 1= 2 marks)***