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

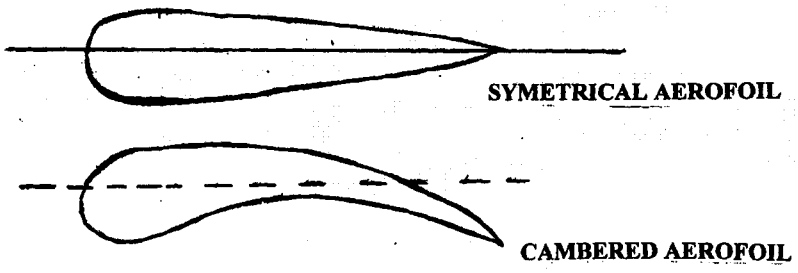
- Increases the forward speed of aircraft.
- Decreases generated lift.
- Lengths the flight range.

(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.

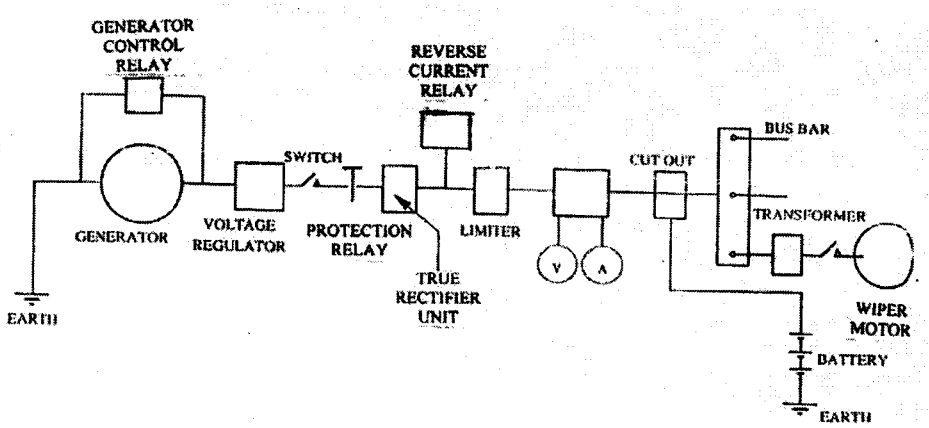
This was a specific question where candidates were expected to sketch an electrical system for a dc wiper motor used in an aircraft and also explain how it works.

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.

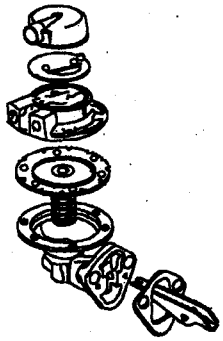
Question 1

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.**

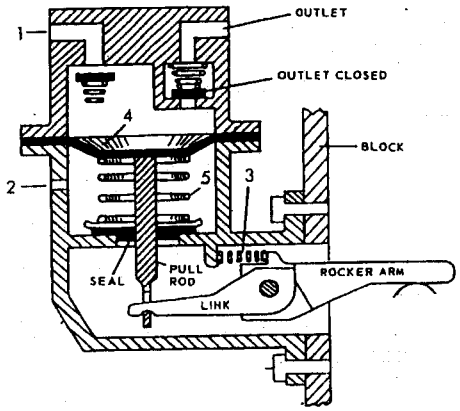


This was a related drawing exercise where candidates were required to sketch a section view of an assembled pump presented in exploded form. The candidates were also expected to name four internal parts of the pump.

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.