HUMAN PERFORMANCE AND LIMITATIONS

The actual actual examination paper consists of twenty questions with a multiple choice of four answers A, B, C or D. The candidate should indicate the chosen answer by placing a cross in the appropriate box on the answer paper provided.

Time allowed thirty minutes.

The pass mark is 75%, so the minimum number of questions that must be answered correctly to obtain a pass is fifteen. Marks are not deducted for incorrect answers.

The explanation section follows the question section and each explanation is prefixed EHP (Explanation Human Performance)

Q1 Within the atmosphere, the pressure of oxygen (referred to as a partial pressure) along with the pressure of other constituent gases decreases with increased altitude, leading eventually to the effects of hypoxia in the most healthy pilot. Such a pilot should not suffer the effects of hypoxia when operating for periods up to and including an altitude of:

A - 8000ft.
B - 10000ft.
C - 12000ft.
D - 14000ft.

Q2 The proportion of oxygen in relation to other gases that comprise the atmosphere:

A - remains constant throughout the atmosphere.
B - decreases with increased altitude.
C - increases with increased altitude.
D - varies exponentially with other constituent atmospheric gases.

Q3 Respiration is a spontaneous act regulated primarily by the brain's sensitivity to:

A - the amount of oxygen adhered to haemoglobin.
B - atmospheric pressure.
C - the carbon dioxide level in the blood.
D - the amount of haemoglobin in the blood.

Q4 The first effects of a lack of oxygen in the bloodstream are most likely to be:

A - a light-headed sensation, possibly dizziness and nausea.
B - loss of memory and impaired muscular control.
C - loss of inhibitions together with difficulty in completing mental tasks.
D - a feeling of intense anxiety and perspiration.

Q5 Chemical receptors in the brain govern the respiratory process by monitoring levels of oxygen and carbon dioxide in the body. The receptors of a healthy body are more sensitive to changes in the level of:

A - equally both carbon dioxide and oxygen.
B - oxygen.
C - non of the above answers are correct.
D - carbon dioxide.

Q6 There is a reduction in the amount of oxygen available to the body when altitude is increased because of the subsequent:

A - decreased atmospheric pressure.
B - decreased atmospheric temperature.
C - decreased proportion of oxygen.
D - increased partial oxygen pressure.

Q7 When the body does not have sufficient oxygen to meet its needs, the condition is known as:

A - hyperventilation.
B - hypsometrosis.
C - hypoxia.
D - hyperpnoea.

Q8 What might describe the time of useful consciousness?

A - The time from when breathable air is no longer available to the time of unconsciousness.
B - The time between the onset of hypoxia to unconsciousness.
C - The time from when there is insufficent oxygen in the air to sustain full consciousness during which cognitive processes and physical functions are relatively unimpaired to a time after hypoxia sets in.
D - from the onset of hypoxia to the point when hyperventilation sets in.

Q9 Compared with a non-smoker, a tobacco smoker is more likely to experience the symptoms of hypoxia at:

A - the same altitude.
B - a lower altitude.
C - a higher altitude.
D - transition altitude.

Q10 When compared with a non smoker, it is probable that a tobacco smoker will suffer the effects of oxygen deficiency at:

A - the same cabin altitude.

B - a lower altitude.

C - a higher cabin altitude.

D - cabin transition altitude.

Q11 The presence of carbon monoxide in a cockpit could be caused by:

A - cigarette smoke or a leaking cockpit heat exchanger.

B - flying through cloud.

C - low flying over industrial areas.

D - a lack of cockpit ventilation.

Q12 How long after prolonged exposure to exhaust gas during flight in a light aircraft would a pilot be considered fit to act as pilot?

A - After 5 or 6 hours.

B - After 1 or 2 hours if exercise is taken.

C - After a number of days.

D - After 24 hours.

Q13 One consequence of smoking is that carbon monoxide adheres to the protein haemoglobin in the red blood cells which will:

A - advance the onset of hypoxia with altitude increase.

B - not affect the onset of hypoxia with altitude increase.

C - delay the onset of hypoxia with altitude increase.

D - negate the effects but not the symptoms of hypoxia at any cruise altitude.

Q14 Haemoglobin, the conjugated protein that transports oxygen around the body, is more readily attractive to:

A - oxygen.

B - nitrogen.

C - carbon dioxide.

D - carbon monoxide.

Q15 When operating at low level below an altitude of 10000ft, a tingling sensation in the hands, feet, and around the lips together with dizziness, anxiety, and visual disorder are symptomatic of:

A - hypoxia.

B - hypothermia.

C - hypopnoea.

D - hyperventilation.

Q16 Whilst operating at relatively low altitude, a pilot who experiences the physical sensation of tingling, particularly in the hands, feet and around the lips, together with anxiety, visual disorder, and dizziness is probably:

A - hyperventilating.

B - hypoxic.

C - hyposthenic.

D - hypopnoic.

Q17 Over-breathing, leading to hyperventilation, may be due to a lack of oxygen in the body as well as:

A - being intensely committed to completing a complex operation.

B - fatigue.

C - motion sickness, heat, vibration and anxiety.

D - a lack of general fitness and well being.

Q18 Hyperventilation is a condition that:

A - pilots should be particularly aware of.

B - does not affect people who keep themselves in good physical condition.

C - will only affect children generally under the age of 10.

D - is symptomatic in older people and acrophobics.

Q19 One remedy for hyperventilation is:

A - that in the absence of a tranquilliser, administer a strong alcoholic drink.

B - the application of a cold compress.

D - breathing oxygen until hyperventilation subsides.

D - pacify and calm the sufferer to restore a normal rate of respiration together with breathing in and out of a bag.

Q20 Hypoxia is associated with which combination of the following?

(1) Sensory loss.

(2) Memory impairment.

(3) Impairment of consciousness.

(4) Impaired judgement.

(5) Personality change.

(6) Muscular impairment.

(7) Sense of feeling physically and mentally unwell.

A - (3) to (6) only.

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

C - (1), (2), (3), (4), (5) and (7.

D - (1) to (6) only.

Q21 When operating at a low altitude where hypoxia would not normally occur, a person breathing abnormally and displaying symptoms associated with hypoxia is probably:

A - nauseous.

B - hyperventilating.

C - suffering from motion sickness.

D - very frightened of flying.

Q22 The peripheral, autonomic and central are what type of human systems?

A - cardiac.

B - nervous.

C - skeletal.

D - circulatory.

Q23 The circulatory system:

A - supplies oxygen to the brain, muscles and other essential organs.

B - after protein digestion, supplies the muscles with lactate and carbohydrate.

C - is a three part closed system that distributes blood around the body.

D - facilitates digestion and dispenses with body waste matter.

Q24 The use of compressed air for scuba diving has resulted in decompression sickness or 'bends' being experienced during a subsequent flight at altitudes as low as 6000ft. Following the use of compressed air for scuba diving, pilots are advised not to fly within .....**(i)**..... hours of diving, and .....**(ii)**..... if a depth of 30ft has been exceeded.

	(i)	**(ii)**
A -	9	18
B -	18	30
C -	12	24
D -	24	48

Q25 Decompression sickness, more commonly known as 'the bends', has been known to occur at the relatively low cabin altitude of 6000ft following a fairly shallow scuba dive using compressed air. Any person who has scuba dived to depths in excess of 30ft using compressed air is advised to wait:

A - 24 hours before flying.

B - 10 hours before flying.

C - 6 hours before flying.

D - 48 hours before flying.

Q26 The cause of decompression sickness is the formation of bubbles in the body tissue. This is the result of a rapid decrease in pressure acting on the body when ascending too rapidly from a deep dive, or flying too high too soon after scuba diving, both of which allows ..... to come out of solution. Which of the following responses correctly completes this statement?

A - Carbon dioxide.
B - Oxygen.
C - Carbon monoxide.
D - Nitrogen.

Q27 Decompression sickness is the result of a gas coming out of solution to form bubbles in the body tissues. The gas in question is:

A - Oxygen.
B - Nitrogen.
C - Carbon dioxide.
D - Carbon monoxide.

IN RESPECT OF THE FOLLOWING THREE QUESTIONS, ONE UNIT OF ALCOHOL IS EQUIVALENT TO ONE MEASURE OF SPIRIT, A STANDARD GLASS OF WINE OR A HALF PINT OF BEER.

Q28 What might be an approximate time to dissipate one unit of alcohol from the blood?

A - Half an hour.
B - Two hours.
C - One hour.
D - Three hours.

Q29 Approximately how much time is required to eliminate one unit of alcohol from the blood?

A - Three hours.
B - Two hours.
C - One hour.
D - Thirty minutes.

Q30 The number of alcohol units consumed generally accepted as being the amount beyond which significant physical damage may be sustained, is 21 for men and 14 for women per:

A - day.
B - fortnight.
C - month.
D - week.

Q31 The parameter advised by the CAA Flight Safety Group regarding flight crew donating blood is that they should not fly within .....hours after giving blood or blood plasma. Select the answer that correctly completes this statement.

A - 6 hours.
B - 2 hours.
C - There is no such advisory time restriction provided the donation blood in any one month is 600 millilitres or less.
D - 24 hours.

Q32 Select the statement you consider to be most correct.

A - Increased altitude greatly increases the adverse effects of alcohol.
B - Eating increases the rate of alcohol oxidation.
C - Sleeping, or drinking black coffee, increases the rate at which the body processes alcohol.
D - Decreased altitude greatly increases the adverse effects of alcohol.

Q33 Following a rapid change from a climb to straight and level flight, a pilot flying solo has the sensation of tumbling backwards. S/ he should:

A - rely on somatosensory (seat of the pants) information.
B - concentrate on and trust the aircraft instruments.
C - initiate a dive then rapid recovery to reverse the sensation.
D - close the eyes for a few seconds then visually concentrate on the natural horizon.

Q34 During flight, a pilot who is aware that s/ he is suffering from spatial disorientation should:

A - not rely upon visual clues.
B - concentrate on and believe the aircraft instruments.
C - shut the eyes and rest until the disorientation has passed.
D - concentrate on the surrounding environment in order to maintain spatial orientation.

Q35 A primary contribution to the onset of motion sickness is the:

A - effect of movement on the stomach acids.

B - change of cognitive process produced by motion.

C - the mismatch between vestibular and visual sensory inputs.

D - fluid motion within the inner ear.

Q36 A comprehensive situational awareness is maintained by:

A - continually scanning by rote, discarding non essential data.

B - interpreting any new data to confirm where you should be.

C - continually obtaining position fixes whilst accurately maintaining heading, height and attitude.

D - gathering and considering all possible data whilst updating the situation and planning ahead.

Q37 If an aircraft is where a pilot thinks it is then:

A - the aircraft is on track

B - the direction indicator is correctly synchronised with the magnetic compass and the correct barometric pressure is set on the altimeter sub-scale..

C - the pilot is situationally aware.

D - the pilot's cockpit management and aviating ability are efficient.

Q38 Whilst maintaining a straight and level attitude, the process of accelerating may produce the sensation of pitching nose up, which requires the pilot to:

A - ease the control column forward to correct the pitch up sensation.

B - use common sense and make full use of vestibular information.

C - believe visual information such as instruments and/ or the real horizon and ignore any vestibular and somatosensory derived information.

D - increase acceleration to reduce the exposure time to disorientation and concentrate on cockpit management.

Q39 During the process of slowing an aircraft down, a pilot may experience the illusory perception of:

A - pitching nose up.

B - pitching nose down.

C - feeling sick.

D - becoming weightless.

Q40 Whilst maintaining a straight and level attitude, the process of accelerating may produce the sensation of:

A - pitching nose down.

B - rolling.

C - yawing due to the gyroscopic effect of the propeller.

D - pitching nose up.

Q41 Physical equilibrium is maintained by sensory information received from the vestibular apparatus in the inner ear, eyes and skeletal muscles. As rotation ceases during spin recovery, confusion caused by conflicting sensory information may be avoided by relying on the single most dependable source of sensory information, which is:

A - the semicircular canals of the inner ear.

B - eyesight.

C - the skeletal muscles.

D - seat of the pants orientation.

Q42 The safest course of action for any pilot flying solo and experiencing spatial disorientation would be to:

A - rely entirely on somatosensory (seat of the pants) information.

B - close the eyes, take some deep breaths and rest.

C - take motion sickness tablets under the supervision of a CAA medical examiner.

D - pay most attention to and trust the aircraft instruments.

Q43 A runway, or other feature believed to be significantly smaller than it actually is, may appear to be:

A - farther away than it actually is.

B - nearer than it actually is.

C - longer than it actually is.

D - shorter than it actually is.

Q44 Approaching a runway that is significantly smaller than previously expected may be perceived as being:

A - nearer than it actually is.

B - at its actual range.

C - farther away than it actually is.

D - longer than it actually is.

Q45 Approaching a runway with very bright approach and runway lighting that is situated in an area almost devoid of lighting may result in the pilot:

A - descending early with the consequence of a low final approach.

B - flying a 3° approach path.

C - descending too late resulting in a very steep final approach path.

D - being distracted by light intensity in which case the approach should be initiated by reference to instruments.

Q46 A visual approach to an unfamiliar aerodrome with a down sloping runway that does not have any form of visual glide slope aid, is more likely to result in:

A - a steeper approach than that intended.

B - an approach very close to the intended approach path.

C - a more shallow approach than that intended.

D - an approach that diverts considerably from intended approach path.

Q47 An attempt to fly a 3° approach path visually to an up-sloping runway that does not have any visual approach aids, such as VASI or PAPI, will most probably result in:

A - a fairly accurate approach close to 3°.

B - a more shallow approach of less than 3°.

C - a steeper approach greater than 3°.

D - an approach that deviates both above and below the intended 3° approach path.

Q48 When flying in haze, a pilot may experience the illusion of external objects appearing to be:

A - larger than they actually are.

B - closer than they actually are.

C - further away than they actually are.

D - dimmer than they actually are.

Q49 A pilot of limited experience is flying with a pilot who is considerably more experienced. If the pilot of greater experience undertakes a course of action considered by the pilot of limited experience to be dangerous, s/ he should:

A - accept the course of action as they may not have the full picture.

B - question the course of action upon completion of the flight.

C - take control of the aeroplane.

D - immediately question the course of action.

Q50 The effect of helicopter rotor blades creating a flickering light in bright sunshine may be the cause of physical discomfort to some passengers. To alleviate the effects a sufferer should:

A - ignore the effects as they tend to be compounded by concentrating on them.

B - cover the relevant window or wear sun glasses.

C - try to sit in a sunny area rather than one that is in shade.

D - ignore the stroboscopic effect as it is no different to that experienced in most night clubs.

Q51 A pilot who is flying with a more experienced colleague considers that the colleague has decided upon a course of action that may endanger the aircraft. The less experienced pilot should:

A - immediately express any doubts.

B - question the experienced pilot's judgement provided it is believed that the criticism will be accepted in good faith.

C - accept the course of action to maintain the rapport between the two pilots.

D - be assertive and prepared to take control of the aeroplane.

Q52 You are the least experienced of two pilots flying the aircraft. You believe that your more experienced colleague has elected to undertake a course of action that may endanger the aircraft. In view of your inexperience you should:

A - only question her/ his judgement if you believe such action will not compromise the working relationship.

B - accept the course of action taken by your more experienced colleague in order to maintain a safe rapport.

C - be assertive and prepared to take control of the aeroplane.

D - always speak up if in doubt.

Q53 A prominent cloud layer sloping across a flight path may result in.

A - flying in a circle.

B - banking the aircraft.

C - the pilot becoming dizzy.

D - disruption of the pilot's selective radial scan.

Q54 A very fast low flying military aircraft and a light aircraft that are on a head on collision course have a very rapid closing speed. In the event of such a scenario, how would the image of the military aircraft be perceived by the pilot of the light aircraft as range decreased?

A - Initially the image would show only a small growth rate until the aircraft were close to impact when the image would enlarge rapidly.

B - Initial growth would be rapid and further growth would be at a steady rate.

C - The image would grow very quickly at a constant rate.

D - Initially it would appear stationary until the last few seconds before impact when it would grow at a uniform rate.

Q55 Assume that an in flight visibility of 5km existed at a time when a very fast low flying military aircraft and a light aircraft were maintaining a head on collision course with a closing speed of approximately 600kt. How much time would either pilot have to take avoiding action if visual contact was made at the maximum possible range?

A - About 10 seconds.

B - About 17 seconds.

C - About 25 seconds.

D - About 35 seconds.

Q56 Assume that an in flight visibility of 3nm existed at a time when a very fast low flying aircraft and a light aircraft were maintaining a head on collision course with a closing speed of approximately 400kt. How much time would either pilot have in order to take avoiding action if visual contact was made at the maximum possible range?

A - About 20 seconds.

B - About 27 seconds.

C - About 32 seconds.

D - About 39 seconds.

Q57 Assume an in flight visibility of 5nm existed when two aircraft were closing head-on with ground speeds of 120kt and 380kt respectively. How much time would either pilot have had to take avoiding action, if visual contact was made at the maximum possible range?

A - 20 - 30 seconds.

B - 40 - 50 seconds.

C - 50 - 60 seconds.

D - 30 - 40 seconds.

Q58 What part of the eye is light sensitive?

A - Iris.

B - retina.

C - pupil.

D - Comea.

Q59 Under normal conditions, what period of time is required to adapt full to night vision?

A - 30 to 40 minutes

B - 20 to 30 minutes

C - 10 to 20 minutes

D - about 5 minutes

Q60 When maintaining a lookout, pilots should understand that the most effective scanning method is:

A - a series of short regularly spaced eye movements, progressing across the field of view.

B - to slowly and smoothly sweep the entire field of view from top to bottom.

C - a selective concentration on the most likely areas of conflicting traffic.

D - not to concentrate on any one particular area for a short period of time.

Q61 What is the function of the eustachian tube?

A - It allows the middle ear to drain freely.

B - It connects the inner ear to the semicircular canals, allowing the inner ear to equalise with ambient pressure.

C - It allows the middle ear to equalise with ambient pressure.

D - It allows the sinus to block unequal pressure in the inner ear and prevent discomfort.

Q62 Visual acuity is the capacity of the eye to determine small detail which is essential for the early detection of distant oncoming aircraft. The sharpest visual acuity occurs when the retinal image is sharply focused on the .....(i)..... so that the pilot .....(ii).... to look exactly in the direction of the oncoming aircraft in order to detect it.

	(i)	(ii)
A -	fovea	does need
B -	optic nerve	does need
C -	iris	does not need
D -	fovea	does not need

Q63 When looking at an object at night after allowing sufficient time for night vision to develop, maximum visual acuity is achieved by looking:

A - directly at the object.

B - at least 45° to the side of the object.

C - slightly to the side of the object.

D - at least 30° to the left side of the object if the right eye is the master eye and to the right if the left is the master eye.

Q64 You are maintaining course and speed and there is another aircraft at the same altitude also maintaining course and speed but on a collision course with you which may be head on or to one side. This results in a constant relative bearing being maintained with the other aircraft, and no apparent movement of that aircraft in your windscreen. Compared with other aircraft that are not on a collision course with you, the total lack of relative movement of the conflicting aircraft makes:

A - its detection the same as any other aircraft within the same field of vision.

B - it easier to detect.

C - it undetectable as there is no relative movement in the windscreen.

D - it more difficult to detect.

Q65 When adjusting their seat, pilots should attempt to establish a comfortable position that facilitates full control movement, together with a balance between a full instrument scan and outside visibility. This desired position should be:

A - used for all phases of the flight.

B - used particularly for take-off and landing when physical handling is at its greatest and forward visibility often at a premium.

C - adopted during the cruise when instrument flying may be a possibility.

D - adjusted only to allow for changes in aeroplane trim.

Q66 A pilot operating at an altitude above cloud with an empty visual field should be aware that the eyes:

A - will tend to focus at a point one to two metres away.

B - will naturally focus at the ideal point to detect other aircraft.

C - will tend to focus on infinity.

D - will tend not to focus on anything thus rendering any visual scan unreliable.

Q67 Most light aircraft do not have a 'Design Eye Position' that allows a consecutive adequate view of both the outside world and all cockpit displays. If the handling pilot's cockpit seat adjustment is too low, during an approach:

A - the pilot will not suffer any disadvantage.

B - the view ahead of the aircraft will be much greater.

C - the view of the approach path and runway will be improved due to the reduced pitch attitude.

D - part of the approach area under the nose of the aircraft will be lost from view.

Q68 What is the human auditory range?

A - 1hz to 5,000Hz

B - 5Hz to 10,000Hz

C - 10Hz to 15K,000Hz

D - 20Hz to 20,000Hz

Q69 The immediate result of adrenaline being released into the bloodstream when the body is initially subjected to stress is:

A - a decrease in the pulse rate.

B - a reduced rate of breathing.

C - stabilisation of the breathing rate.

D - an increased pulse rate.

Q70 Gastroenteritis is a complaint that makes a pilot:

A - fit to fly with medication.

B - fit to fly.

C - unfit to fly.

D - only fit to fly with the prior permission of a CAA medical examiner.

Q71 Flight crew of ..... should not fly whilst suffering from a cold or flu. Select the phrase that correctly completes this statement.

A - pressurised aircraft.

B - any aircraft.

C - unpressurised aircraft.

D - open cockpit aircraft, open hot air balloon or airship.

Q72 The three needle type altimeter as employed in many light aircraft is generally both reliable and accurate. It should also be understood that it can:

A - never be misread.

B - easily be misread.

C - only ever be misread by novices.

D - only ever be misread if inadvertently caged during aerobatic manoeuvres.

Q73 Co-located controls within a cockpit that operate different systems should be designed to:

A - both look and feel different.

B - look the same but feel different.

C - both look and feel identical.

D - feel identical but look different

Q74 Proprietory branded medication available without prescription:

A - can produce minor side effects which are not detrimental to pilot performance.

B - should only be taken by an active pilot if s/ he is aware of any secondary effects.

C - can cause mild analgesia which is not detrimental to pilot performance.

D - should only be self administered after seeking the advice of an authorised CAA medical examiner.

Q75 A runway that is narrower than previously expected may result in:

A - a high approach path being flown and overshooting the runway stop end.

B - a high approach path being flown and undershooting the runway threshold.

C - a normal approach path being flown as any pilot will set up a visual approach relative to the actual runway.

D - Initially a high approach path then a low approach with the possibility of undershooting the runway threshold.

Q76 A runway that is unusually wider than previously expected may result in:

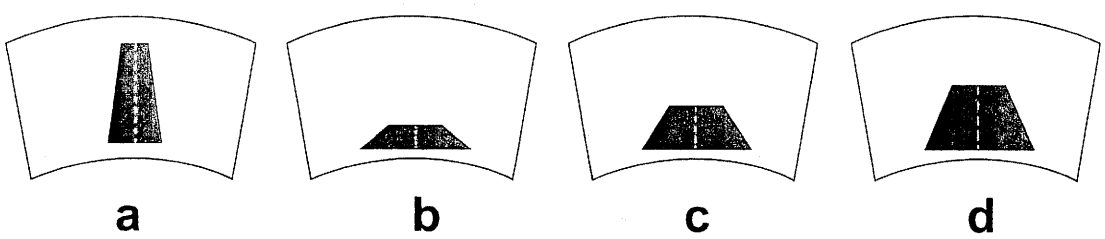
A - a high approach path being flown and overshooting the runway threshold.

B - a high approach path being flown and undershooting the runway threshold.

C - a normal approach path being flown as any pilot will set up a visual approach relative to the actual runway.

D - a low approach path being flown and undershooting the runway threshold.

Q77 The cockpit perspective of a down sloping runway is represented by illustration:



A - a

B - b

C - c

D - d

HUMAN PERFORMANCE AND LIMITATIONS
PRACTICE ANSWER SHEET

	A	B	C	D
1				
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	A	B	C	D
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77				

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HUMAN PERFORMANCE AND LIMITATIONS
ANSWERS

	A	B	C	D
1		X		
2	X			
3			X	
4			X	
5				X
6	X			
7			X	
8			X	
9		X		
10		X		
11	X			
12			X	
13	X			
14				X
15				X
16	X			
17			X	
18	X			
19				X
20				X
21		X		
22		X		
23			X	
24			X	
25	X			

	A	B	C	D
26				X
27		X		
28			X	
29			X	
30				X
31				X
32	X			
33		X		
34		X		
35			X	
36				X
37			X	
38			X	
39		X		
40				X
41		X		
42				X
43		X		
44			X	
45	X			
46	X			
47		X		
48			X	
49				X
50		X		

	A	B	C	D
51	X			
52				X
53		X		
54	X			
55		X		
56		X		
57				X
58		X		
59	X			
60	X			
61			X	
62	X			
63			X	
64				X
65	X			
66	X			
67				X
68				X
69				X
70			X	
71		X		
72		X		
73	X			
74				X
75				X

	A	B	C	D
76	X			
77		X		

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HUMAN PERFORMANCE AND LIMITATIONS EXPLANATIONS

EHP1(B)

Hypoxia is the condition caused by insufficient oxygen to meet the needs of the body. The transfer of oxygen from the lungs to the red blood cells depends upon a pressure gradient resulting from the partial pressure of oxygen in the atmosphere which decreases with ascent. However, the partial pressure of oxygen remains sufficient to prevent the onset of hypoxia in healthy pilots when operating for periods of time up to 10,000ft. The effects of hypoxia are accelerated with exposure to lower partial oxygen pressures that exist at higher altitudes.

The brain is affected first, being the most sensitive to oxygen deficiency which will impair the mental process.

It must be emphasised that 10,000ft is a maximum altitude at which flight should not be prolonged.

EHP2(A)

Although the atmosphere thins with increased altitude, the proportions of constituent gases that make up the atmosphere remain constant.

EHP3(C)

See EHP5.

EHP4(C)

The brain is the most sensitive organ to oxygen deficiency with the first symptoms manifested as impairment of cognitive processes. This is commonly followed by loss of inhibitions together with changes in personality that lead to either euphoria or aggression.

EHP5(D)

The chemical receptors in the brain that govern the respiratory process are more sensitive to changes of carbon dioxide. The body has only a very small store of oxygen compared to carbon dioxide and it is the level of carbon dioxide that triggers either an increase or decrease in the rate of respiration.

EHP6(A)

That part of atmospheric pressure due to the presence of oxygen is known as the partial pressure of oxygen. When atmospheric pressure falls, the partial pressure of oxygen must also fall proportionately, decreasing the amount of oxygen transferred from the lungs to the bloodstream. See EHP1.

EHP7(C)

Hypoxia. See EHP1.

EHP8(C)

The time of useful consciousness may be described as the time available to a pilot to perform useful tasks without the use of supplementary oxygen up to a point, depending upon the individual, after hypoxia has set in.

Hypoxia is a condition that occurs when there is insufficient oxygen delivered to body tissues to meet their needs, the brain tissues being the most susceptible. For pilots and increased altitude, the onset of hypoxia will occur as ambient pressure decreases, particularly above 10,000ft but some pilots, particularly smokers may experience hypoxia below this altitude. Although the symptoms are progressive as ambient pressure decreases, due to brain tissue susceptibility to oxygen deficiency, loss of inhibitions together with difficulty in completing mental tasks are the first symptomatic manifestations. Hence, the time of useful consciousness will cease at some point after hypoxia has set in.

EHP9(B)

Haemoglobin is the protein that gives red blood cells their characteristic colour and combines with oxygen, transporting it to the body tissue. Haemoglobin has a greater affinity with carbon monoxide (produced by smoking) than oxygen. Carbon monoxide in the blood-stream will reduce the amount of oxygen transported to body tissue, accelerating the onset of hypoxia causing its symptoms to develop at lower altitudes.

EHP10(B)

Lower altitudes. See EHP9 and EHP12.

EHP11(A)

Carbon monoxide is a product of cigarette smoke. Light aircraft cabin heaters are normally a heat exchanger that shrouds the engine exhaust system or a combustion heater fuelled by the engine fuel system. The combustion heater also employs a heat exchanger that ducts air from outside the aircraft around the outside of the heater combustion chamber forming a heat exchanger. Should a leak occur in either type of heat exchanger, carbon monoxide will mix with the fresh heated air and enter the cockpit or cabin. The problem with detecting carbon monoxide is that it is both colourless and odourless.

EHP12(C)

Carbon monoxide (CO), which combines with haemoglobin to form Carboxy Haemoglobin, has a half life of about six hours at sea level pressures and a quarter life after twelve hours and so on. This may be reduced by breathing greater concentrations of oxygen. Problems arising from CO poisoning are the delayed effects such as visual loss, spatial disorientation, psychosis, and dementia. Should a pilot go to altitude soon after inhalation of substantial quantities of CO, the reduced partial pressure of oxygen would seriously delay recovery and possibly accelerate the onset of normally delayed effects.

EHP13(A)

See EHP5, EHP9.

EHP14(D)

Carbon monoxide. See EHP9.

EHP15(D)

The following are symptoms of hyperventilation:

- Visual disturbance such as tunnel vision or clouding.
- Tingling sensation especially around the lips and in the hands and feet.
- Sensation of alternately feeling hot or cold.
- A dramatically impaired pilot performance.
- Anxiety.
- Dizziness.

EHP16(A)

See EHP15.

EHP17(C)

Motion sickness may cause nausea, vomiting and lead to hyperventilation.

With temperatures above 30°C, the pulse rate, blood pressure and sweat rate all increase, which may lead to hyperventilation.

Vibration frequencies in the order of 1 - 4 Hz can disrupt breathing patterns leading to hyperventilation.

EHP18(A)

All pilots should be aware of hyperventilation because of its debilitating effects leading to severe impairment of the ability to function both physically and mentally. See EHP15, 17 and 19.

EHP19(D)

See EHP5.

Hyperventilation means breathing too deeply or too fast or both.

There are two different varieties of hyperventilation syndrome. The obvious one is 'acute hyperventilation' which is where a person is breathing very fast (tachypnea).

The symptoms of hyperventilation are:

* Lightheadedness and feeling dizzy.
* A feeling of suffocation
* Squeezing chest pain
* Pounding, racing heartbeat
* Numbness or tingling in the hands and feet or around the mouth
* A red rash of tiny red spots called petechiae
* In severe cases unconsciousness

Hyperventilation is essentially a psychological problem as there is often a component of anxiety or stress but the symptoms are real. Over breathing removes carbon dioxide (CO_2) too rapidly from the blood and alters the balance of blood gases. This causes alkalosis (High pH--opposite of acidic). Alkalosis, in turn, causes increased binding of oxygen to haemoglobin (blood), reducing the amount of oxygen released to the body. The brain may receive as little as 60% of the normal amount of oxygen due to hyperventilation contributing to the multitude of symptoms that can occur.

First aid treatment.

* As the condition is psychological, calming the victim will help reduce the symptoms.
* Breathing into a paper bag (sometimes for several minutes) increases the carbon dioxide levels, thus returning the blood to a normal pH and restoring a balanced oxygen supply to the tissues.

EHP20(D)

1 to 6 are all symptoms of hypoxia.

With regard to 7, hypoxia can produce similar effects to alcohol consumption leading to a sensation of physical and mental well-being, even euphoria.

EHP21(B)

See EHP1 and EHP19.

Abnormal breathing is a symptom common to both hypoxia and hyperventilation. As hypoxia is rare below 10,000ft, a person breathing abnormally is probably hyperventilating.

EHP22(B)

The central nervous system refers to the brain and spinal cord. These serve as the main "processing centre" for the whole nervous system, and thus control all workings of the body. However, the central nervous system does not include the peripheral nerves in the arms, legs, muscles, and organs.

The peripheral nervous system is part of the nervous system, and consists of the nerves and neurons that reside or extend outside the central nervous system, its function for example is to serve the limbs and organs. Unlike the central nervous system, the peripheral nervous system is not protected by bone or the blood-brain barrier, leaving it exposed to toxins and mechanical injuries. The peripheral nervous system is divided into the somatic nervous system and the autonomic nervous system.

The autonomic nervous system (elemental to the peripheral nervous system) is a regulatory structure that assists humans in adapting to changes in their personal environment and adjusts or modifies some functions in response to stress. By acting through a balance of its two sub components, namely the sympathetic nervous system and parasympathetic nervous system, the automatic nervous system also helps regulate:

* blood vessel size and blood pressure.
* the heart's electrical activity and ability to contract.
* diameter of the bronchium and consequently air flow in and out of the lungs.
* movement and work of the stomach.
* intestine and salivary glands.
* secretion of insulin and the urinary and sexual functions.

EHP23(C)

On average, the human body has about 5 litres of blood continually travelling through it by way of the circulatory system. The heart, the lungs, and the blood vessels work together to form the circle part of the circulatory system with the heart pumping the blood around the body.

The circulatory system really has three distinct parts: pulmonary circulation (the lungs), coronary circulation (the heart), and systemic circulation (the rest of the body). Each part must work independently in order for the three systems to work together.

EHP24(C)

The body is normally saturated with nitrogen and when scuba diving, is subjected to increased pressure. A rapid ascent and sudden pressure decrease will cause soluble nitrogen in the body to come out of solution as bubbles, forming in the muscles and joints as the environmental pressure decreases. This is known as 'decompression sickness' or 'bends', the severity of which will depend upon the depth and duration of the dive together with the rate of ascent.

Depending upon the duration, even with shallow dives when decompression sickness is not normally a consideration, some nitrogen will remain in solution requiring time to dissipate as the body adjusts to normal atmospheric pressure.

Should a pilot attempt to fly within 12 hours of scuba diving, even at cabin altitudes as low as 6000ft, decompression sickness or bends may result due to decreased environmental pressure. This should be extended to at least 24 hours if a depth of 30ft was exceeded during the dive.

EHP25(A)

24 hours. See EHP24.

EHP26(D)

Nitrogen. See EHP24.

EHP27(B)

Nitrogen. See EHP24.

EHP28(C)

The liver will take approximately one hour to eliminate one unit of alcohol from the blood.

EHP29(C)

See EHP28.

EHP30(D)

Men 21 units per week.

Women 14 units per week.

EHP31(D)

The reduction of blood volume due to donation can, in a few people, lead to feeling faint. The CAA advise that aircrew should not donate blood or plasma if they are required to fly within the following 24 hours.

EHP32(A)

The affect of alcohol is similar to that of hypoxia in that it reduces tolerance to the effects of altitude. See EHP1, hypoxia.

EHP33(B)

The pilot should trust and concentrate on the attitude and performance instruments. See EHP 38.

The illusion of tumbling backwards after a rapid change from a climb to straight and level flight is caused by aircraft acceleration. The otoliths that form part of the vestibular apparatus of the inner ear detect and interpret linear acceleration as tumbling backwards or the aircraft pitching nose up. This would conflict with visual perception causing spatial disorientation. Visual information derived from the aircraft instruments must under such circumstances be relied upon.

EHP34(B)

See EHP37.

EHP35(C)

Motion sickness can be caused by a mismatch between vestibular and visual information sent to the brain and is a primary contribution to the onset of motion sickness.

EHP36(D)

Situational awareness is maintaining an accurate mental model of the working environment which requires all possible data to be gathered, whilst updating the situation regularly and planning ahead. See EHP37.

EHP37(C)

For a pilot, situation awareness is an accurate mental model of her/ his environment.

Individual situation awareness has been defined in a number of ways. Three such definitions are:

a - Situation awareness is the perception of the elements that make up an environment within a period of time and space, the comprehension of their meaning and the projection of how those meanings might affect the environment in the near future.

b - Situation awareness refers to an up to the minute comprehension required to operate or maintain a system.

c - Situation awareness is an appropriate awareness of a situation.

Situation assessment may be defined as the process of acquisition and interpretation of information that leads to situation awareness. It is an ongoing process of observation and analysis of information required to maintain an accurate mental model.

As such, if an aircraft is where the pilot thinks the aircraft is then the pilot is situationally aware.

EHP38(C)

See fig H1

Forward acceleration sensed by the otoliths in the inner ear is perceived as the weight of the body (which normally acts vertically downward) acting rearward and downward, producing the somatogravic illusion of pitching up. This will conflict with visual perception causing spatial disorientation during which **the pilot should believe the real horizon or trust and concentrate on the attitude and performance instruments.**

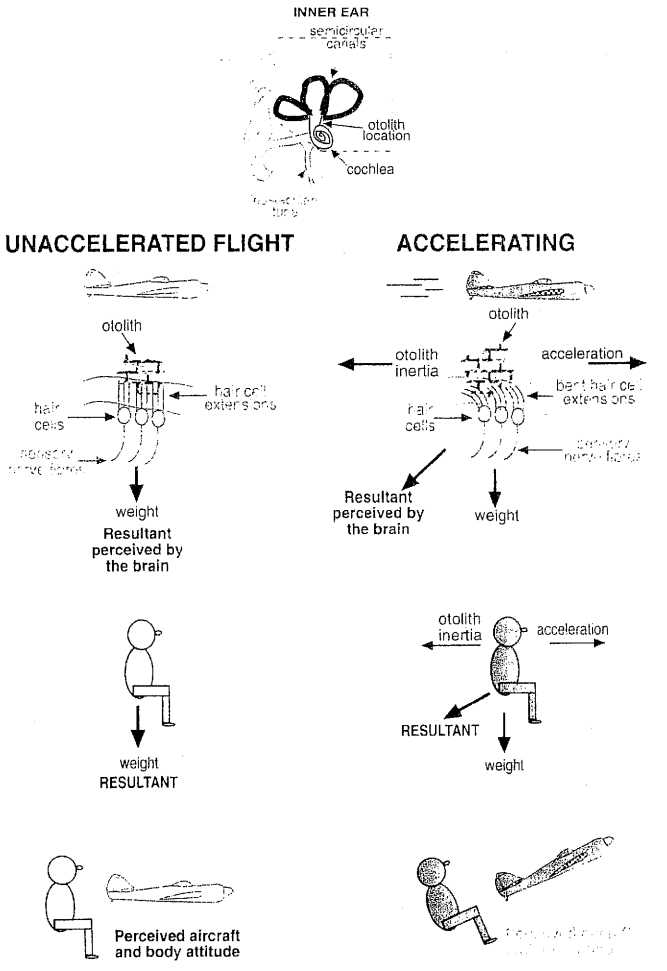

fig H1

EHP39(B)

The pilot should trust and concentrate on the attitude and performance instruments. See EHP38.

The illusion of tumbling forwards after a rapid change from a dive to straight and level flight is caused by aircraft deceleration. The otoliths that form part of the vestibular apparatus of the inner ear detect and interpret linear deceleration as tumbling forward or the aircraft pitching nose down. This would conflict with visual perception causing spatial disorientation. Visual information derived from the aircraft instruments must under such circumstances be relied upon.

This scenario is the antithesis of question 38 and the explanation given in EHP38.

EHP40(D)

See EHP38.

EHP41(B)

Eyesight is the most dependable source of sensory information.

EHP42(D)

See EHP33 to EHP38.

EHP43(B)

Approaching any object or a runway believed to be smaller than it actually is, may appear to be nearer than it actually is. The problem with a runway under such circumstances is descending too early with the possibly of a very low final approach.

EHP44(C)

Any object or runway that is smaller than previously believed, will appear to be farther away than it actually is.

EHP45(A)

An approach to a runway that is brightly illuminated in isolation of its surroundings will create the illusion of the aeroplane being higher than it actually is. This may result in the pilot descending too early and flying a dangerously low final approach. A solution would be to maintain the correct rate of descent and airspeed for the approach while maintaining the touch down point at a constant position in the windscreen.

EHP46(A)

During a visual approach to an unfamiliar down-sloping runway, in order to establish and maintain the correct visual perspective of the runway when flying a 3° approach path, the pilot may initiate the approach from a greater height and fly the approach at a steeper angle. See fig H2

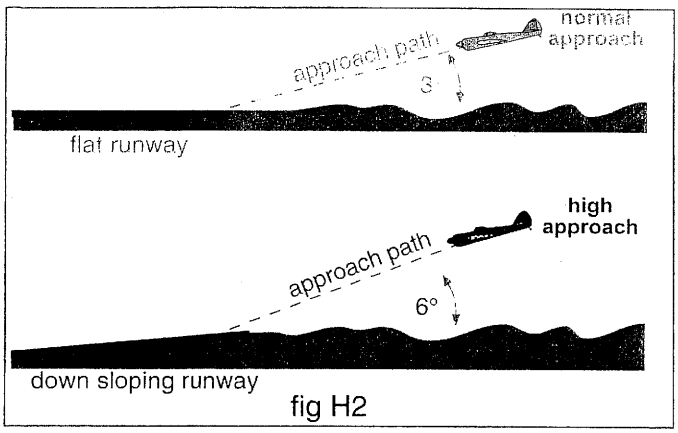

fig H2

However, even when the 3° approach angle to the runway aiming point is flown correctly, should the runway be preceded by flat terrain, a visual illusion of a steep approach path could occur as the preceding flat foreground will provide a dominant visual cue to the approach path angle than the more distant runway. If believed, the pilot may respond by flying a too shallow final approach which may result in an undershoot and serious accident.

EHP47(B)

During a visual approach to an unfamiliar up-sloping runway, in order to establish and maintain the correct visual perspective of the runway when flying a 3° approach path, the pilot may initiate the approach from a lower height and fly the approach at a more shallow angle. See fig H3

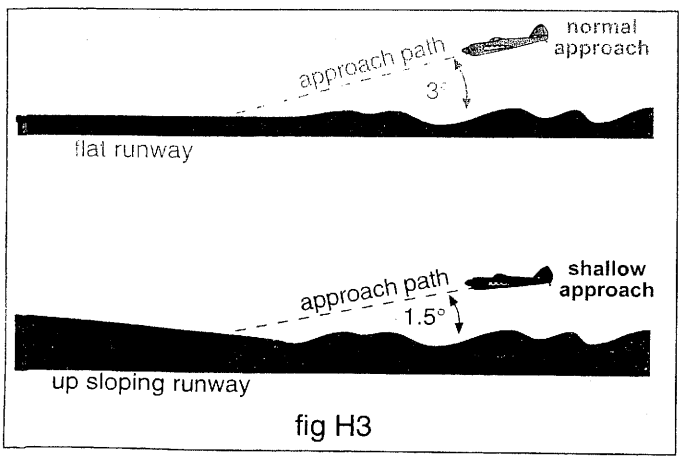

fig H3

However, even when the 3° approach angle to the runway aiming point is flown correctly, should the runway be preceded by flat terrain, a visual illusion of a shallow approach path could occur as the preceding flat foreground will provide a dominant visual cue to the approach path angle than the more distant runway. If believed, the pilot may respond by pitching the aircraft nose up to increase altitude and correct the approach path which may result in a low-altitude stall or a missed approach.

EHP48(C)

Haze is the result atmospheric impurities being held in suspension in descending air. The effect of the impurities is to refract light, diminishing the resolution of objects within visual range, creating the illusion that they are further away than they actually are.

EHP49(D)

Greater experience invites the connotation of superior knowledge and greater ability which can intimidate any inexperienced person in a working environment. At any level of experience human beings are fallible, being prone to misinterpretation and incorrect decision making which, in the case of a pilot, could be dangerous.

Any pilot, irrespective of status or experience should immediately express any doubts by questioning the actions of a more experienced colleague considered to be inappropriate or dangerous.

EHP50(B)

The stroboscopic effect of flickering lights such as that caused by the shadow effect of helicopter rotor blades wind milling in bright sunshine can, to those susceptible cause discomfort, even epileptic fits.

A solution would be to cover the windows through which the stroboscopic effect is visible, or wear sun glasses or close the eyes.

EHP51(A)

See EHP49.

EHP52(D)

See EHP49.

EHP53(B)

A prominent sloping cloud cloud layer lying across an aircraft's flight path may partially or completely obscure the natural horizon creating an illusion that the aircraft is flying with an angle of bank. If believed, the tendency will be for the pilot to accept the cloud as the natural horizon and actually fly the aircraft banked and with crossed controls (opposite rudder) to maintain heading.

EHP54(A)

See fig H4

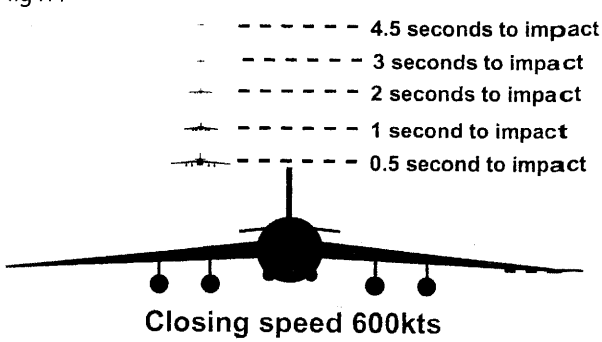

fig H4

The perspective of an aircraft approaching head on at high speed is that it will remain very small growing only slowly in size until it is very close. When close, it will appear to grow in size very rapidly.

EHP55(B)

This requires a simple distance/ speed calculation where the 5 kilometres visibility must first be converted to nautical miles, or the speed from knots to kilometres/ hour, both of which can be achieved using your CRP circular slide rule. 5km = 2.7nm

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{2.7\cancel{\text{nm}}}{1} \times \frac{1\text{hr}}{600\cancel{\text{nm}}} \times \frac{60\cancel{\text{min}}}{1\cancel{\text{hr}}} \times \frac{60\text{ seconds}}{1\cancel{\text{min}}} = 16.2\text{ seconds}$$

600kt = 1110km/hr

$$\text{TIme} \quad \frac{\text{distance}}{\text{speed}} \times \frac{5\cancel{\text{km}}}{1} \times \frac{1\cancel{\text{hr}}}{1110\cancel{\text{km}}} \times \frac{60\cancel{\text{min}}}{1\cancel{\text{hr}}} \times \frac{60\text{ seconds}}{1\cancel{\text{min}}} = 16.2\text{ seconds}$$

Nearest answer = 17 seconds

EHP56(B)

See EHP55

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{3\cancel{\text{nm}}}{1} \times \frac{1\cancel{\text{hr}}}{400\cancel{\text{nm}}} \times \frac{60\cancel{\text{min}}}{1\cancel{\text{hr}}} \times \frac{60\text{ seconds}}{1\cancel{\text{min}}} = 27.0\text{ seconds}$$

Answer = 27 seconds.

EHP57(D)

See EHP55

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{5\cancel{\text{nm}}}{1} \times \frac{1\cancel{\text{hr}}}{500\cancel{\text{nm}}} \times \frac{60\cancel{\text{min}}}{1\cancel{\text{hr}}} \times \frac{60\text{ seconds}}{1\cancel{\text{min}}} = 36\text{ seconds}$$

Nearest answer = 30 – 40 seconds.

EHP58(B)

Retina. See fig H5

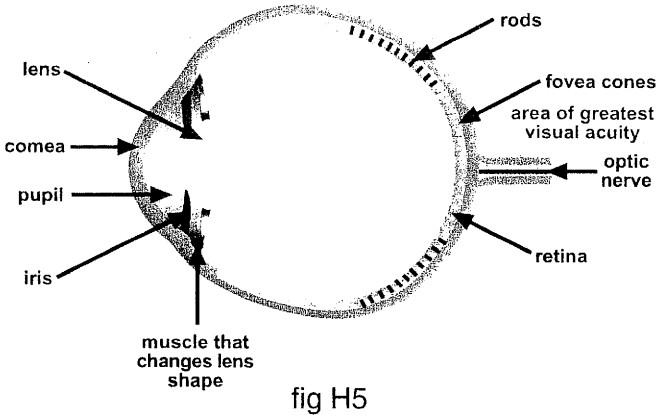

fig H5

The greatest visual acuity is achieved by light sensitive cones in the fovea which itself forms the central part of the retina on which visual images are focused. Because of the central position of the fovea, a pilot must look directly at a distant oncoming aircraft to provide the best opportunity of its early detection.

Rods form that part of the retina outside of the central fovea and are sensitive to lower levels of light than cones. Rods therefore are significant to night vision and because of their peripheral location in the retina, maximum visual acuity is achieved by looking slightly to one side of an object.

EHP59(A)

Night Vision Adaptation

Dark adaptation is the process by which the eyes adapt for optimal night visual acuity under conditions of low ambient illumination. The eyes require about 30 to 40 minutes to fully adapt to minimal lighting conditions. The lower the starting level of illumination, the more rapidly complete dark adaptation is achieved.

To minimise the time necessary to achieve complete dark adaptation and to maintain it, you should:

a - avoid inhaling carbon monoxide from smoking or exhaust fumes.

b - get enough Vitamin A in your diet.

c - adjust instrument and cockpit lighting to the lowest level possible.

d - avoid prolonged exposure to bright lights.

e - use supplemental oxygen when flying at night above 5,000 ft (MSL).

If dark, should adapted eyes be exposed to a bright light source (searchlights, landing lights, flares, etc.) for a period in excess of 1 second, night vision is temporarily impaired. Exposure to aircraft anti-collision lights does not impair night vision adaptation.

EHP60(A)

The most effective lookout is achieved by scanning with short regularly spaced head movements with the eyes stationary because the visual world is sampled when the eye is at rest. By minimising the length of time that the head is at rest, the field of vision scanned in relation to time is maximised.

EHP61(C)

The eustachian tube connects the middle ear with the nose and throat where its soft walls at the nasal end act as a flap. During ascent, this allows expanding gas in the middle ear to equalise with reducing atmospheric pressure.

Note: With an atmospheric pressure increase experienced during a descent, the flap can prevent atmospheric pressure equalising with the middle ear, causing the ear drum to distort creating pain known as barotrauma.

EHP62(A)

See EHP58 and fig H5

The greatest visual acuity in daylight is achieved by cones in the fovea, which itself forms the central part of the retina on which visual images are focused. Because of the central position of the fovea, a pilot must look directly at a distant oncoming aircraft to provide the best opportunity of its early detection.

EHP63(C)

Rods form that part of the retina outside of the central fovea and are sensitive to lower levels of light than cones. Rods therefore are significant to night vision. Because of their peripheral location in the retina, maximum visual acuity is achieved by looking slightly to one side of an object. See EHP58 and fig H5.

EHP64(D)

Compared to aircraft within the pilot's field of vision that are not maintaining a constant relative bearing and are seen to move across the windshield, an aircraft that has no relative movement across the pilot's windshield will be more difficult to spot because it will not provide a movement cue to assist its detection.

EHP65(A)

The desired seating position, once established, should be used for all phases of the flight.

EHP66(A)

With an empty field of vision, the eyes will tend to focus at very short distances , normally one or two metres ahead.

EHP67(D)

If the seat is too low, the eye level will be too low and part of the approach area ahead and below will be obscured by the aircraft nose.

EHP68(D)

SOUND

The term sound is used to describe the mechanical radiant energy that is transmitted by longitudinal pressure waves in any medium (solid, liquid, or gas). Sound waves are variations in air pressures both above and below the ambient pressure. From a more practical point of view, this term describes the sensation perceived by the sense of hearing. All sounds have three distinctive variables:

a - Frequency,

b - Intensity

c - Duration.

Frequency. This is the physical property of sound that gives it a pitch. Since sound energy propagates in a wave-form, it can be measured in terms of wave oscillations or wave cycles per second, known as hertz (Hz). Sounds that are audible to the human ear fall in the frequency range of about **20-20,000 Hz**, and the highest sensitivity is between 500 and 4,000 Hz. Sounds below 20 Hz and above 20,000 Hz cannot be perceived by the human ear. Normal conversation takes place in the frequency range from 500 to 3,000 Hz.

Intensity - the correlation between sound intensity and loudness. The decibel (dB) is the unit used to measure sound intensity. The range of normal hearing sensitivity of the human ear is between -10 to +25 dB. Sounds below -10dB are generally imperceptible. A pilot who cannot hear a sound unless its intensity is higher than 25 dB (at any frequency) is already experiencing hearing loss.

Duration. Determines the quality of the perception and discrimination of a sound, as well as the potential risk of hearing impairment when exposed to high intensity sounds. The adverse consequences of a short-duration exposure to a loud sound can be as bad as a long-duration exposure to a less intense sound. Therefore, the potential for causing hearing damage is determined not only by the duration of a sound but also by its intensity.

EHP69(D)

Adrenaline is a chemical released by the adrenal gland in response to signals from the sympathetic division of the autonomic nervous system. Such signals are triggered by stress, exercise or an emotion such as fear. Adrenaline increases both the speed and force of the heart beat and consequently the work that can be done by the heart.

EHP70(C)

Gastroenteritis is an inflammation of the stomach and intestines often causing sudden and violent upsets resulting in diarrhoea and sometimes vomiting. A pilot suffering from gastroenteritis will be unfit to fly even with medication as the symptoms can be extremely debilitating.

EHP71(B)

A cold or flu will cause the soft tissue around the sinuses (located below the eyes in the cheeks and at the back of the nose) together with the wall of the eustachian tube to expand. This will obstruct the inward passage of air during a descent, greatly increasing the probability of barotrauma. See EHP61.

A pressurised aircraft will, during a descent, create just as effectively the environmental conditions that cause barotrauma so the crew of any aircraft should not fly whilst suffering the symptoms of a cold or flu.

EHP72(B)

A three-pointer altimeter takes about three times longer to read than a digital altimeter. Although it is very accurate, pilots should be aware that a **three-pointer altimeter can easily be misread.**

EHP73(A)

The identification of a control is both visual and tactile. As an aid to preventing incorrect control selection, co-located controls should be designed to both look and feel different.

EHP74(D)

Pilots are advised not to take any medicines before or during flight unless they are completely familiar with their effects on their body. If any doubt exists at all, a doctor with experience of aviation medicine should be consulted.

AIC 58/2000 (pink 4)

EHP75(D)

See fig H6

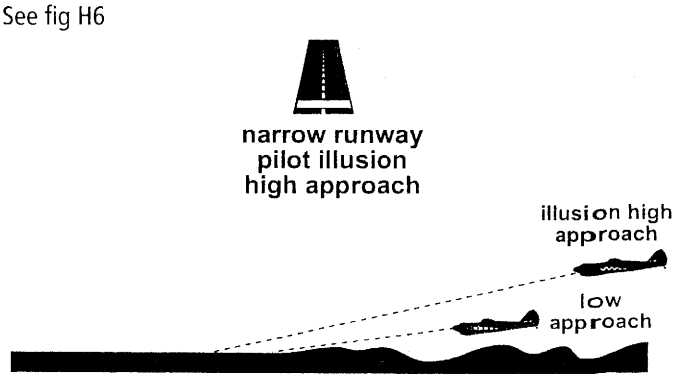

fig H6

A final approach to an unusually narrow runway or an unusually long runway may initially produce the visual illusion of being too low resulting in a high-altitude final approach. Latterly, a pilot may attempt to correct the approach by pitching the aircraft nose down to decrease altitude which, if performed too close to the ground, may result in an undershoot and serious accident .

EHP76(A)

See fig H7

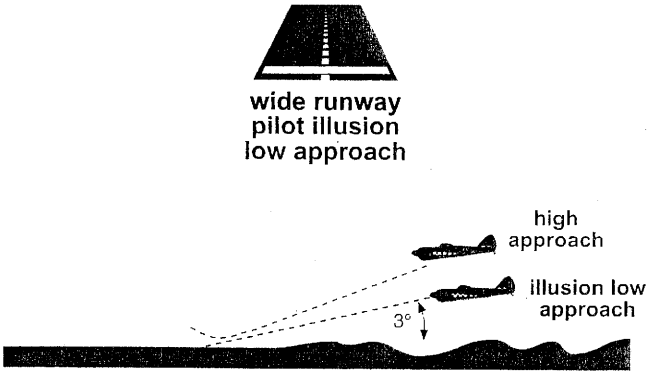

fig H7

A final approach to a runway that is unusually wider than expected may produce the visual illusion of a low-altitude final approach. If the illusion is believed, the pilot may respond by pitching the aircraft nose up to increase the altitude, which may result in a low altitude stall or overshooting the touch down point and a missed approach.

EHP77(B)

See fig H8 '**b**' and EHP46.

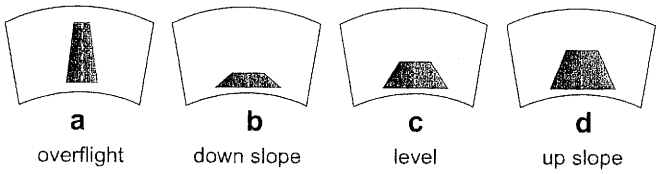

fig H8

Perspective '**b**' would be typical of a down sloping runway. '**a**' would be overflying a runway, '**c**' would be a level runway and '**d**' would be an upsloping runway.

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