Pearson BTEC Level 2 Diploma in Aerospace and Aviation Engineering (Foundation Knowledge)

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Sample Assessment Materials

Unit 3: Principles of Aerodynamics and the Theory of Flight

Version 1.0

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Sample Assessment Materials

Unit 3: Principles of Aerodynamics and the Theory of Flight

Information for candidates

INSTRUCTIONS

- Read each question carefully before you start to answer it.
- Answer all questions
- You can use rough paper to make notes and calculations. This will not be marked but must be handed in at the end of the test.

INFORMATION

- Time allowed 60 minutes.
- There are 40 questions in this test.
- The total number of marks is 40.
- The marks for each question are shown in brackets e.g. (2).
- An accessibility panel is available on every screen. This allows you to magnify your screen and apply a range of colour filters.
- You may use a non-programable calculator.

ADVICE

- Check your answers if you have time at the end.

Start Test

Which of these aerofoil designs will produce streamlined airflow? **(1)**

Select **one** option.

- Shaped to reduce the amount of drag
- Shaped to increase the amount of turbulence
- Shaped to reduce the amount of lift
- Shaped to increase the resistance to motion

Which of these airflows has a separation point? **(1)**

Select **one** option.

- [ ] Laminar
- [ ] Turbulent
- [ ] Boundary layer
- [ ] Free stream

Which of these characterises the mean camber line? **(1)**

Select **one** option.

- The line drawn joining points at the centre's curvature of the leading and trailing edges
- The line drawn joining the centre of gravity and the centre of pressure
- The line drawn between the chord line and the relative airflow
- The line drawn joining points halfway between the upper and lower curved surfaces

The angle of attack of an aircraft is increased positively.

In which direction will the centre of pressure move until a stall angle is reached? **(1)**

Select **one** option.

- Towards the tailplane
- Towards the nose cone
- Vertically upwards
- Vertically downwards

Which of these is a cause of profile skin friction drag? **(1)**

Select **one** option.

- [ ] Creation of wing tip vortices
- [ ] Differential pressure acting on the aerofoils
- [ ] Shape of the aerofoils
- [ ] Surface roughness of the aerofoils

Which of these will reduce skin friction drag when applied to a smooth metal aerofoil? **(1)**

Select **one** option.

- [ ] Oiling
- [ ] Painting
- [ ] Polishing
- [ ] Sanding

Which of these wing planform design ratios is suitable for a small plane to fly at low subsonic speeds? **(1)**

Select **one** option.

- Very low aerofoil thickness to chord
- Low aerofoil thickness to chord
- Medium aerofoil thickness to chord
- High aerofoil thickness to chord

Which of these wing planforms is suitable for an aircraft to fly at transonic speed? **(1)**

Select **one** option.

- Straight
- Swept
- Tapered
- Elliptical

An aircraft has a 20 m wingspan and a wing area of 16 m^2

Calculate the aspect ratio. **(1)**

Select **one** option.

- 4 : 5
- 5 : 4
- 25 : 1
- 320 : 1

How will a build-up of ice affect an aerofoil of an aircraft in flight? **(1)**

Select **one** option.

- [ ] Lift increases
- [ ] Weight increases
- [ ] Friction drag decreases
- [ ] Induced drag decreases

What are the relationships between lift, weight, thrust and drag for an aircraft flying in straight and level flight? **(1)**

Select **one** option.

- lift = weight
  thrust = drag
- lift = thrust
  weight = drag
- lift > drag
  weight < thrust
- lift < drag
  weight > thrust

What is the effect of streamlining an aerofoil? **(1)**

Select **one** option.

- Increases induced drag
- Increases pressure
- Decreases air velocity
- Decreases compression shockwave

An aircraft travelling at the speed of sound climbs from 20 000 ft to 40 000 ft

What happens to the speed of sound as the plane climbs to 40 000 ft? **(1)**

Select **one** option.

- It stays the same
- It doubles
- It increases
- It decreases

Which of these is a buffet problem that occurs as an aircraft approaches the speed of sound? **(1)**

Select **one** option.

- Control reversal
- Loss of control
- Reduction in drag
- Tailplane veering down

Which of these describes how an aircraft's elevators create stability? **(1)**

Select **one** option.

- They support longitudinal control
- They support lateral control
- They support vertical control
- They support directional control

What controls the yaw of an aircraft in flight? **(1)**

Select **one** option.

- [ ] Wings
- [ ] Slats
- [ ] Rudder
- [ ] Flaps

An aircraft is about to make a banked turn.

What will happen to the loading on the airframe as it begins to bank? **(1)**

Select **one** option.

- It decreases
- It increases
- It is unchanged
- It becomes zero

Which of these is used to calculate the load factor on an aircraft in flight? **(1)**

Select **one** option.

- load ÷ weight
- lift ÷ weight
- weight ÷ lift
- weight ÷ load

Which of these explains the term ‘flight envelope’? **(1)**

Select **one** option.

- The directional stability of an aircraft
- The static combination of airspeed and load factor
- The point where the critical angle of attack is exceeded
- The operational capabilities of an aircraft

Which of these is a flight couple in straight and level flight? **(1)**

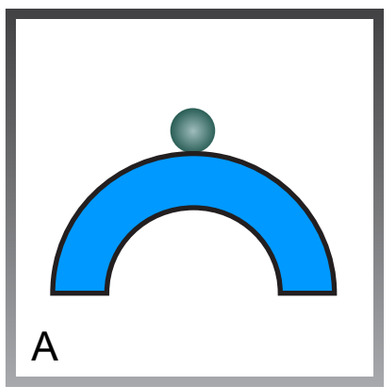
Select **one** option.

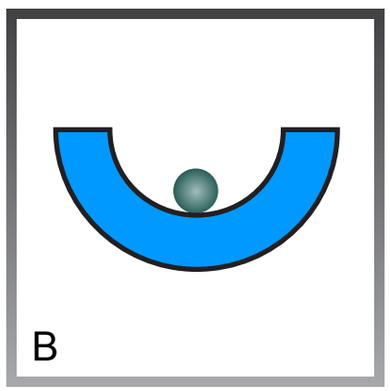
- [ ] thrust / weight
- [ ] velocity / pressure
- [ ] thrust / drag
- [ ] pressure / temperature

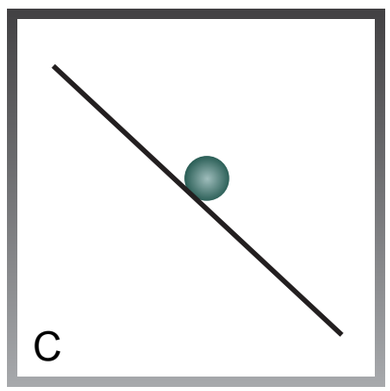
The diagrams show a ball in different states of equilibrium.

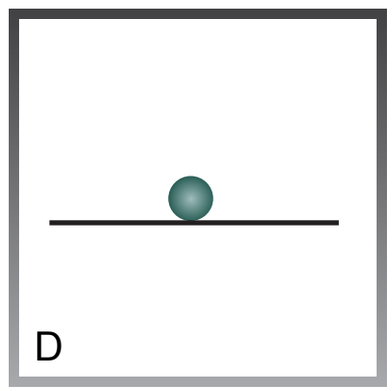
Which of these demonstrates neutrally stable equilibrium? **(1)**

Select **one** option.









Which of these defines an aircraft that exhibits both static and dynamic stability? **(1)**

Select **one** option.

- [ ] The sum of all of the forces and moments acting on it are in equilibrium
- [ ] When disturbed from equilibrium, it continues with small oscillations
- [ ] The sum of all of the forces and moments acting on it are greater than zero
- [ ] When disturbed from equilibrium, it does eventually return to equilibrium

An aircraft is in a correctly banked, steady circular turn.

What is the name of the force acting on the aircraft that maintains the turn? **(1)**

Select **one** option.

- Gravity
- Drag
- Weight
- Centripetal

An aircraft is subject to long-period (40–50 seconds) pitch oscillations.

What is the name of this motion? **(1)**

Select **one** option.

- Phugoid
- Weather cocking
- Dutch roll
- Yawing

How is an aircraft in longitudinal, statically stable flight affected by a nose-up pitching movement? **(1)**

Select **one** option.

- Angle of attack decreases
- Centre of pressure moves forward
- Centre of gravity moves forward
- Angle of incidence decreases

Which of these changes to the flight of an aircraft will cause the tailplane to exert a balancing aerodynamic force? **(1)**

Select **one** option.

- Pitching
- Yawing
- Rolling
- Banking

Which of these describes lateral static stability? **(1)**

Select **one** option.

- Control about the longitudinal axis
- Control about the line through the centre of gravity
- Control about the normal axis
- Control about the chord line

Which of these can be adjusted to enhance the stability of an aircraft? **(1)**

Select **one** option.

- Centre of gravity
- Chord line
- Reference datum
- Centre of pressure

Which of these is a reason for balancing a control surface on an aircraft? **(1)**

Select **one** option.

- To move the centre of pressure
- To control drag
- To move the centre of gravity
- To control flutter

Which of these is a purpose of an aircraft lift augmentation device? **(1)**

Select **one** option.

- Facilitate low-altitude landing
- Reduce take-off distance
- Increase the speed of take off
- Decrease the wing camber

Which of these describes the purpose of aircraft slots? **(1)**

Select **one** option.

- Decrease aircraft drag
- Enable the aircraft to fly at higher speeds
- Reduce the aircraft stall speed
- Increase horizontal stability of the aircraft

Which of these describes how aircraft flaps alter the flow characteristics of an aerofoil? **(1)**

Select **one** option.

- Decrease lift, increase drag
- Decrease angle of descent, decrease drag
- Increase stall speed, decrease drag
- Increase lift, increase drag

Which of these is generated by the production of lift? **(1)**

Select **one** option.

- Induced drag
- Interference drag
- Skin friction drag
- Form drag

Which of these describes the use of rudder limiters? **(1)**

Select **one** option.

- Disables rudder input from the cockpit pedals
- Prevents rudder deflection at high air speeds
- Disables rudder at constant airspeed
- Prevents the pilot from applying excessive rudder force

Which of these are used for counteracting adverse yaw on an aircraft? **(1)**

Select **one** option.

- [ ] Ailerons
- [ ] Slats
- [ ] Tailerons
- [ ] Stabilators

Which of these describes an operation of flaperons on an aircraft? **(1)**

Select **one** option.

- Controls the pitch or lift
- Controls the roll or bank
- Reduces the angle of attack
- Acts as a horizontal stabiliser

Which of these is an advantage of a Fowler flap over a plain flap on an aircraft? **(1)**

Select **one** option.

- Decreases maintenance costs
- Makes plane lighter
- Produces more lift
- Decreases the wing area

Which of these is an advantage of aircraft slats? **(1)**

Select **one** option.

- Coefficient of lift is lowered
- Flight speeds are higher
- Take-off distance is increased
- Stalling angle is increased

Which of these describes an asymmetric flap condition on an aircraft? **(1)**

Select **one** option.

- One flap extends and the other does not
- Both flaps extend by the same amount
- One flap extends while the other retracts
- Both flaps retract by the same amount

What does the use of stall strips give an early indication of? **(1)**

Select **one** option.

- A stall in level flight
- A stall at low angles of attack
- A stall at high angles of attack
- A stall in flight descent