

Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Mark Schemes

Q1.

- (a) (momentum of air) increases ✓
words implying increase 1
- (b) (rate of change of momentum so) force acting on the air (Newton 2) ✓ 1
it/air exerts force (on engine) of the same/equal magnitude/size ✓ 1
 but opposite in direction (Newton 3) ✓ 1
allow backwards and forwards to indicate opposite 1
- (c) (use of $F = \Delta mv/t$)
 $F = 210 \times 570 = 120\,000$ (N) (119 700) ✓ 1
- (d) momentum/velocity is a vector OR momentum/velocity has direction ✓ 1
 there is a change (in the air's) direction ✓ 1
- (e) (use of $F = ma$)
 $a = (-) 190\,000/7.0 \times 10^4 = 2.7$ (2.71) (m s^{-2}) ✓ 1
- (f) (use of $v^2 = u^2 + 2as$)
CE from 01.5
accept range 850 – 860
if forget to square u or double a score 1 mark 1
 $0 = 68^2 - 2 \times 2.7 \times s$ ✓
 $s = 68^2/(2 \times 2.7) = 860$ (m) (856)
accept alternatives using $s = ut + 1/2at^2$ OR average speed – first mark
for time calculation AND correct substitution 1
- (g) rate of intake of air decreases (as plane slows) OR
 volume/mass/amount of air (passing through engine) per second
 decreases ✓
allow argument in terms of (air) resistance
(air) resistance decreases as speed of aircraft decreases for 1 mark 1

(as) smaller rate of change of momentum OR momentum change ✓

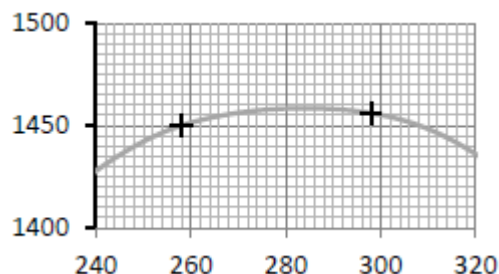
NOT FRICTION

1

[12]

Q2.

- (a) 2 missing points plotted, each to nearest 1 mm (half a grid square); points marked + or × or ⊙; reject thick points, blobs or uncircled dots ✓



1

- (b) continuous smooth best fit line through all 7 points to 1 mm ✓
allow mis-plotted points to be treated as anomalies; multiple lines or points of inflexion lose the mark

1

- (c) candidate's value from Figure 2 $\pm \frac{1}{2}$ grid square ✓
if multiple lines are drawn condone value if $\pm \frac{1}{2}$ grid square of all lines

1

- (d) finding θ_N from Figure 3 is easy since the result is read off where $G = 0$ $_1$ ✓
or
finding θ_N from Figure 2 is difficult since θ has a range of values for which ε is a maximum $_2$ ✓

accept evidence that $G = 0$ used shown on Figure 3; physics error about how Figure 3 used means no credit for any further valid comment about Figure 2

accept 'curve is shallow at peak' for $_2$ ✓

MAX 1

- (e) method:
correctly determines gradient of Figure 3 or uses gradient result with any point on line to determine (vertical) intercept $_1$ ✓

result in range 9.8 to 10.9 $_2$ ✓

gradient values in the range -0.040 to -0.034 for $_1$ ✓ (minus sign essential)

for $_1$ ✓ allow the substitution of at least one pair of correct values of G and θ into $G = \beta\theta + \alpha$ to obtain α using simultaneous equations condone 2sf '10' for $_2$ ✓

2

- (f) full scale pd = $100 \times 1000 = 100000$ or $10^5 \mu\text{V}$ ✓
allow 100 mV or 0.1 V if μV deleted from answer line ✓

- (g) idea that resolution of the meter is not satisfactory ₁✓
 because the largest pd that will be measured is less than 1500 μV
 OR
 only uses 1.5% of the range
 OR

pd across meter at full-scale deflection ÷ divisions = $\frac{10^5}{50} = 2000 \mu\text{V}$
 per division ₂✓

condone use of 'sensitivity' or 'precision' for 'resolution'; ignore 'meter is not accurate'

allow 'hard to tell different readings apart'

for ₂✓ allow ce for incorrect 02.6

allow 'unable to measure to nearest microvolt'

allow 'resolution of scale should be 1 μV'