Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) Capacitor must not lose charge through the meter ✓

1

(b) Position on scale can be marked / easier to read quickly etc ✓

1

(c) Initial current = $\frac{6}{100000}$ = 60.0 μA ✓

100 μA or 200 μA ✓ (250 probably gives too low a reading)

Give max 1 mark if 65 μA (from 2.6) used and 100 μA meter chosen

2

(d) 0.05 V ✓

1

(e) Total charge = 6.0 x 680 x 10^{-6} (C) (= 4.08 mC) ✓

Time = 4.08 x 10^{-3} / 60.0 x 10^{-6} = 68 s ✓

Hence 6 readings ✓

3

(f) Recognition that total charge = 65 *t* μC and final pd = 0.098 *t*

so C = 65μ / 0.098✓

660 μF ✓

Allow 663 μF

2

(g) (yes) because it could lie within 646 – 714 to be in tolerance ✓

OR

it is 97.5 % of quoted value which is within 5% ✓

1

(h) Suitable circuit drawn ✓

Charge C then discharge through R and record V or I at 5 or 10 s intervals ✓

Plot ln V or ln I versus time ✓

gradient is 1 / RC ✓

OR

Suitable circuit drawn ✓

Charge C then discharge through R and record V or I at 5 or 10 s intervals ✓

Use *V* or *I* versus time data to deduce half-time to discharge ✓

1 / RC = ln 2 / $t_{½}$ quoted ✓

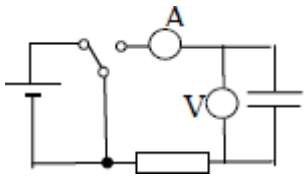
OR

Suitable circuit drawn ✓

Charge C then discharge through R and record V or I at 5 or 10 s intervals ✓

Plot V or I against *t* and find time T for V or I to fall to 0.37 of initial value ✓

$T = CR$ ✓



Either A or V required

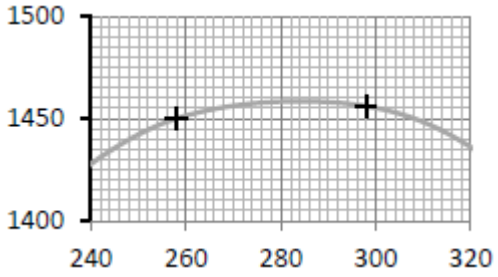
For 2nd mark, credit use of datalogger for recording V or I.

4

[15]

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 ± ½ grid square ✔

if multiple lines are drawn condone value if ± ½ 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 × 1000 = 100000 or 10^5 μV ✔

allow 100 mV or 0.1 V if μV deleted from answer line ✔

1

(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 μV 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 <u>micro</u>volt'

allow 'resolution of scale should be 1 μV'

2

[9]