### Experiment Copy Marking Schemes

These must be marked by a colleague – as honestly as possible.

Remember that they are a record of your own experiments

Copy and paste the *Index Page* into the inside cover of your hardback so you have a record of all the mandatory experiments.

A department of education inspector is entitled to call to the school and ask to see these and can refuse to allow you to sit the leaving cert exam if he or she believes there is no record of you having completed the experiments.

### Cut and paste each page onto the relevant page of your hardback experiment copy

**Teachers:**

When printing, use the “print 2 pages per sheet” option to cut down on paper (if you don’t know how to do this on your printer then ask a student).

**List of all mandatory experiments**

The ‘page’ column refers to the corresponding page in your hardback. You should therefore number these pages as you go along.

|  |  |  |
| --- | --- | --- |
|  | **Experiment** | **Page** |
| **Fifth Year** |
|  | Measurement of the focal length of a concave mirror |  |
|  | To verify Snell’s law of refraction and hence measure the refractive index of a glass block |  |
|  | Measurement of the focal length of a convex lens |  |
|  | Measurement of speed using a ticker-tape timer |  |
|  | Measurement of acceleration using a data-logger |  |
|  | Measurement of acceleration due to gravity (*g*) using the freefall method |  |
|  | To show that acceleration is proportional to the force which caused it (F = ma) |  |
|  | To verify the principle of conservation of momentum |  |
|  | Verification of Boyle’s Law  |  |
|  | Investigation of the laws of equilibrium for a set of co-planar forces |  |
|  | To calibrate a thermometer using the laboratory mercury thermometer as a standard |  |
|  | Measurement of the specific heat capacity of water |  |
|  | Measurement of the specific latent heat of fusion of ice |  |
|  | Measurement of the specific latent heat of vaporisation of water |  |
|  | To measure the speed of sound in air |  |
|  | Investigation of the variation of fundamental frequency of a stretched string with length |  |
|  | Investigation of the variation of fundamental frequency of a stretched string with tension |  |
|  | Measurement of the wavelength of monochromatic light |  |
|  | To investigate the variation of current (I) with potential difference (V) for a metallic conductor |  |
|  | To investigate the variation of current (I) with potential difference (V) for a filament bulb  |  |
|  | To measure the resistivity of the material of a wire |  |
|  | To investigate the variation of the resistance of a metallic conductor with temperature |  |
| **Sixth Year** |
|  | To investigate the variation of current (I) with potential difference (V) for copper electrodes in a copper-sulphate solution |  |
|  | To verify Joule’s Law |  |
|  | To investigate the variation of current (I) with potential difference (V) for a semiconductor diode |  |
|  | To investigate the variation of the resistance of a thermistor with temperature |  |
|  | Investigation of the relationship between *periodic time* and *length* for a simple pendulum and hence calculation of *g*. |  |

### To Measure the *focal length of a concave mirror*

|  |  |
| --- | --- |
| Fully labelled diagram including all essential apparatus |  /5 |
| U and V clearly indicatedon diagram |  /5 |
| Description of how to obtain an approximate value for focal length |  /10 |
| Reference to object always placed beyond this distance |  /5 |
| Description of how to obtain values for U |  /5 |
| Description of how to obtain values for V(including reference about how to know where to place screen) |  /10 |
| Mention of how system was adjusted to obtain a new set of variables |  /10 |
| Reference to relevant formula |  /10 |
| Table of Results |  /10 |
| Average value for focal length calculated |  /10 |
| Sources of Error |  /10 |
| Neatness |  /10 |

Total:

Comment:

Examiner and date:

**To measure the *refractive index of a glass block***

|  |  |
| --- | --- |
| Fully labelled diagram including all essential apparatus |  /10 |
| Angles i, r and normal clearly indicated |  /5 |
| Description of how to obtain angle of incidence |  /10 |
| Description of how to obtain angle of refraction |  /10 |
| Mention of how to adjust system to obtain a new set of variables |  /5 |
| Table of Results |  /10 |
| Labelled graph of Sin i against Sin r |  /10 |
| ‘Best-fit’ line drawn |  /10 |
| Slope of graph calculatedand reference to answer being Refractive Index |  /10 |
| Sources of Error |  /10 |
| Neatness  |  /10 |

Total:

Comment:

Examiner and date:

**To Measure the *focal length of a convex (converging) lens***

|  |  |
| --- | --- |
| Fully labelled diagram including all essential apparatus |  /5 |
| U and V clearly indicatedon diagram |  /5 |
| Description of how to obtain an approximate value for focal length |  /10 |
| Reference to object always placed beyond this distance |  /5 |
| Description of how to obtain values for U |  /5 |
| Description of how to obtain values for V(including reference about how to know where to place screen) |  /10 |
| Mention of how system was adjusted to obtain a new set of variables |  /10 |
| Table of Results |  /10 |
| Reference to relevant formula |  /10 |
| Average value for focal length calculated |  /10 |
| Sources of Error |  /10 |
| Neatness |  /10 |

## To measure *speed using a ticker-tape timer*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /20 |
| Was trolley raised slightly to offset friction? |   /5 |
| Explanation for how value for *distance* was obtained |  /15 |
| Explanation for how value for *time* was obtained |  /15 |
| Reference to formula:speed = distance ÷ time |  /10 |
| Results (ticker-tape must be pasted onto the page) |  /15 |
| Sources of Error |  /20 |

Total:

Examiner and date:

Comment:

# To measure *acceleration using a ticker-tape timer*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /20 |
| Explanation for how value for *speeds were* obtained |  /20 |
| Explanation for how value for *time* was obtained |  /15 |
| Reference to formula:acceleration = change in speed ÷ time |  /10 |
| Results (ticker-tape must be pasted onto the page) |  /15 |
| Sources of Error |  /20 |

# Total:

# Examiner and date:

# Comment:

# To *measure* *acceleration using a data-logger*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /20 |
| Reference to acceleration = slope of velocity-time graph |  /20 |
| Explanation of why that particular section of the graph was selected |  /20 |
| Results (should include screen-shot of graph) |  /20 |
| Sources of Error |  /20 |

Total:

Comment:

Examiner:

**To calculate acceleration due to gravity *(g) by method of freefall***

|  |  |
| --- | --- |
| Fully labelled diagram |  /15 |
| Reference to formula:*s = ½ a t2* |  /5 |
| Description of how values for *s* were obtained |  /10 |
| Description of how values for *t* were obtained |  /10 |
| Mention of how system was adjusted to obtain a new set of data |  /10 |
| Table of results |  /10 |
| Labelled graph of s against t2 |  /5 |
| ‘Good fit’ line drawn |  /5 |
| Slope of graph calculated |  /5 |
| Value for *g* obtained |  /10 |
| Sources of Error |  /5 |
| Neatness |  /10 |

Total:

Comment:

Examiner and date:

# To verify *F = ma*

|  |  |
| --- | --- |
| Diagram (fully labelled)Was trolley raised slightly to offset friction? |  /10 |
| Reference to formula F = ma |  /10 |
| Explanation of how to obtain values for F |  /10 |
| Explanation of how to obtain values for a |  /10 |
| What was changed to obtain a new set of values? (reference to masses being taken *from trolley* to pan) |  /10 |
| Table of Results |  /10 |
|  Labelled graph of F against a(Force on y-axis) |  /10 |
| Best-fit line (equal number of points on either side of the line) |  /10 |
| Slope of graph calculated |  /10 |
| Sources of Error |  /10 |

Total:

Comment:

Examiner and date:

# To verify the *principle of conservation of momentum*

|  |  |
| --- | --- |
| Diagram (fully labelled)Was trolley raised slightly to offset friction? |  /15 |
| Reference 2nd trolley being stationary and therefore having no momentum |  /10 |
| Reference to formula m1v1 = (m1+m2)v3 |  /15 |
| Explanation of how to obtain values for the masses. |  /15 |
| Explanation of how to obtain values for the velocities. |  /15 |
| Reference to having changed variables to obtain a new set of values |  /10 |
|  Table of Results |  /10 |
| Sources of Error |  /10 |

Total:

Comment:

Examiner and date:

# To verify *Boyle’s Law*

|  |  |
| --- | --- |
| Diagram (fully labelled)Must include reference to enclosed gas |  /15 |
| Explanation of how to obtain values for pressure |  /10 |
| Explanation of how to obtain values for volume |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Labelled graph of Pressure against 1/VolumeUnits must be included |  /15 |
| ‘Best-fit’ line drawn |  /10 |
| Sources of Error |  /10 |
| Neatness  |  /10 |

Total:

Comment:

Examiner and date:

# To *verify the laws of equilibrium*

|  |  |
| --- | --- |
| Fully labelled diagram |  /10 |
| Reference to how values for *F* were obtained in upward and downward directions.(This may be clear from the diagram) |  /10 |
| Reference to relevant equation for *moments* |  /10 |
| Reference to the fact that distances are measured *from the force to the fulcrum.*(This may be clear from the diagram) |  /10 |
| Table of results |  /10 |
| Procedure for verifying forces up = forces down |  /10 |
| Procedure for verifying that moments clockwise = moments anti-clockwise |  /20 |
| Sources of Error |  /10 |
| Neatness |  /10 |

Total:

Comment:

Examiner and date:

# *Calibration curve of a thermometer* using the laboratory mercury thermometer as a standard

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Temperature |  /10 |
| Mention of how student obtained values for Length |  /10 |
| Explanation of how the set-up was changed to get a separate set of readings |  /10 |
| Table of results |  /10 |
| Graph of temperature against length |  /10 |
| Best fit line |  /10 |
| Results |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To measure the *specific heat capacity of water*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained a value for Energy In |  /10 |
| Mention of how student obtained values for mass of water and calorimeter |  /10 |
| Mention of how student obtained values for change in temperature of water and calorimeter |  /10 |
| Reference to relevant equation |  /10 |
| Results |  /10 |
| Correct substitution into equation |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To measure the *specific latent heat of fusion of ice*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Reference to how student crushed and dried the ice |  /10 |
| Mention of how student obtained a value for mass of ice |  /10 |
| Mention of how student obtained values for mass of water and calorimeter |  /10 |
| Mention of how student obtained values for change in temperature of water, calorimeter and melted ice |  /10 |
| Reference to relevant equation |  /10 |
| Results |  /10 |
| Correct substitution into equation |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /10 |

Total:

Comment:

Examiner and date:

# To measure the *specific latent heat of vapourisation of water*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained a value for mass of water vapour |  /10 |
| Mention of how student obtained values for mass of water and calorimeter |  /10 |
| Mention of how student obtained values for change in temperature of water, calorimeter and condensed water vapour |  /10 |
| Reference to relevant equation |  /10 |
| Results |  /10 |
| Correct substitution into equation |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To determine the *speed of sound* *using a resonance tube*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Mention of how student obtained the resonance point  |  /10 |
| Explanation of how to obtain values for Frequency |  /10 |
| Explanation of how to obtain values for L |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Reference to correction term |  /5 |
| Reference to relevant equation to obtain speed of sound |  /15 |
| Table of Results |  /10 |
| Sources of Error |  /10 |
| Neatness  |  /10 |

Total:

Comment:

Examiner and date:

Important lesson on how to be a good scientist:

***CHEAT !!!***

We can ignore the small correction term in order to give us a rough idea of what L should be:

v = f λ ⇒ v = f (4L ) ⇒ 340 = 4(f)(L) ⇒ L = 340 / 4 (f)

Now check this each time before you put a value for L in your table.

###### Table of Results

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Frequency(Hz) | Length(m) | v = f (4l)(m/s) | Diameter d (m) | 0.3 d(m) | v = 4f(l+0.3d) |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

# To show that *frequency is inversely proportional to* *length* for a stretched string

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Mention of how student obtained the resonance point  |  /10 |
| Explanation of how values were obtained for Frequency |  /5 |
| How did student ensure resonance point obtained did not correspond to a multiple of the natural frequency |  /5 |
| Explanation of how to obtain values for L(must refer to length as being between the two bridges) |  /10 |
| Reference to having changed variables to obtain a new set of values |   /5 |
| Table of Results |  /15 |
| Graph (axes labelled including units) |  /10 |
| Best fit line |  /10 |
| Sources of Error |  /10 |
| Neatness  |  /10 |

Total:

Comment:

Examiner and date:

**To show that *frequency is proportional to the* *square root of tension* for a stretched string**

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Mention of how student obtained the resonance point  |  /10 |
| Explanation of how values were obtained for Frequency |  /5 |
| How did student ensure resonance point obtained did not correspond to a multiple of the natural frequency |  /5 |
| Explanation of how to obtain values for Tension |  /10 |
| Reference to having changed variables to obtain a new set of values |   /5 |
| Table of Results |  /15 |
| Graph (axes labelled including units) |  /10 |
| Best fit line |  /10 |
| Sources of Error |  /10 |
| Neatness  |  /10 |

Total:

Comment:

Examiner and date:

# To determine *the wavelength of monochromatic light* using a diffraction grating

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Reference to relevant formula |  /10 |
| Mention of how student obtained values for n(the order) |  /10 |
| Explanation of how value were obtained for d (slit width) |  /10 |
| Explanation of how to obtain values for θ (the angle) |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Sources of Error |  /10 |
| Neatness |   /10 |
|  Is this person a likeable student? |  /10 |

Total:

Comment:

# Examiner and date:

# To investigation the variation of *current* (I) with *pd* (V) for a metallic conductor

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Current |  /10 |
| Explanation of how value were obtained for Potential Difference |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Graph of current against p.d. |  /10 |
| Best Fit line |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To investigation the variation of *current* (I) with *pd* (V) for a filament bulb

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Current |  /10 |
| Explanation of how value were obtained for Potential Difference |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Graph of current against p.d. |  /10 |
| Best Fit curve |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# Measurement of the *resistivity* of the material of a wire

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Mention of how student obtained value for Resistance |  /10 |
| Explanation of how value was obtained for Length |  /10 |
| Explanation of how value was obtained for diameter |  /10 |
| Reference to value for diameter being the average of a number of readings |  /10 |
| Reference to how student calculated Area (this may not be necessary if formula was included in final formula) |  /10 |
| Reference to final formula used |  /10 |
| Results |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /10 |

Total:

Comment:

Examiner and date:

# To investigate the relationship between the *resistance of a metallic conductor and temperature*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Resistance |  /10 |
| Mention of how student obtained values for Temperature |  /10 |
| Explanation of how the set-up was changed to get a separate set of readings |  /10 |
| Table of results |  /10 |
| Graph of Resistance against temperature |  /10 |
| Best fit line |  /10 |
| Results |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To investigation the variation of *current* (I) with *pd* (V) for a copper sulphate solution with copper electrodes

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Current |  /10 |
| Explanation of how value were obtained for Potential Difference |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Graph of current against p.d. |  /10 |
| Best Fit line |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To verify *Joules’ Law*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /10 |
| Mention of how student obtained values for Current |  /10 |
| Explanation of how value were obtained for change in temp |  /10 |
| Reference to how current was kept constant throughout each run |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Graph of current against change in temp |  /10 |
| Best Fit line |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /10 |

Total:

Comment:

Examiner and date:

# To investigation the variation of *current* (I) with *pd* (V) for a semiconductor diode

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Current |  /10 |
| Explanation of how value were obtained for Potential Difference |  /10 |
| Reference to having changed variables to obtain a new set of values |  /10 |
| Table of Results |  /10 |
| Graph of current against p.d. |  /10 |
| Best Fit line |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

# To investigate the relationship between the *resistance of a thermistor and temperature*

|  |  |
| --- | --- |
| Diagram (fully labelled) |  /15 |
| Mention of how student obtained values for Resistance |  /10 |
| Mention of how student obtained values for Temperature |  /10 |
| Explanation of how the set-up was changed to get a separate set of readings |  /10 |
| Table of results |  /10 |
| Graph of Resistance against temperature |  /10 |
| Best fit line |  /10 |
| Results |  /10 |
| Sources of Error |   /10 |
|  Neatness |  /15 |

Total:

Comment:

Examiner and date:

**To show the relationship between *periodic time* and *length* for a simple pendulum and use the graph to calculate a value for acceleration due to gravity (*g*)**

|  |  |
| --- | --- |
| Fully labelled diagram |  /15 |
| Reference to formula |  /5 |
| Description of how values for *l* were obtained |  /10 |
| Description of how values for *T* were obtained |  /10 |
| Mention of how system was adjusted to obtain a new set of data |  /10 |
| Table of results |  /10 |
| Labelled graph of T2 against l |  /5 |
| ‘Good fit’ line drawn |  /5 |
| Slope of graph calculated |  /5 |
| Value for *g* obtained |  /10 |
| Sources of Error |  /5 |
| Neatness |  /10 |

Total:

Comment:

Examiner and date: