Common Error and Improvement for Physics Practical (AS)

Tips:

*Can write more than 4 errors and 4 improvements

*If the value of the quantity measured is very small, can write increase the magnitude of the quantity of the independent variable

* Credit is not given for suggestions that should be carried out anyway, such as repeating measurements and calculating average or avoiding parallax errors by looking at an instrument “square on”.

* Ask yourself whether the improvement is practical or not.

Common answers that is rejected by mark scheme

-Repeat experiment

-Human error

-Use a computer to improve the experiment

-Use assistant

- If clay/plasticine is used in the experiment, wind movement doesn’t affect it anymore.

(Think whether turning off fan will make a difference or not)

Type of experiment

A) Water related experiment

E: (1) Hard to see water surface due to refraction effects/ meniscus effect

(2) Labels get wet/ink runs

I: (1) Use coloured liquid

(2) Use waterproof labels/ink

X: Bottle not vertical

B) Ball related experiment

E: (1) Locating the centre of the ball when reading rule

(2) Inconsistent bounce

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I: (1) Mark the centre of the ball with marker

(2) Use a flat surface/ Turn off fan

C) Fast- moving object experiment

E: # (1) Difficult to judge when the ball is at its (maximum displacement, highest point etc)

(2) Hard to see when object strikes floor.

(3) Difficult to judge end point

(4) Difficulty in deciding the toppling point

I: #(1) Position sensor above or below with data logger/ Video camera to play back frame by frame.

(2) Use pressure sensor to stop timer.

(3) Mark distance with lines on ramp (to eliminate parallax)

(4) Move by increments

X: Reject reaction time ideas/difficult to release from the same point each time.

D) Releasing object from rest experiment

E: (1) Difficulty in releasing the object due to (applied force etc)

(2) (Object) falls at an angle due to wind.-Light object

(3) Rod falls sideways/not entering sand vertically. - Heavy object

I: (1) Use a remote-controlled clamp to release the object/ slot in tube

+ card/electromagnet

(2) Turn off fans

(3) Practical method to keep rod vertical e.g. guide for rod.

E) Oscillation experiment

E: #(1) T or time short/large uncertainty in T

(2) Object does not swing freely/ friction between pivot and object

(3) Not swinging in one plane only/idea of non-uniform oscillation (Light object only)

(4) Oscillations die out quickly/ heavy damping (Light object only)

(5) Difficult to judge end/start/ centre of swing/difficult to judge complete swing

I: #(1) A marker to time as reaches maximum displacement with (motion sensor) at end with video with timer (playback) in slow motion/ Increase the magnitude of the independent variable

(2) Make hole bigger/bush or bearing idea

(3) Turn off fan(Light object only) * For heavy object, no improvement available.

(4) Use increased thickness of object

(5) Use of fiducial marker/pointer

X: do the experiment in a vacuum, switch the fans off, not just 'use video', light gates, Camera, High speed camera, Too fast, Time too fast, Time more swings , Time large no. of swings,not 'repeated readings', not just 'use computer/data logger', Difficult to release from

same point each time/human error/reaction time/unqualified use of light gates/sensors

F) Electricity experiment

E: (1) Resistance / current fluctuating

(2) Voltmeter scale not sensitive enough

(3) Wires not straight

I: (1) Clean contacts

(2) Use digital voltmeter

(3) Method of keeping wire (during experiment) straight e.g. tape to ruler, hang weights off end, clamp wire.

X: Voltmeter not accurate enough. More accurate voltmeter/ Parallax error/zero error on meters/heating effects of wire

G) Force experiment

E: (1) Maximum force reached without warning

(2) Weights move.

I: (1) Practical method of recording maximum value e.g force sensor with data logger

(2) Method of fixing cotton loop to rule e.g. tape, glue.

X: Increase force slowly/reaction time error

H) Pulley experiment

E: (1) Masses hit each other

(2) Friction at pulley

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(3) Uncertain starting position

I: (1) Use larger pulley

(2) Lubricate pulley

(3) Method of fixing rule e.g. clamp rule/electromagnetic with steel /magnetic material ball) release mechanism

X: Friction between pulley and string

I) Moment experiment

E: (1) Rule hits bench

(2) Ruler slips on support

I: (1) Method of preventing rule hitting bench, e.g. project end of cylinder over bench or elevate apparatus.

(2) Glue support to block

X: Difficult to start at the same amplitude each time

J) Magnetism experiment

E: Glass may affect magnetic force / effect of surrounding magnetic materials

I: Use a variety of materials to separate magnets and test if material affects results

X: Reference to Earth's field/Move object further away

K) Bench/ Ramp (Surface) related experiment

E: (1) Some parts of board rougher than others/surface of board is uneven/board not flat

(2) Board tends to slip/board not stable/supporting block can topple

I: (1) Method to ensure same section of board used in each experiment (e.g. mark one section)

(2) Method described to secure board/block/support e.g. clamp the board, fix the supporting block to the bench with tape/blu-tack

X: Board is rough/there is friction between the block and the board/use a smoother surface/references to oil/lubricants

L) Heat loss experiment

E: (1) Heat lost through sides and /or Bottom

(2) Low precision of thermometer

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(3) Bulb of thermometer is not completely immersed

(4) Resistor continues to give out heat when switched off/ temperature continues to rise after switching off

I: (1) Method to reduce heat loss/lag/insulate/polystyrene container

(2) Thermometer with specified better precision, e.g. 0.1^{o}C, 0.5^{o}C

(3) Use larger volume of water/use of thermocouple/other small temperature sensor(e.g. probe)

(4) Wait until temperature reaches a maximum before reading

X: Switch off fans to reduce convection/Just "weigh water"/ different starting temperatures of water; uneven temperature distribution in beaker/ parallax errors in reading volume or temperature/use of lid/heat loss in warming bowl/cup/draughts/heat loss to surroundings/use more accurate thermometer/thermometer not precise enough/not just 'digital thermometer'

M) Terminal velocity experiment

E: (Object) may not have reached terminal velocity.

I: Time constant over three markers

N) Light dependent experiment

E: External light affects (LDR)

I: Conduct experiment in dark room.

Errors and improvement of common apparatus

A) Metre rule

E: (1) Ruler not vertical

!(2) Parallax error

(3) Difficult to hold rule still

(4) Difficult to take measurements because the ruler moves / is not vertical

(5) Reason for difficulty in measuring d e.g. viewed through ruler/parallax error in d

(6) String too wide for markings on rule

(7) Rules have different thicknesses /different lengths so not a fair test

I: (1) Sensible method to ensure ruler vertical

!(2) Put coloured paper behind (object) /Description of method of reducing parallax error requiring additional equipment, e.g. !shadow projection/ extend mark to wood or track / pointer on rule / travelling microscope*)

(3) Mount ruler in stand

(4) Clamp rule / ensure rule is vertical using a set square on the bench

(5) Method to improve measurement of d e.g. travelling microscope

(6) Use thinner string

(7) Use rulers of similar thicknesses/ readings/method to take thickness into account /use rulers of the same length

* If the diameter is quite wide, meter rule is prefer over calipers! Accuracy of metre rule is increased by using set square held against ruler.

X: View at eye level.

B) Newton metre

E: (1) Difficult to pull newton-meter parallel to ruler/bench

(2) Difficult to judge reading on newton-meter when detaches with reason e.g. ruler moves suddenly/without warning (so difficult to read newton-meter at the instant the ruler starts to move)/force drops to zero immediately after detachment

(3) Difficult to zero newton-meter when used horizontally

I: (1) Method to ensure force is parallel to ruler e.g. use a long string/pulley and weights*

(2) Method to read force at detachment e.g. newton meter with a 'max hold' facility/video and playback or freeze frame/ use system of pulley and weights or sand to measure F*/ use force sensor and data logger or computer*

(3) Improved method to measure F: e.g. use system of pulley and weights or sand*/use force sensor with datalogger or computer*

X: Video to take reading/digital (electronic) newton meter/parallax related to newton meter/difficult to measure force/issue of viewing ruler and meter simultaneously/zero error in newton-meter/just a pulley

C) Slotted mass

E: Labelled values of mass may not be accurate.

I: Use balance/method of weighing mass.

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X: Weigh mass.

D) Objects with unfixed diameter(Circular objects)

E: (1) Difficult to measure diameter because (object) is flexible/not circular.

(2) Difficult to form a perfect sphere or disc/diameter of sphere or disc varied

I: (1) Measure diameter of (object) in two directions and average/ Use vernier calipers or micrometer screw gauge to measure average diameter

(2) Method to make uniform spheres/discs e.g. moulds

E) Protractor

E: (1)Protractor "wobbles" when being held by hands/ Difficulty in measuring θ owing to container not perfectly right angled (curved) at the bottom/difficult to line up protractor/horizontal line of protractor not on table

(2) parallax error in θ measurement

(3) θ (or reading) is difficult (or inaccurate, or imprecise) because pointer is thick

I: (1) use protractor with horizontal line flush to table top/freestanding or clamped protractor.

(2) use mirror scale

(3) -

X: view at right angles