List of Practical
Physics Grade-IX (SSC-I)

S. No.	Practical/ SLOs Description
1.	[SLO: P-09-A-12] Justify and illustrate the use of common lab instruments to measure length [including how to measure a variety of lengths with appropriate precision using tapes, rulers, micrometers, and Vernier calipers (including reading the scales on analogue calipers and micrometers)]
2.	[SLO: P-09-A-13] Justify and illustrate the use of measuring cylinders to measure volume [including both measurement of volume of liquid and determining the volume of a solid by displacement]
3.	[SLO: P-09-A-14] Justify and illustrate how to measure time intervals using lab instruments [including clocks and digital timers]
4.	[SLO: P-09-A-15] Determine an average value for an empirical reading [including small distance and for a short interval of time by measuring multiples (including the period of oscillations of a pendulum)]
5.	[SLO: P-09-A-16] Round off and justify calculational estimates [Based on empirical data to an appropriate number of significant figures]
6.	[SLO: P-09-A-19] Determine the least count of a data collection instrument (analog) from its scale
7.	[SLO: P-09-10-N-01] explain, with examples, how hazards in a science lab can be classified into: ((i) physical hazards, (ii) chemical hazards, (iii) biological hazards, (v) safety hazards)
8.	[SLO: P-09-10-N-02] Identify for a given experimental procedure -what would be the most appropriate personal protective equipment to wear before setting up the apparatus.
9.	[SLO: P-09-10-N-03] Identify the meaning of common hazard signs in the laboratory
10.	[SLO: P-09-10-N-04] call emergency services in case of an accident in the lab
11.	[SLO: P-09-10-N-05] Define and use the below terms: -True value: the value that would be obtained in an ideal measurement - Measurement error: the difference between a measured value and the true value of a quantity -Accuracy: a measurement result is described as accurate if it is close to the true value -Precision: how close the measured values of a quantity are to each other

	-Repeatability: a measurement is repeatable if the same or similar result is obtained when the measurement is repeated under the same conditions, using the same method, within the same experiment -Reproducibility: a measurement is reproducible if the same or similar result is obtained when the measurement is made under either different conditions or by a different method or in a different experiment -Validity of experimental design: an experiment is valid if the experiment tests what it says it will test. The experiment must be a fair test where only the independent variable and dependent variable may change, and controlled variables are kept constant -Range: the maximum and minimum value of the independent or dependent variables - Anomaly: an anomaly is a value in a set of results that appears to be outside the general pattern of the results, i.e., an extreme value that is either very high or very low in comparison to others - Independent variables: independent variables are the variable that are changed in a scientific experiment by the scientist. Changing an independent variable may cause a change in the dependent variable Dependent variables: dependent variables are the variable that are observed or measured in a scientific experiment. Dependent variable may change based on changes made to the independent variables
12.	[SLO: P-09-10-N-06] identify appropriate apparatus for collecting the data.
13.	[SLO: P-09-10-N-07] visualize how the collected data would be tabulated or graphed
14.	[SLO: P-09-10-N-08] explain step by step the methodology for analyzing the data (e.g. gradient of line of best fit, plugging average value of dependent Variable into a formula etc.)
15.	[SLO: P-09-10-N-09] suggest how sources of human and systematic error could be mitigated
16.	[SLO: P-09-10-N-10] set up experimental apparatus under supervision from an instructor
17.	[SLO: P-09-10-N-11] take steps to avoid parallax error
18.	[SLO: P-09-10-N-12] identify and correct for potential zero error
19.	[SLO: P-09-10-N-13] take an appropriate number of readings to average out errors
20.	[SLO: P-09-10-N-14] take correct meniscus readings
21.	[SLO: P-09-10-N-15] record sources of potential error (e.g. lack of lighting due to power outage)

22.	[SLO: P-09-10-N-16] take steps to avoid systematic error in specific context of the experiment e.g. ensuring that the table the set-up in on is level
23.	[SLO: P-09-10-N-17] make measurements using common laboratory apparatus, such as millimetre scales, protractors, top-pan balances, newton meters, analogue or digital electrical meters, measuring cylinders, vernier calipers, micrometer screw gauges and thermometers
24.	[SLO: P-09-10-N-18] use a stop-watch to measure intervals of time, including the period of an oscillating system by timing an appropriate number of consecutive oscillations
25.	[SLO: P-09-10-N-19] use both analogue scales and digital displays. Be familiar with the following experimental contexts
26.	[SLO: P-09-10-N-20] measurement of physical quantities such as length, volume or force
27.	[SLO: P-09-10-N-21] measurement of small distances or short intervals of time
28.	[SLO: P-09-10-N-22] determining a derived quantity such as the extension per unit load for a spring, the value of a known resistance or the acceleration of an object
29.	[SLO: P-09-10-N-23] testing and identifying the relationship between two variables such as between the potential difference across a wire and its length
30.	[SLO: P-09-10-N-24] comparing measured quantities such as angles of reflection
31.	[SLO: P-09-10-N-25] comparing derived quantities such as density
32.	[SLO: P-09-10-N-26] cooling and heating, including measurement of temperature
33.	[SLO: P-09-10-N-27] experiments using springs and balances
34.	[SLO: P-09-10-N-28] timing motion or oscillations
35.	[SLO: P-09-10-N-29] electric circuits, including the connection and reconnection of these circuits, and the measurement of current and potential difference
36.	[SLO: P-09-10-N-30] optics experiments using equipment such as optics pins, mirrors, prisms, lenses, glass or Perspex blocks (both rectangular and semi- circular), including the use of transparent, translucent and opaque substances to investigate the transmission of light
37.	[SLO: P-09-10-N-31] procedures using simple apparatus, in situations where the method may not be familiar to the candidate
38.	**Use the below good practices in tabulating data [SLO: P-09-10-N-32] to [SLO: P-0910-N-37]:**

	[SLO: P-09-10-N-32] Record measured and calculated quantities with correct units accompanying them
39.	[SLO: P-09-10-N-33] Organize tabulated results with the following elements present: the heading of each column, the name or symbol of the measured or calculated quantity, together with the appropriate unit
40.	[SLO: P-09-10-N-34] Label axes with quantities and units
41.	[SLO: P-09-10-N-35] Use scales for the axes that allow the majority of the graph paper to be used in both directions, and be based on sensible ratios, e.g. 2cm on the graph paper representing 1, 2 or 5 units of the variable (or 10, 20 or 50, etc.).
42.	[SLO: P-09-10-N-36] Plot data points to an accuracy of better than one half of one of the smallest squares on the grid.
43.	[SLO: P-09-10-N-37] Plot data points using small crosses or fine dots with a circle drawn around them.
44.	[SLO: P-09-10-N-38] Use measuring instruments to their full precision
45.	[SLO: P-09-10-N-39] Estimate the number of significant figures for calculated quantities as being the same as the least number of significant figures in the raw data used.
46.	[SLO: P-09-10-N-40] Show clear working in calculations, and key steps in reasoning
47.	[SLO: P-09-10-N-41] Express calculated ratios as decimal numbers, of two or three significant figures.
48.	[SLO: P-09-10-N-42] Sketch lines of best fit with an equal number of points on either side of the line over its entire length (the points should not be seen to lie all above the line at one end, and all below the line at the other end)
49.	[SLO: P-09-10-N-43] Convey the calculations for the gradient of a straight line by using a triangle whose hypotenuse extends over at least half the length of the plotted graph line.
50.	[SLO: P-09-10-N-44] Determine the intercept of a straight-line graph
51.	[SLO: P-09-10-N-45] Take readings from graphs by extrapolation or interpolation
52.	[SLO: P-09-10-N-46] Identify whether an experimental procedure has validity (whether the results really do represent what they are supposed to measure) regarding the hypothesis being tested, and suggest changes to ensure validity as appropriate
53.	[SLO: P-09-10-N-47] identify whether an experimental procedure is reliable (whether the results can be reproduced under the same conditions), and suggest changes to ensure reliability as appropriate

54.	[SLO: P-09-10-N-48] recommend how to mitigate sources of random and systematic error inherent in the given experimental design
55.	[SLO: P-09-10-N-49] identify unsafe procedure in an experimental design and suggest ways to mitigate any hazards