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Senior Secondary Level

PHYSICS (312)

Practical Examination

1. **Objectives**

   Like any other science subject, Physics is a subject which can be learnt better by doing. In fact, the experiments form an integral part of the Physics course at the senior secondary stage. Practicals, being an inseparable part of Physics Curriculum, are to be done with sincerity and evaluated as precisely as possible. In any practical course, the learner handles a number of instruments. In later career the learner you may be involved in scientific research, or in an industry. This guideline covers the procedure to be adopted by the NIOS learners for dealing with the practical examination. It focuses on developing practical skills and prepares learners for cultivating scientific attitude and scientific temper. The purpose of introducing Formative and Summative Assessments in Practical PCP is to increase learners' involvement and active participation in PCP classes as well as continuous assessment which leads to learning.

2. **Implementation**

   To inculcate the necessary practical skills, 29 experiments have been identified which are listed in 03 sections. (The list covers the major aspects of the practical Physics curriculum.

   These activities are to be conducted in 5 PCP sessions, as given below, at the study centre. These will be assessed through Formative (Continuous) Assessment. The Sixth PCP is reserved for the final examination that will be assessed through Summative (Final) Assessment at the Study Centre. The dates for the practical examination (Final) will be notified by NIOS in the examination date sheet. 50% weightage is for each of Formative (Continuous) and Summative (Final) Assessments. The maximum mark for Practical in Physics is 20. The *distribution of* activities in 05 PCPs is as follows:

First PCP Practical:

i) Orientation of the learners about the distribution of activities to be performed and allocation of marks for both the Formative (Continuous) and Summative (Final) Assessments.

ii) Orientation of learners about the handling of scientific equipment and apparatus, chemicals, etc.

iii) Learners have to choose **any two activities** to be performed from following experiments (S. No. Section A (1-5) of Practical Manual) as:

- To determine the internal diameter and depth of a cylindrical container (like tin can, calorimeter) using a Vernier callipers and find its capacity. Verify the result using a graduated cylinder.
- To determine the diameter of a given wire, using a screw gauge
- To determine the radius of curvature of a concave mirror, using a spherometer
- To find the time period of a simple pendulum for small amplitudes and draw the graph of length of the pendulum against square of the time period. Use the graph to find the length of the second's pendulum.
- To find the weight of a given body, using law of parallelogram of vectors

Second PCP Practical:

i) Orientation of learners about plotting of graphs, determination of specific heat etc. and its scientific principles

ii) Learners have to choose **any two activities** to be performed out of the following activities. (S. No. Section A (6-9) of Practical Manual) as:

- To study the Newton's law of cooling by plotting a graph between cooling time and temperature difference between calorimeter and surroundings
- To determine the specific heat of a solid, using the method of mixtures
- To measure extensions in the length of a helical spring with increasing load. Find the spring constant from the load extension graph.
- To find the time required to empty a burette, filled with water to ½ of its volume, to ¼ of its volume, to 1/8 of its volume and so on. Then, plot a graph between volume of water in the burette and time. Thus, verify that the fractional rate of flow is same (analogy to radio-active decay).

Third PCP Practical:

i) Orientation of learners about the interpretation of the data and conclusions of experiments

ii) Learners have to choose **any two activities** to be performed. (S. No. From Section B (10-13) of Practical Manual) as:

- To determine the wavelength of sound produced (i) in an air column and (ii) the velocity of sound in air at room temperature, using a resonance column and a tuning fork
- To compare the frequencies of two tuning forks by finding the first and second resonance positions in a resonance tube
- To establish graphically, the relation between the tension and resonating length of a string of a sonometer wire vibrating in its fundamental mode with a given tuning fork. Use the graph to determine the mass per unit length of the string.
- To find the value of v for different values of u for a concave mirror and find its focal length (f) by plotting graph between $1/u$ and $1/v$

Fourth PCP Practical:

(i) Orientation of learners about the concept of determination of focal length (f) convex lens, concave lens, convex mirror, concave mirror and plotting of graphs.

(ii) Learners have to choose **any two activities** to be performed from the following experiments. (S. No. Section B 14 to 17 of Practical Manual) as:

- To find the focal length (*f*) of a convex lens by plotting graph between 1/*u* and 1/*v*
- To find the focal length (*f*) of a convex mirror, using a convex lens
- Determine the focal length of a concave lens by combining it with a suitable convex lens.
- To draw a graph between the angle of incidence (*i*) and angle of deviation (*D*) for a glass prism and to determine the refractive index of the glass of the prism using the graph

Fifth PCP Practical:

(i) Orientation of learners about the working principles of ammeter, voltmeter, potentiometer, meter bridge for determination of e.m.f., specific resistance etc. for a given or wire.

(ii) Learners have to choose **any two activities** to be performed from the given exercises. (S. No. Section C 20-24 of Practical Manual) as:

- To verify the law of combination (series and parallel) of resistances, using ammeter-voltmeter method and coils of known resistances
- To compare the e.m.f's of two given primary cells by using a potentiometer
- To determine the specific resistance of the material of a given wire using a metre bridge
- To determine the internal resistance of a primary cell, using a potentiometer

3. **Scheme of Practical Examination:**

The following scheme of practical examinations is to be followed as per the details given below:

- The conduct of practical examinations is mainly linked with practical PCP. There are 06 practical sessions which are made compulsory.
- The initial five (05) PCP practical sessions have to be assessed through Formative (Continuous) Assessment and will be utilized for learning.
- The final (6th PCP) practical session will be utilized for Summative (Final) Assessment for practical examination.
- A weightage of 50% of the marks will be awarded for Formative (05 practical classes) Assessment and 50% marks for the 6th practical class for Summative Assessment.

I. **Marks Distribution in Formative Assessment (05 PCP Sessions):**

S.No.	Criteria for Assessment	Marks	Remarks
1.	Regular Participation in 05 PCP Classes	2	The five boxes under formative assessment in the award list will be
2.	Activities Performed in 05 PCP Classes	2	

3.	Practical Record maintained in 05 PCP Classes	2	filled up based on these 05 criteria.
4.	Use of practical instruments/equipment	2	
5.	Participation with Peer-Group and Tutor	2	
Total		**10**	

II. Marks Distribution in Summative Assessment (6th Final PCP Class):

S. No.	Criteria for Assessment	Marks	Remarks
1.	Assessment of activity performed (Two activities out of given three activities)	2 x 3½ =7	Time of 3 hours will be allowed for the final examination.
2.	Viva-Voce based on the activities	3	
Total		**10**	

Note: The total (Formative and Summative assessment) weightage is 20 marks. In the award list, the marks obtained by the learner, both in Formative and Summative Assessments are to be mentioned clearly and the final figure is the sum of the marks of Formative and Summative Assessments.

3. Preparations for PCP Practical Sessions:

(i) The Centre Superintendent and Tutor must read the instructions mentioned in the Guidelines for practical PCPs.

(ii) Check and arrange the materials, tools, equipment etc. that will be needed in the Practical PCP sessions in advance.

(iii) Learners are informed about the schedule of Practical PCP sessions. Practicals may be arranged in groups of learners.

(iv) The attendance sheet must be properly maintained in each Practical PCP class.

(v) The award list must be filled up as per the given assessment criteria.

(vi) The techniques of group work may be followed in Practical PCP sessions.

(vii) Learners shall be asked to bring the practical record book in each class. Each learner is expected to maintain it as per the instructions given in the practical manual.

4. Precautions (DOs and DON'Ts)

Discuss the following points with learners regarding writing the practical record book:

(i) Throughout the practical note book, the learners should follow the same style. Ask them to use a good fountain pen and a sharp black pencil. It is recommended that the right hand page should be written in blue ink and the left hand page with a black pencil.

The recommended style of writing is shown below:

Left hand page	Right hand page
Scale, Projections, Calculations. Graph, Diagram, Figures	Title of the Exercise, Date, Exercise No, Interpretation and Conclusion

(ii) Each experiment should start from a new page.

(iii) Graphs and diagrams should be drawn neatly in a proportionate scale.

(iv) Mistakes should be crossed out with a single line so that they can still be read. The correct statement should be written in its place.

(v) No page should be torn-off from the practical record book.

(vi) Before going to take Practical Examination, get all the exercises of Practical Record Book signed by your tutor.

5. List of Practicals

Experiments which a learner may perform during PCPs are listed below under three sections A, B and C:

Section-A

1. To determine the internal diameter and depth of a cylindrical container (like tin can, calorimeter) using a Vernier callipers and find its capacity. Verify the result using a graduated cylinder.
2. To determine the diameter of a given wire, using a screw gauge
3. To determine the radius of curvature of a concave mirror, using a spherometer
4. To find the time period of a simple pendulum for small amplitudes and draw the graph of length of the pendulum against square of the time period. Use the graph to find the length of the second's pendulum.
5. To find the weight of a given body, using law of parallelogram of vectors
6. To study the Newton's law of cooling by plotting a graph between cooling time and temperature difference between calorimeter and surroundings
7. To determine the specific heat of a solid, using the method of mixtures
8. To measure extensions in the length of a helical spring with increasing load. Find the spring constant from the load extension graph.
9. To find the time required to empty a burette filled with water to ½ of its volume, to ¼ of its volume, to 1/8 of its volume and so on. Then, plot a graph between volume of water in the burette and time. Thus, verify that the fractional rate of flow of water is same (analogy to radio-active decay).

Section-B

10. To determine the wavelength of sound produced (i) in an air column and (ii) the velocity of sound in air at room temperature, using a resonance column and a tuning fork
11. To compare the frequencies of two tuning forks by finding first and second resonance positions in a resonance tube.
12. To establish graphically the relation between the tension and resonating length of a string of a sonometer wire vibrating in its fundamental mode with a given tuning fork. Use the graph to determine the mass per unit length of the string.
13. To find the value of v for different values of u for a concave mirror and find its focal length (f) by plotting graph between $1/u$ and $1/v$
14. To find the focal length (f) of a convex lens by plotting graph between $1/u$ and $1/v$
15. To find the focal length (f) of a convex mirror, using a convex lens
16. Determine the focal length of a concave lens by combining it with a suitable convex lens
17. To draw a graph between the angle of incidence (i) and angle of deviation (D) for a glass prism and to determine the refractive index of the glass of the prism, using the graph
18. To compare the refractive indices of two transparent liquids, using a concave mirror and a single pin
19. To set up an astronomical telescope and find its magnifying power

Section-C

20. To verify the law of combination (series and parallel) of resistances, using ammeter and voltmeter and coils of known resistances.
21. To compare the e.m.f's of two given primary cells by using a potentiometer
22. To determine the specific resistance of the material of a given wire, using a metre bridge
23. To determine the internal resistance of a primary cell using a potentiometer
24. To determine the inductance and resistance of a given coil (inductor) using a suitable series resistance and an AC voltmeter
25. To study decay of current in a R.C. circuit while charging the capacitor, using a galvanometer and find the time constant of the circuit
26. To draw the characteristic curve of a forward biased *pn* junction diode and to determine the static and dynamic resistance of the diode
27. To draw the characteristics of an *npn* transistor in common emitter mode. From the characteristics, find out (i) the current gain (β) of the transistor and (ii) the voltage gain A_1 with a load resistance of 1 k Ω.
28. To draw the lines of force due to a bar magnet, keeping (i) N-pole pointing to north (ii) N – pole pointing to South. Locate the neutral points.
29. To determine the internal resistance of a moving coil galvanometer by half deflection method and to convert it into a voltmeter of a given range, say (0-3V), and verify it.