



**FEDERAL BOARD OF INTERMEDIATE
AND SECONDARY EDUCATION
H-8/4, ISLAMABAD**



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NOTIFICATION

The Assessment Frameworks for Composite Practical-Based Assessment (PBA), in accordance with the Inclusive Scheme of Studies 2024 (Revised Version-I), comprising lists of experiments/practicals, relevant instructions, and Model Question Papers (Composite) for the subjects of Physics, Chemistry, Biology, and Computer Science at SSC and HSSC levels, based on the National Curriculum of Pakistan 2022–23, along with the E-Sheets for the said subjects, are hereby notified for implementation with effect from the First Annual Examination 2027 and onwards.

2. The Assessment Frameworks for Composite PBA and E-Sheets are available at FBISE website. The weblink is https://www.fbise.edu.pk/curriculum_model_paper.php

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ASSESSMENT FRAMEWORK

FOR PRACTICAL BASED ASSESSMENT (PBA) - COMPOSITE

PHYSICS

HSSC LEVEL



NATIONAL CURRICULUM OF PAKISTAN (2022-23)

SCHEME OF STUDIES 2024

WE WORK FOR EXCELLENCE

**FEDERAL BOARD OF INTERMEDIATE AND SECONDARY
EDUCATION (FBISE), ISLAMABAD**



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ACKNOWLEDGEMENT

It is a great honour that we at the Federal Board of Intermediate and Secondary Education (FBISE) has developed the Assessment Framework (AF) for the Practical Based Assessment (PBA) of Physics at the Higher Secondary School Certificate (HSSC) level. The primary objective of the Assessment Framework is to optimize the Student Learning Outcomes (SLOs) of curriculum 2022-23 that are associated with practical concepts and laboratory work. This comprehensive framework has been crafted meticulously by subject matter and assessment experts who conducted an in-depth review of all learning outcomes of HSSC level Physics curriculum.

This significant undertaking was the result of a series of extensive meetings and collaborative efforts of the subject and assessment experts. Their dedication and expertise have been instrumental in bringing this framework to fruition.

The Assessment Framework for Practical Based Assessment (PBA) will serve as a guiding document for students, teachers, and paper setters. Students will receive clear directions for preparing themselves for the PBA examinations. Similarly, teachers will use it as a guide to perform laboratory work and to prepare students for the final PBA examinations. Paper setters of PBA will also seek guidance from this document and prepare PBA paper accordingly for annual examinations. It may be noted that only those students will be able to attempt the PBA paper who have performed all the practicals in laboratory.

Following subject as well as assessment experts remained constantly engaged in the development of the Assessment Framework for PBA:

1. Mr. Muhammad Jahangir Mirza, HOD Physics, OPF College for Boys, H-8/4 Islamabad
2. Mr. Muhammad Imran Khaliq, Assistant Professor, Islamabad Model College for Boys, G-10/4, IBD
3. Ms. Sehrish Imran, Lecturer, Islamabad Model College for Girls, I-8/4, Islamabad
4. Ms. Saima Waheed Khan, Subject Experts, APSAC Secretariat Rawalpindi

The whole work was successfully accomplished under the able supervision and guidance of Dr. Ikram Ali Malik, Chairman, FBISE and due to the hard work and dedication of the staff of Research Section of FBISE, in particular, Syed Zulfiqar Shah, Deputy Secretary, Research and Academics who played pivotal role in finalizing the Assessment Framework for PBA.

MIRZA ALI
Director (Test Development)
FBISE, Islamabad

ABOUT THE PBA ASSESSMENT FRAMEWORK

To ensure clarity and precision in the understanding of Practical Based Assessment (PBA) Question Paper, the Student Learning Outcomes (SLOs) have been categorized into two distinct groups: formative for PBA and summative for PBA in the composite Assessment Frameworks for HSSC Classes based on the Revised Version-I of Inclusive Scheme of Studies 2024. Subsequently, all the SLOs of HSSC-I and HSSC-II meant for summative PBA have been translated into workable and functional composite lists of practicals which are part of this booklet. This extraction of lists of practicals helps in effectively measuring student progress and understanding of the scientific concepts linked with laboratory work. These practicals must be performed by the students under the supervision of their teachers in the laboratories in order to prepare themselves for the PBA Examinations.

The Assessment Framework for Practical Based Assessment (PBA) will act as a comprehensive guide for students, teachers, and paper setters. Students will receive clear instructions in order to perform practicals in the laboratory and prepare themselves for the PBA examination. Teachers will use the same to strategize the optimal use of the laboratory for performing practicals.

The Model Question Paper for Practical Based Assessment (PBA), along with clear instructions, has also been developed and made part of this booklet to provide a structured format for upcoming examinations. The model question paper ensures consistency and fairness, offering students a comprehensive understanding of PBA examination.

All the practicals have been aligned with their corresponding SLOs marked summative for PBA. The purpose of this alignment is to explain how the practicals relate with their corresponding summative SLOs for PBA.

Instructions for paper setters have also been included before the PBA model question paper, providing self-explanatory guidance on the selection and nature of each question which is part of the model paper.



PRACTICAL BASED ASSESSMENT (PBA) COMPOSITE

Physics HSSC Level for Annual Examination 2027 & onwards

Physics Curriculum (2022-23)-Scheme of Studies 2024



Guidelines/instructions for Students/Teachers/Paper Setters

- i. This PBA paper consists of two sections i.e section A and B.
- ii. The weightage of section A is 60% i.e 24 marks, while that of section B is 40 % i.e 16 marks.
- iii. Section A includes Major Practicals. This section contains three questions, each of 8 marks and containing sub-parts. Each question tests a single practical and focuses on student's performance, calculations, procedures, or observations.
- iv. Section B includes Minor Practicals. This section also contains three questions. One question is of 6 marks and other two are of 5 marks each. Each question may be based on single or multiple practicals.
- v. In Practical Based Assessment (PBA), there are no marks for practical notebooks and viva voce. However, students may record procedures, observations, apparatus and calculation etc on any type of plain papers/work sheets / practical folders for their future memory of all aspects of practical performance in order to attempt the PBA Examination amicably.
- vi. It should be noted that performance of all the prescribed practicals is mandatory in the laboratory during the whole academic session because only those students will be able to attempt the PBA who have performed the practicals in the laboratory as per requirement of each practical.
- vii. MCQs will not be included/assessed in the Practical Based Assessment paper.
- viii. Questions carrying 0.5 mark will not be included/assessed as single part in any section of the PBA paper.



**List of Experiments aligned with SLOs (Composite PBA)
For HSSC Annual Examination 2027 & onwards
Physics Curriculum (2022-23) - Scheme of Studies 2024**



Note: In the Practical-Based Assessment (PBA), questions will be taken/developed from the list of experiments provided below, aligned with the summative SLOs listed in the corresponding column.

Section A (60% of practical marks 24 Marks)

No.	List of Experiments	Aligned SLOs
Major Practicals	1. Measure the volume of a small spherical object using screw gauge and calculate the uncertainty in the result.	[SLO: P-11-A-05] Analyze and critique the accuracy and precision of data collected by measuring instruments. [SLO: P-11-A-06] Assess the uncertainty in a derived quantity [By simple addition of absolute, fractional or percentage uncertainties] [SLO: P-12-N-06] Show uncertainty estimates, in absolute terms, beside every value in a table of results
	2. Determine the radius of curvature of convex lens using a spherometer and calculate uncertainty in the result.	[SLO: P-11-A-05] Analyze and critique the accuracy and precision of data collected by measuring instruments. [SLO: P-11-A-06] Assess the uncertainty in a derived quantity [By simple addition of absolute, fractional or percentage uncertainties] [SLO: P-12-N-15] Calculate uncertainty estimates in derived quantities
	3. Investigate the fall of spherical steel ball through a viscous medium and determine Coefficient of viscosity of the fluid.	[SLO: P-11-B-42] Describe how viscous forces in a fluid cause a retarding force on an object moving through it.
	4. Study stationary waves using Melde's apparatus and calculate the frequency of AC source.	[SLO: P-11-D-12] Explain the formation of harmonics in stationary waves.
	5. Determine the wavelength of sound in air using stationary waves and to calculate the speed of sound at 0°C using resonance tube.	[SLO: P-11-D-10] Illustrate experiments that demonstrate stationary waves [using microwaves, stretched strings and air columns (it will be assumed that end corrections are negligible; knowledge of the concept of end corrections is not required)].
	6. Compare the emf of cells using potentiometer.	[SLO: P-11-E-23] State and use the principle of the potentiometer as a means of comparing potential differences.
	7. Determine the time period, frequency and angular frequency of simple pendulum by varying its length.	[SLO: P-11-D-03] Express the period of simple harmonic motion in terms of both frequency and angular frequency.

	8. Determine the relation between current and capacitance for different combinations of capacitors in AC circuits.	[SLO: P-12-E-06] use the capacitance formula for capacitors in series and in parallel. [SLO:P-12-E-25] Calculate the reactance of capacitors and inductors.
	9. Study the charging and discharging of a capacitor through a resistor and calculate the time constant.	[SLO: P-12-E-08] Analyze graphs of the variation with time of potential difference, charge and current for a capacitor discharging through a
		resistor [use $\tau = RC$ for the time constant for a capacitor discharging through a resistor]
	Section B (40% of practical marks 16 Marks)	
Minor Practicals	1. Calculate elastic potential energy from the load-extension graph for vertical mass spring system.	[SLO: P-11-B-28] Determine the elastic potential energy of a material. [that is deformed within its limit of proportionality from the area under the force- extension graph. Also state and use $E_p = 1/2 (kx^2)$ for a material deformed within its limit of proportionality]. [SLO: P-11-B-30] Deduce the work done from force- displacement graph.
	2. Sketch magnetic field pattern due to the currents in a long straight wire/ a flat circular coil/ a long solenoid.	[SLO: P-09-E-35] Sketch magnetic field patterns due to the currents in a long straight wire, a flat circular coil and a long solenoid.
	3. Investigate the value of 'g' by free fall method using electronic timer.	[SLO: P-12-B-07] Analyze why g is approximately constant for small changes in height near the Earth's surface.
	4. Study the input and output waveforms for half wave rectification using CRO. (Questions will not be asked from CRO)	[SLO: P-12-E-19] explain the use of a single diode for the half-wave rectification of an alternating current.
	5. Study the input and output waveforms for full wave rectification using CRO. (Questions will not be asked from CRO)	[SLO: P-12-E-20] explain the use of four diodes (bridge rectifier) for the full-wave rectification of an alternating current.
	6. To study variation of electric current with intensity of light using photoelectric apparatus.	[SLO: P-12-F-06] describe that photoelectron may be emitted from a metal surface when it is illuminated by electromagnetic radiation. [SLO: P-12-F-07] Describe and use the terms threshold frequency and threshold wavelength [SLO: P-12-F-08] Explain photoelectric emission in terms of photon energy and work function energy [SLO: P-12-F-09] State and apply $hf = \phi + \frac{1}{2} m V_{\max}^2$ [SLO: P-12-F-10] Explain why the maximum kinetic energy of photoelectrons is independent of intensity, whereas the photoelectric current is proportional to intensity



MODEL PHYSICS PBA PAPER (COMPOSITE HSSC)
For HSSC Annual Examination 2027 & onwards
Physics Curriculum (2022-23)-Scheme of Studies 2024



Total Marks: 40

Time: 2:30 hours

Note: Attempt all questions and write within provided spaces on E-sheet.

SECTION-A (24 Marks)

Q.1 This question is about the experiment “Compare the emf of cells using potentiometer.”.

- Draw circuit diagram to compare emfs of two cells by using potentiometer and label the components of circuit? (01+02)
- Table below shows some values obtained using the null deflection method. Copy and complete the missing entries in the given table. (02)

No. of Observations	Balancing Length For 1 st Cell of emf E_1 $l_1(\text{cm})$	balancing Length For 2 nd Cell of emf E_2 $l_2(\text{cm})$	$\frac{E_1}{E_2} = \frac{l_1}{l_2}$
1.	271	275	
2.	280	283	
3.	285	289	
4.	289	292	

- Write a precaution that should be kept in mind while performing above experiment. (01)
- The potentiometer wire must be long and have uniform thickness, why? (02)

Q.2 This question is about investigating the motion of a spherical steel ball falling through a viscous medium and determining the coefficient of viscosity of the fluid.

A steel ball is dropped in a long, transparent graduated measuring cylinder filled with glycerine. Students are asked to calculate terminal velocity of the steel ball and finally calculate coefficient of viscosity of glycerine using the data given below:

- Diameter of steel ball = 6 mm
 - Density of steel ball, $\rho_s = 8000 \text{ kg m}^{-3}$
 - Density of glycerin, $\rho_g = 1260 \text{ kg m}^{-3}$
 - Acceleration due to gravity, $g = 9.8 \text{ m s}^{-2}$
- i. Complete the following observations and calculations. (01+03)

Radius of the ball = $r =$ _____ cm = _____ m

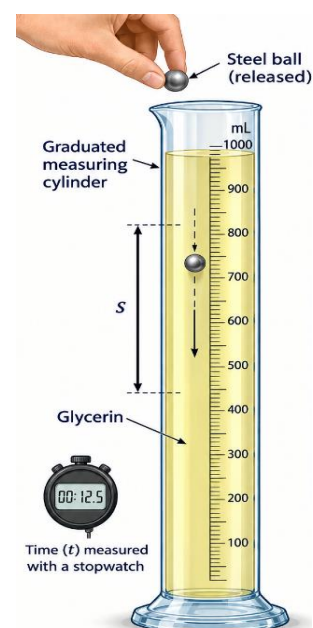


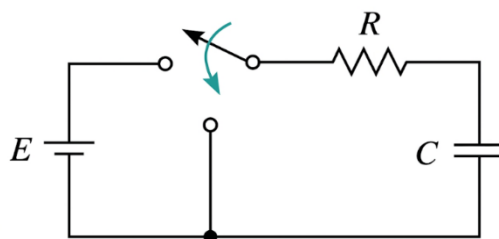
Figure Q.2

No. of observations	Distance of fall S(m)	Time taken t(s)	Terminal velocity $v = S/t$ (m/s)	$\eta = \frac{2r^2g(\rho_s - \rho_g)}{9v}$ ($\text{kgm}^{-1}\text{s}^{-1}$)
1.	0.15	0.9		
2.	0.20	1.4		
3.	0.30	2.4		

- ii. Why do we allow the steel ball to fall some distance in glycerine before start taking measurement? (01)
- iii. Why does net force on the steel ball become zero when it moves with terminal velocity? (02)
- iv. In this experiment, glycerine is replaced with kerosine oil; what will be effect on terminal velocity of the steel ball? (01)

Q.3 This question is about studying the both charging and discharging of a capacitor through a resistor and calculating the time constant.”

A student records the voltage across the capacitor (V_c) during both its charging and discharging at fixed time intervals (t). The observation data is tabulated below:



Observations of this experiment are given below:

Resistance= $R = 33\text{k}\Omega$

Capacitance= $C = 47\mu\text{F}$

No. of observations	Time t (s)	Voltage across the Capacitor V_c (V)	
		During Charging	During Discharging
1.	0	0	6.0
2.	1	2.85	3.15
3.	2	4.34	1.66
4.	3	5.13	0.87
5.	4	5.54	0.46
6.	5	5.76	0.24
7.	6	5.87	0.13

- i. Plot a neat, properly scaled graph of capacitor voltage (V_c) against time (t) for both the charging and discharging cycles on the same graph sheet provided. Label both curves clearly. (01+01+01)
- ii. Calculate the theoretical time constant (τ_{th}) of the circuit using the given values of resistance (R) and capacitance (C). Show complete calculation with units. (01)
- iii. Determine the experimental time constant (τ_{exp}) directly from your plotted graph and show extrapolation lines on your graph for it. (01+01)
- iv. Compute the percentage error between your graphical value (τ_{exp}) and theoretical value (τ_{th}). (02)

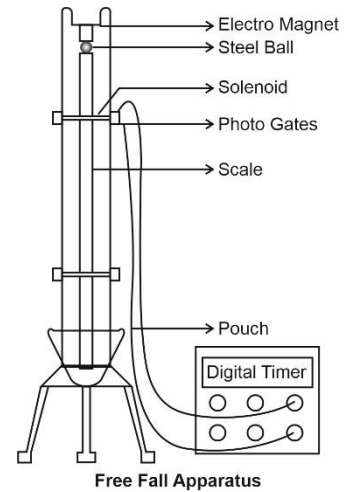
SECTION-B (16 Marks)

Q.4 Investigate the value of 'g' by free fall method using electronic timer.

With the help of electronic timer, students measure the distance and time of free fall by repeating procedures with same steel ball for different heights and recorded readings given in following table.

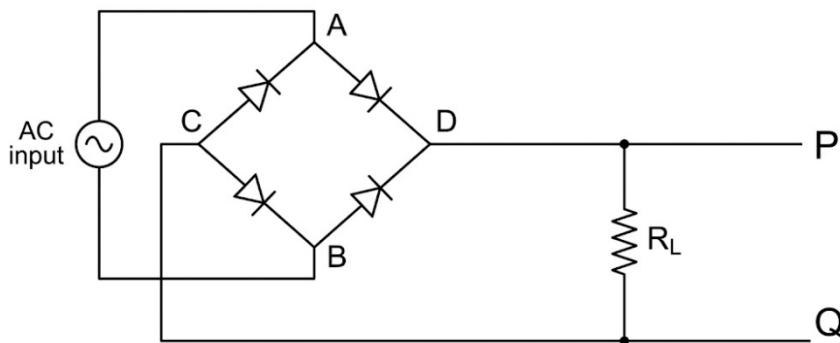
- i. Copy and complete the table. (03)

No. of obs.	Height h (cm)	Time (s)		Average time t (s)	t^2 (s ²)	$g = 2h/t^2$ (cms ⁻²)
		t ₁	t ₂			
1	30	0.25	0.25			
2	45	0.28	0.29			
3	65	0.34	0.36			



- ii. Calculate the mean value of g. (01)
- iii. How do we magnetize steel ball in this experiment? (01)
- iv. How does air resistance affect the result? (01)

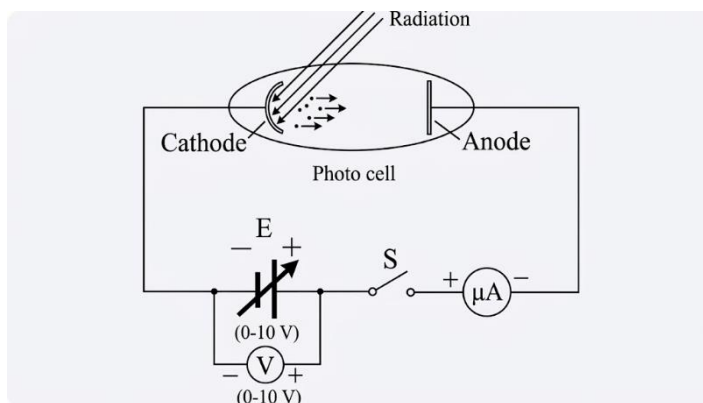
Q.5 A circuit shows a bridge rectifier connected to an AC supply. The terminals P and Q are connected to CRO circuit.



- i. Draw the shape of input and output waveform displayed on CRO. (02)
- ii. At output PQ (from CRO) peak value of voltage 'V_o' is 8V. What is its V_{rms} value? (01)
- iii. What is the ripple frequency of a full-wave rectifier compared to the input AC supply? (01)
- iv. If the mains input time period is 0.02 s, what is the time period of output waveform after full-wave rectification? (01)

Q.6 To study variation of electric current with intensity of light using photoelectric apparatus.

A schematic diagram is shown below to study the variation in electric current with the intensity of light using photocell. Data is recorded and mentioned in the table where “d” is the distance of a light source from the photocell and “I” is the current flowing in the



circuit.

- i. Copy and complete the table (02)

No. of observations	Distance d (cm)	Current I (μA)	Intensity of light $I \propto \frac{1}{d^2} (\text{cm}^{-2})$
1	60	15	
2	50	25	
3	40	45	
4	30	70	

- ii. Plot the graph between current and intensity of light according to data provided. (03)



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For more information, please visit
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