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DEVELOPMENT AND VALIDATION OF GRADE 10 SCIENCE LEARNING MATERIALS IN SELECTED SECONDARY SCHOOLS IN DISTRICT III, DIVISION OF PUERTO PRINCESA CITY, PHILIPPINES

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ABSTRACT

Introduction: With the recent implementation of the K-12 curriculum in the Philippines, teachers are challenged to develop relevant, research-based, and responsive instructional materials.

Purpose: The main purpose of this study was to develop and validate learning material in physics based on selected least mastered competencies for tenth grades. The researcher developed a set of learning material which covers the topic mirror and lenses.

Methodology: This study utilized the descriptive-developmental research focus on the development of instructional material. Mean and Mean Percentage Score (MPS) used to analyse descriptive data. Instructional materials support learning content, allow students to engage in the concepts application and provide an opportunity for evaluation. They are developed to help teachers facilitate learner's prior knowledge, assist them to process and understand the new learning, and eventually aid them apply newly acquired knowledge to their practical lives.

Results: The result of the study showed that students has low mastery in the topic light, specifically in mirror and lenses. The developed set of learning materials was anchored to the ADDIE model: the Analysis, Design, Development, Implementation, and Evaluation.

Recommendations/Classroom Implications: Teachers should develop learning materials based on the least mastered competencies of the students. The proposed learning materials is recommended for use in Grade 10 Physics classes. Further, the proposed learning materials should be subjected for further research to determine its effectiveness in improving the performance of students in science 10 Physics.

Keywords: development, validation, learning material, competency, and light

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PUBLIC INTEREST STATEMENT

This study is of utmost importance to secondary school students, science teachers and lecturers, the department of education in the Philippines and the stakeholders in the education sector of the country in terms of providing an insight into students' performance in the subject competency.

INTRODUCTION

A basic understanding of science is vital for everyone because science and technology have become relevant to different enterprises. The fast-paced changing world and the challenges of the Fourth Industrial Era continue to transform the educational landscape of today. Educators are challenged by the demanding task of educating Generation Z to keep them abreast with digital world (Rogayan & Dollete, 2019). Because of the scientific nature of today's society, individuals and society are expected to be scientifically literate in order to function effectively and to meet the demands of the time.

The Philippine government has laid the educational responsibility of developing its individuals to the optimum in their physical, mental, social, emotional and moral aspects on the school. Such tasks include the development of scientific culture among the youths through scientific, technological and vocational skills. Science learning, at the helm of the 21st century, is confronted with the relevance of science and technology to the societal needs and demands. In its concordance to relevance, science learning is paramount to reshape the mental cognition of students towards academic performance and the acquisition of the desired competencies, e.g subject specific skills and general and transferable scientific skills (Lavigne, Vallerand & Miquelon, 2007; Bautista, 2013).

Globally, the Philippines lag behind other countries in terms of the quality of education, particularly in science education. According to the World Economic Forum (2018), the Philippines ranked 55th out of 137 participating countries in terms of higher education and ranked 76th out of 137 countries in the quality in math and science education. Beihler and Snowman, (2006) suggested that teachers can do something in motivating students to learn. It is the responsibility of teachers to make every subject interesting and make learning active, investigative, adventurous, social and useful as possible. They can do these by analyzing the learning experiences that students respond to with interest when they are given the opportunities to make free choice. Subjects become appealing to students if they are given the opportunity to manipulate and construct things, observe, investigate, use their mental ingenuity in solving problems or puzzles and create their own designs in working problem at hand. The different process skills mentioned can be of great help in creating or stimulating interests in science as a learning area.

The state of science education today is influenced by several problems specifically the issue of inadequate instructional materials and teaching tools aligned to the learning outcomes prescribed by the department of education (DepEd). Teachers find it difficult to teach some science concepts and principles due to the scarcity of relevant, responsive and research-based learning materials. According to Jalmasco (2014), lack of science education facilities is reflected in the poor quality of basic science and math education seen by the low achievement scores of Filipino students in various tests. In addition, instructional materials that are aligned to the target competencies are lacking. Instructional materials for K-12 school science include textbooks, laboratory manual, and other books about scientific matters, kits, software, CDs and other multimedia materials for specific inquiry-based lesson. Not only are these materials a primary source of classroom science learning, but also because of professional development for teachers.

The development of learning materials that foster inquiry is an

emphasis of curricular reform in K-12 science because inquiry has become the core element of science education over the past few decades (Meyer, Nabb, Connell & Avery, 2013; Trumbell, Bonney & Grudens-Schuck, 2005). However, there are very few studies conducted on the development and validation of the workbook for junior high school science. Instructional materials support learning content, allow students to engage in the concepts application and provide an opportunity for evaluation. They are developed to help the teachers facilitate learner's prior knowledge, assist them to process and understand the new learning, and eventually aid them apply newly acquired knowledge to their practical lives. The availability and efficiency of instructional materials in teaching is a factor to be considered to determine the effectiveness of a science and mathematics curriculum. Instructional materials and aids, such as textbooks, reference books, tables of information, periodicals and magazines, mathematical instruments and computers are strengths of mathematics curriculum to promote research readiness (Cabido, 1992). In response to this, the researcher feels the need to develop supplementary learning materials that will enhance students learning in science 10. The learning materials could serve as the teacher's partner in imparting knowledge to the students.

STATEMENT OF THE PROBLEM

It is a fact that most Grade 10 Junior High School students find physics difficult to understand. This may be accounted to the use of mathematics as its language which requires skills in computation. Misunderstandings and misconceptions among students arise when physics concepts are not properly explained. The cause of students' low science literacy is directly and closely related to the students, which is the lack of learning materials. Learning materials are very important in conducting the process of teaching and learning activities. Instructional materials help learners to understand the lesson better. Learning was difficulty to achieve and individual differences are hardly monitored especially when a classroom has a great number of students.

RESEARCH QUESTIONS

This study intends to develop a learning material based on the least-mastered competencies of the students in Science 10. Specifically, it sought answers to the following questions:

1. What is the level of competency of the students along the following content areas:
   - Lenses,
   - Mirror?
2. How can the learning manual be developed?
3. What is the proposed learning material?
4. What is the evaluation of the teachers on the proposed developed learning material?

METHODOLOGY

Research Design

This study utilized the descriptive-developmental research focus on the development of instructional or learning materials in the form of a supplementary material to facilitate learning of the least-mastered concepts and skills of students in the Junior High School. As cited by Aquino (2011) descriptive method involves collection of data in order to answer questions concerning the current status of the subject of the study. The developmental method was also used since a learning material in Physics for grade 10 students was developed in this study.

POPULATION AND SAMPLE

The respondents of this study are the grade 10 Junior High School students of District III, City division of Puerto Princesa who were officially enrolled during the school year 2019-2020. Total enumeration was used in this study. The distribution of the respondents is presented in Table 1.

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Table 1: Distribution of the Respondents

School	Male	Female	Total
F. Conde High School	10	29	39
Babuyan NHS	34	29	63
San Rafael NHS	48	25	73
Langogan NHS	40	28	68
Marcelino Javarez NHS	40	31	71
TOTAL	172	142	314

Instrument for Data Collection

The researcher was granted permission by School Division Superintendent of Puerto Princesa City Division to conduct questionnaire distribution to selected schools in District III. A request letter was presented to the school head or principal to gather data needed in the study.

Method of Data Analysis

The instrument used in this study was a researcher-made questionnaire. A physics achievement test (see appendix) along Light was developed by the researcher based on the K to 12 Curriculum Guide in Grade 10 Science. First draft was constructed and presented to the master teachers for corrections, revision and improvement. After the corrections and suggestions given in the first draft were incorporated, it was presented again to the validators for further verification and assessment.

The test consisted of 30 multiple choice questions. Questions 1 to 15 determined the level of competency of the students along Lenses and questions 16 to 30 determined the level of competency of the students along Mirror.

Based on the content evaluation done by the validators, the test was rated as Very Highly Valid with a mean score of 4.93. A number of items were revised as suggested by the evaluators. To determine the content validity of the assessment instrument, the following scale was used. The content validity of the assessment instrument is presented in Table 2.

Table 2: Content validity of the assessment instrument

Numerical Value Equivalent	Statistical Range	Descriptive
5	4.50-5.00	Very Highly Valid
4	3.50-4.49	Highly Valid
3	2.50-3.49	Moderately Valid
2	1.50-2.49	Poorly Valid
1	1.00-1.49	Not Valid

RESULTS

Research Question 1: What is the level of competency of the students along the following:

a. Lenses, and
b. Mirror?

Level of Competency of the Students along Light. Tables 3, 4 and 5 present the level of performance of the students along lenses and mirrors.

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Table 3: Level of Competency of the Students along Lenses

School	Mean	MPS	Description Rating
F. Conde High School	3.82	25.47	Low Mastery
Babuyan NHS	3.51	23.39	Low Mastery
San Rafael NHS	3.44	22.92	Low Mastery
Langogan NHS	3.49	23.24	Low Mastery
Marcelino Javarez NHS	3.34	22.25	Low Mastery
Overall	3.52	23.45	Low Mastery

It can be gleaned from the table that the students have low mastery level along Lenses with a mean of 3.52 and a mean percentage score of 23.45. F. Conde High School has the highest mean percentage score of 25.47 followed by while Babuyan National High School (MPS = 23.39). Marcelino Javerez National High School got the lowest mean percentage score of 22.25.

Table 4: Level of Competency of the Students along Mirror

School	Mean	MPS	Description Rating
F. Conde High School	4.08	27.18	Low Mastery
Babuyan NHS	4.05	26.98	Low Mastery
San Rafael NHS	3.97	26.48	Low Mastery
Langogan NHS	4.25	28.33	Low Mastery
Marcelino Javarez NHS	3.93	26.20	Low Mastery
Overall	4.06	26.18	Low Mastery

As shown in Table 4, the students also have low level of mastery along mirror with a mean score of 4.06 and mean percentage score of 26.18. Langogan National High Schcool has the highest mean percentage score of 28.33, followed by F. Conde High School (MPS = 27.18). Marcelino Javerez National High School got the lowest score mean percentage score of 26.20.

Table 5: Overall Level of Competency of the Students along Light

Science Topic	Mean	MPS	Description Rating
Lenses	3.52	23.45	Low Mastery
Mirror	4.06	26.18	Low Mastery
Overall	3.79	24.82	Low Mastery

As shown in Table 5, the students have low level of mastery in the overall, with a mean score of 3.79 and mean percentage score of 24.82. It is a fact that most high school students find physics difficult to understand. Misunderstandings and misconceptions among students arise when physics concepts are not properly explained. An instructional material will help learners to understand the lesson better, especially when a classroom has a great number of students, learning is difficult to achieve and individual differences are hardly monitored ("What Makes Physics Difficult?" 2008).

Research Question 2: How can this learning material be developed?

The success of curriculum is the availability of instructional materials used in teaching. The aim of education is to determine the curriculum, the kind of teaching procedure and instructional materials that should be used in the classroom. The curriculum has to meet all the experience of the child in and out of the school for which the school is responsible (Bauzon, 2009). Teaching materials, which are "tools of the trade", must measure up the rigorous demands of daily instruction (Kim, 2006). Teachers must be able to place students in proper curricular materials, detect instructional tactics that will enhance learning, maintain motivation, correct shortcomings of materials and monitor student performance.

The development of the learning material followed the ADDIE model. The Analysis, Design, Development, Implementation, and Evaluation (ADDIE) is an acronym for ADDIE. This model guides the process of creating effective educational courses and materials for your audience (Instructional Design, 2015). It is an instructional design model that has withstood the test of time and use. It is simply a device to help us think through a course's design. The following phases were followed in the study based on the ADDIE model:

Phase 1. Analysis: A diagnostic test among 314 Grade 10 students was conducted Second Semester of SY 2019-2020. This was to determine the least mastered competencies in Science, specifically in the topic light, which became the basis of the activities included in the learning activities.

Phase 2. Design: The researcher formulated the learning objectives, assessment instruments, and content of each of the worksheets. Each worksheet contains the following parts: Introductory statement, learning objectives, materials, directions, questions and conclusion.

Phase 3. Development: The researcher started by writing the list of learning materials list. Activities that were included are student-centered and reflective in nature.

Phase 4. Implementation: The researcher subjected it to an expert validation to gauge the learning materials face and content validity based on the content, format, presentation and organization, and accuracy and up-to-datedness of information. Five experts were requested to complete the expert validator's form.

Phase 5. Evaluation: Experts' verbal suggestions and comments were taken into consideration for the revision of the material. The revised learning activities was then subjected to final evaluation.

Research Question 3: What is the proposed learning material?

Results of the students' diagnostic test in Science Grade 10 topic Light served as the basis for the selection of concepts to be included in the learning activities. The activities were included based on the least learned competencies, as indicated in the diagnostic test. The developed learning activities was first subjected to expert validation. Design, development, or even selection of instructional materials can be quite challenging depending on the subject, goals, target audience, context, and so on (Şendurur, Ersoy, E., & Çetin, 2016).

The developed learning manual consists of eight (8) learning activities. It contains enrichment exercises which can expand the knowledge and understanding of the JHS students on the basic concepts of topic light (lenses and mirror). The topics included in this workbook were aligned with the competencies required in the K-12 curriculum.

The developed learning manual follows the same components, which are congruent with each other. Each worksheet has an introductory paragraph to give students the idea of what topic they are working on. The learning

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outcomes spell out the targets that should be attained after performing different activities specified in the learning tasks.

Research Question 4: What is the evaluation of the teachers on the proposed learning material as to:

a. Content,
b. Format,
c. presentation and organization, and
d. accuracy and up-to-datedness of information?

Evaluation of the Teachers on the Proposed Learning Material

The developed learning material was evaluated independently by five (5) evaluators who are science teachers using the "Educational Quality Evaluation Print Materials" by Learning Resource Management and Development Standards of Department of Education. The Evaluators utilized the Evaluation Rating Sheet (Section 6.4) and associated Descriptors (Section 6.4.1) for Print Materials, to assess suitability of materials for use in public schools and to ensure that they are free of errors. The rating sheet includes criteria on the following: a) Content, b) Format, c) Presentation and Organization, and d) Accuracy and up-to-datedness of information.

Table 6: Factor 1: Content Quality of the Learning Materials

Indicators	Mean	Remark/s
1. Content is suitable to the student's level of development.	4.00	Very satisfactory
2. Materials contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended.	4.00	Very satisfactory
3. Materials provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	4.00	Very satisfactory
4. Material is free of ideological, cultural, religious, racial, and gender biases and prejudices.	4.00	Very satisfactory
5. Material enhances the development of desirable values and traits such as: (Put a check mark only to the applicable values and traits).	4.00	Very satisfactory
6. Material has the potential to arouse interest of target reader.	4.00	Very satisfactory
7. Adequate warning/cautionary notes are provided in topics and where safety and health are of concern.	3.80	Very satisfactory
Overall Mean	**27.80**	**Passed**

*Resource must score at least **21 points** out of a maximum **28 points** to pass this criterion.

As shown in Table 6, the content quality of the learning material was rated passed by the evaluators with total points of 27.80 out of 28 points. The scope, range and depth of content and topics are appropriate to the target audience learning needs. Material reinforces, enriches, and or leads to mastery of certain learning competencies. The learning activities require cognitive effort not just chance selection of responses. Presentation of social content including values and perspectives is fairly represented. Presentation of controversial social content is balanced and structured

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to promote an educated understanding of differing points of view. The material is presented in such a way that is likely to connect with the target reader's knowledge and experience. Inclusion of adequate warning / cautionary notes (where needed) is evident in the material.

Table 7: Factor 2: Format Quality of the Learning Material

Indicators	Mean	Remark/s
1. Print		
1.1 Size of letters is appropriate to the intended users.	3.80	Very satisfactory
1.2 Spaces between letters and words facilitate reading.	4.00	Very satisfactory
1.3 Font is easy to read.	3.80	Very satisfactory
1.4 Printing is a good quality (i.e., no broken letters, evenly distributed, correct alignment, properly placed screen registration).	4.00	Very satisfactory
2. Illustrations		
2.1 Simple and easily recognizable.	3.80	Very satisfactory
2.2 Clarify and supplemented the text.	3.80	Very satisfactory
2.3 Properly labelled or captioned (if applicable)	4.00	Very satisfactory
2.4 Realistic/appropriate colors.	4.00	Very satisfactory
2.5 Attractive and appealing.	4.00	Very satisfactory
2.6 Culturally relevant.	3.80	Very satisfactory
3. Design and Layout		
3.1 Attractive and pleasing to look at.	4.00	Very satisfactory
3.2 Simple (i.e., does not distract the attention of the reader)	4.00	Very satisfactory
3.3 Adequate illustration in relation to text.	4.00	Very satisfactory
3.4 Harmonious blending of elements (e.g., illustrations and text)	4.00	Very satisfactory
4. Paper and Binding		
4.1 Paper used to contributes to easy reading	4.00	Very satisfactory
4.2 Durable binding to withstand frequent use.	4.00	Very satisfactory
5. Size and Weight of Resource		
5.1 Easy to handle.	4.00	Very satisfactory
5.2 Relatively light.	4.00	Very satisfactory
Overall Mean	**71.00**	**Passed**

*Resource must score at least **54 points** out of a maximum **72 points** to pass this criterion

As shown in Table 7, shows that the format quality of the proposed learning material was rated *Passed* by the evaluators with total points of 71.00 out of 72 points. It shows that this material meets the indicators as to print, illustrations, design and layout, paper and binding, and size and weight of resource. Size of letters is appropriate to the intended user. Simple and easily recognizable. Simple (i.e., does not distract the attention of the reader). Paper used contributes to easy reading. Easy to handle. Components are packaged for easy handling.

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Table 8: Factor 3: Presentation and Organization of the Learning Material

Indicators	Mean	Remarks/s
1. Presentation is engaging, interesting, and understandable.	4.00	Very satisfactory
2. There is logical and smooth flow of ideas.	4.00	Very satisfactory
3. Vocabulary level is adapted to target reader.	4.00	Very satisfactory
4. Length of sentences is suited to the comprehension of the target reader.	4.00	Very satisfactory
5. Sentences and paragraph structures are varied and interesting to the target reader.	4.00	Very satisfactory
Overall Mean	**20.00**	**Passed**

*Resource must score at least **15 points** out of a maximum of **20 points** to pass this criterion.

As shown in Table 8, the content quality of the proposed learning material was rated *Passed* by the evaluators with total points of 20.00 out of 20 points. The presentation promotes engagement and supports understanding by the target user. The logic of presentation of ideas is clear and evident to the target user. Vocabulary used is suitable / appropriate to the target reader age and level. Length of sentences is suitable to the target reader. Language structures enhance meaning making.

Table 9: Factor 4: Accuracy and Up-to-Datedness of Information of the Learning Material

Indicators	Mean	Remark/s
1. Conceptual errors.	4.00	Very satisfactory
2. Factual errors.	4.00	Very satisfactory
3. Grammatical errors.	4.00	Very satisfactory
4. Computational errors.	4.00	Very satisfactory
5. Obsolete information.	4.00	Very satisfactory
6. Typographical and other minor errors (e.g., inappropriate or unclear illustrations, missing labels, wrong captions, etc.).	4.00	Very satisfactory
Overall Mean	**20.00**	**Passed**

*Resource must score at least **15 points** out of a maximum of **20 points** to pass this criterion.

As shown in Table 9, the accuracy and up-to-datedness of information of the proposed learning material was rated *Passed* by the evaluators with total points of 20.00 out of 20 points. It shows that the content will not lead to the development of misconceptions or misunderstanding. Presentation of factual content is accurate and up-to-date. No spelling errors. No computational error found. No obsolete information found. No outdated information- maps; inaccurate graphs, diagrams or pictures.

DISCUSSIONS

The students have a low level of competency in light with a mean percentage score of 24.82. The students have low competency in lenses and mirror. Bayle (2004) developed an activity manual for low performing fourth year students in Science and Technology IV (Physics) in the Division of Taguig and Pateros for the school year 2003-2004. For this reason, she conducted her study on how the activity manual she

developed affects the student's performance. She then concluded that the manual effectively increased the performance level of the students and was highly acceptable instructional materials as regard to its usability, adequacy, clarity, and relevance. The low level of mastery of the students in all the topics has implications for designing instructional materials and identifying pedagogical techniques which will help improve the performance of the students. Thus, the need to propose a learning material in Science 10.

The development of the learning material followed the Analysis, Design, Development, Implementation, and Evaluation or the ADDIE model. This instructional model design guides you the process of creating effective educational courses and materials for students. Based on the least mastered competencies, a learning material was developed, which consisted of 7 learning activities as follows: Reflection of light in mirrors, looking over obstacles, Properties of images formed by a plane mirror, Relationship between the angle of incidence and the angle of reflection, bending of light in glass, making a prismatic periscope, constructing a microscope.

The material is just one instructional material that teachers and students could use in enriching students' inquiry, conceptual knowledge, and understanding in physical science. The use of other learning materials to supplement the workbook is recommended to make the learners better understand the basic concepts of physical science. Today in most K-12 classrooms, textbooks serve as the principal tool and tutor of teaching and learning and have an enormous influence on what is taught in science classrooms and how the curriculum is presented (McDonald, 2016; Pingel, 2010; Roseman, Kulm & Shuttleworth, 2001). It was assumed that well-designed inquiry-based tasks in science textbooks play an important role in supporting students' experience with scientific inquiry and developing understandings about scientific ideas (Yang & Liu, 2016). The developed learning material was rated passed by evaluators using "Educational Quality Evaluation Print Materials" by Learning Resource Management and Development Standards of Department of Education. The rating sheet includes criteria on the following: a) Content, b) Format, c) Presentation and Organization, and d) Accuracy and up-to-datedness of information.

CONCLUSION

Based on the findings of the study, the following conclusions were drawn. The study conducted in selected secondary schools in the district III of the Division of Puerto Princesa City was dominated by Male grade 10 respondents. On the other hand, in the topic lenses students have low mastery level with a mean of 3.52 and a mean percentage score of 23.45 while in the topic mirror with a mean score of 4.06 and mean percentage score of 26.18. The data shows that students have low level of mastery in the overall, with a mean score of 3.79 and mean percentage score of 24.82.

The development of the learning material followed the ADDIE model(The Analysis, Design, Development, Implementation, and Evaluation). This model guides the process of creating effective educational courses and materials for your audience (Instructional Design, 2015).

The developed learning activities was first subjected to expert validation. The developed learning material consists of eight (8) learning activities. It contains enrichment exercises which can expand the knowledge and understanding of the JHS students on the basic concepts of topic light (lenses and mirror). The learning material is valid and can be used by Grade 10 students and physics teachers to supplement the teaching-learning process.

RECOMMENDATIONS

1. Teachers should develop learning material based on the least mastered competencies of the students.

2. The proposed learning material is recommended for use in Grade 10 Physics classes.
3. The proposed learning material should be subjected for further research to determine its effectiveness in improving the performance of students in science 10 Physics.

Conflicts of Interest: The authors declare no conflict of interest

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APPENDIX
Survey Questionaire

Part I: Demographic Profile

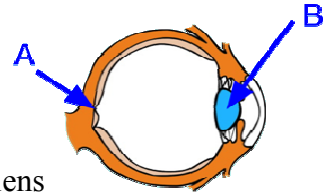
Directions: Please indicate your response to each of the items below by writing or putting a check (√) on the blank which corresponds to your answer.

Gender: _____ Male _____ Female

Part II: Questionnaire on the topic Light: Lenses

Directions: The questionnaire consist of 15 multiple choices items representing the topic LIGHT particularly on LENSES. Read each items carefully and ENCIRCLE the correct answer of your choice.

1. Identify the parts of the eye labelled A and B in the diagram.



A. A = iris, B = retina
B. A = retina, B = lens
C. A = retina, B = cornea
D. A = optic nerve, B = lens

2. An object is placed 25 cm in front of a convex mirror whose focal length is 15 cm.What will be the magnification of its image?

A. ⅓ B. 3/7 C. 60/7 **D**. 3

3. The focal length of a converging (convex) lens is equal to:

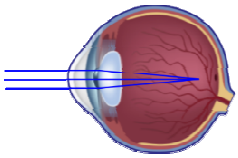
A. $\frac{v}{u}$

B $\frac{uv}{v+u}$

C. $\frac{1}{u}+\frac{1}{v}$

D. $\frac{u+v}{uv}$

4. The diagram shows rays entering a human eye. This diagram represents:

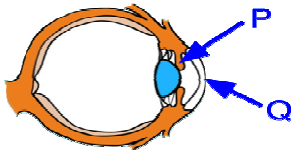


A. hyperopia B. a normal eye C. conjunctivitis D.myopia

5. The power of a convex lens of focal point 15 cm is

A. 15 B. 0.15 C. 30 D. 1/15

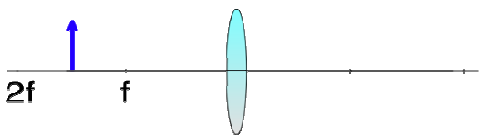
6. Identify the parts of the eye labelled P and Q in the diagram.



A.P = iris, Q = cornea
B. P = iris, Q = retina
C. P = retina, Q = cornea
D. P = cornea, Q = pupil

7. When an object is placed outside the focal point of a converging lens, the image

A. may be real and erect
B. is always virtual and erect.
C. is always magnified and virtual.
D. is always real and inverted.



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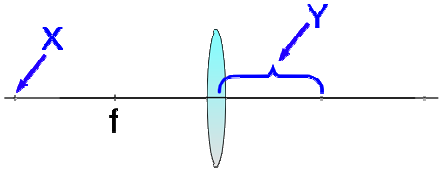
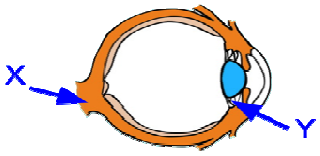
8. The diagram shows a converging (convex) lens.Identify the parts labelled X and Y in the diagram.



A. X = center of curvature, Y = focal length
B. X = focus, Y = focal length
C. X = center of curvature, Y = focus
D. X = radius of curvature, Y = principal axis

9. The image formed by a diverging lens is:
A. virtual, inverted and diminished if the object is outside the focus.
B. virtual, erect and magnified if the object is inside the focus.
C. always virtual, erect and magnified.
D. always virtual, inverted and diminished.

10. Identify the parts of the eye labelled X and Y in the diagram.



A. X = cornea, Y = ciliary muscle
B. X = optic nerve, Y = lens
C. X = retina, Y = ciliary muscle
D. X = optic nerve, Y = ciliary muscle

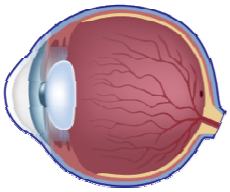
11. A converging lens is focused to give an image on a screen 5 m from the lens when the slide is 10 cm behind the lens.If the slide is 2 cm x 2 cm, the size of the image on the screen will be:
A. 50 cm × 50 cm
B. 80 cm × 80 cm
C. 100 cm × 100 cm
D. 200 cm × 200 cm

12. The image formed by a diverging lens is always
A. virtual, upright and diminished
B. real, upright and diminished
C. virtual, upright and magnified
D. virtual, inverted and diminished

13. The focal length of a converging lens is equal to:
A. the radius of curvature
B. half the radius of curvature
C. twice the radius of curvature
D. quarter the radius of curvature

14. When an object is placed inside the principal focus of a converging lens, the image formed is
A. virtual, upright and diminished
B. real, upright and magnified
C. virtual, inverted and magnified
D.virtual, upright and magnified

15. The human eye can focus objects close to it by



A. making the eye lens thicker
B. making the eye lens thinner
C. increasing the distance between the eye and lens
D. decreasing the distance between the eye and lens

Part III: Questionnaire on the topic Light: Mirror

Directions: The questionnaire consist of 15 multiple choices items representing the topic LIGHT particularly on MIRROR. Read each items carefully and ENCIRCLE the correct answer of your choice.

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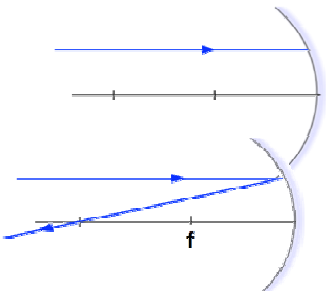
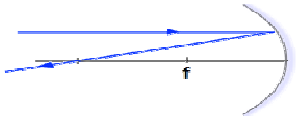
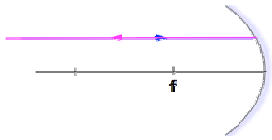
16. A very narrow light ray strikes the surface of a concave mirror as shown on the diagram.Which of the following diagrams represents the reflected ray?

A. 

B.

C. 

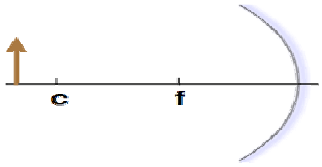
D. 

17. An object is placed 60 cm from a spherical convex mirror. If the mirror forms a virtual image 20 cm from the mirror, what's the magnitude of the mirror's radius of curvature?

A. 60 cm B. 30 cm C. 15 cm D. 120 cm

18. The diagram shows an object placed in front of a concave mirror. Where will its image be formed?

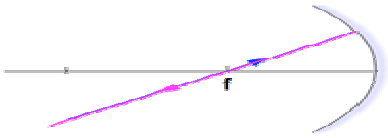
A. To the left of c
B. At c
C. At f
D.Between f and the mirror

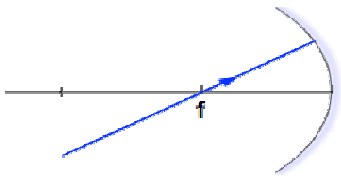


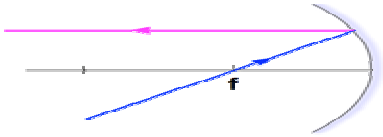
19. When a small object is placed on the principal axis of a concave mirror between the focus and the mirror, the image formed is:

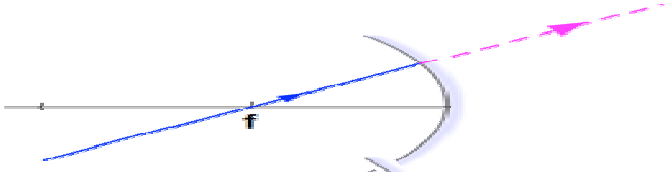
A. inverted, magnified and real
B. inverted, diminished and real
C. Inverted, diminished and virtual
D. erect, magnified and virtual

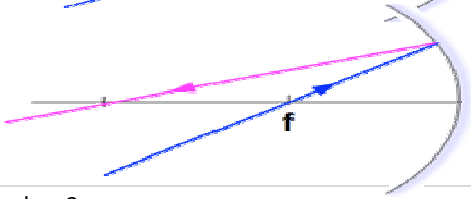
20. A very narrow light ray strikes the surface of a concave mirror as shown on the diagram. Which of the following diagrams represents the reflected ray?

A. 



B. 

C. 

D. 

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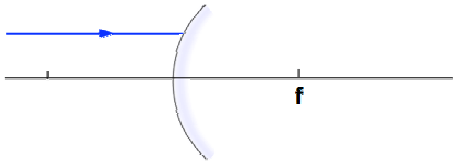
21. Which one of the following statements regarding a convex mirror is **incorrect**?

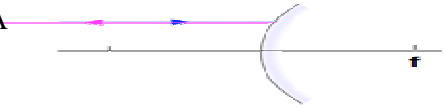
A. It gives a wide field of view
B. It always gives a real image
C. It always gives a diminished image
D. It always gives an erect image

22. A very narrow light ray AB strikes the surface of a convex mirror as shown on the diagram.

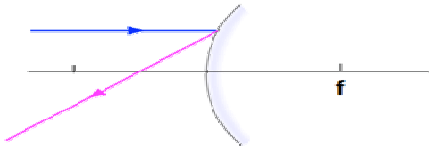


Which of the following diagrams represents the reflected ray?

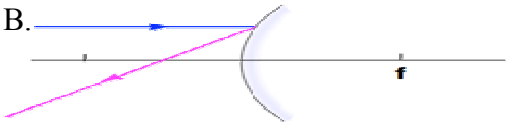
A



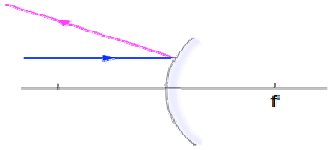
C.



B.



D.

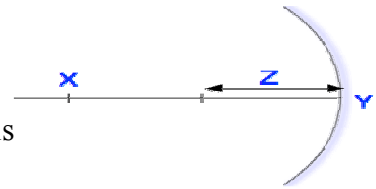


23. If a man's face is 30 cm in front of a concave shaving mirror creating an upright image 1.5 times as large as the object, what is the mirror's focal length?

A. 18 cm B. 12 cm C. 20 cm D. 90 cm

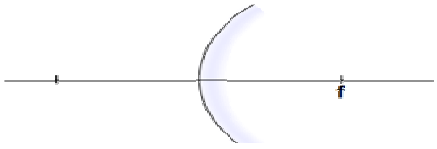
24. The diagram shows a concave mirror.Identify the labelled parts.

A. X = focus, Y = principal axis, Z = focal length
B.X = centre of curvature, Y = pole, Z = focal length
C. X = radius of curvature, Y = focus, Z = principal axis
D. X = centre of curvature, Y = pole, Z = focus



25. The image in a convex mirror is always

A. real, erect and magnified
B. virtual, erect and diminished
C. virtual, inverted and diminished
D. virtual, erect and magnified



26. An object is placed at a distance of 2*f* from a concave mirror of focal length *f*.The magnification of the image is

A. 2 B. 1 C. 1½ D. ½

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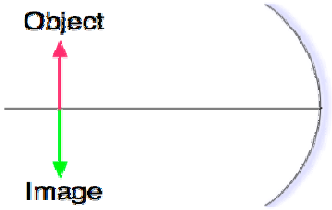
27. Concave mirrors are used as rear view mirrors in cars because:

(i) they have a wide field of view
(ii) the image is always virtual
(iii) the image is always diminished
(iv) the image is always erect

Which of these reasons is/are correct?

A. (ii) and (iii) B.(i) and (iv) C. (ii) and (iv) D. (i) and (ii)

28. Student using a concave mirror, locates an inverted image, the same size and at the same position as the object.Which one of the following conclusions is justified?



A. The object is at the focus of the mirror.

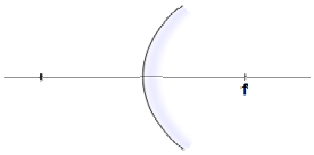
B. The object is nearer to the pole of the mirror than it is to the focal point.

C. Only rays parallel to the principal axis can form a real image.

D. The object is at the center of curvature of the mirror.

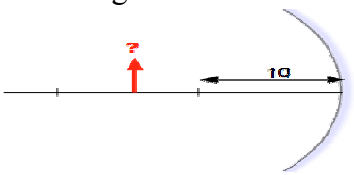
29. A convex mirror produces a virtual image when the object is

A. between the center of curvature and the focus
B. at the focus
C. inside the focus
D.anywhere in front of the mirror



30. How far in front of a concave mirror of focal length 10 cm, would you place a 2cm pin in order to obtain an erect image 4 cm in height?

A.15 cm
B. 25 cm
C. 30 cm
D. 10 cm



END OF THE TEST
THANK YOU FOR YOUR COOPERATION