



Diagrams and Graphs in Physics: Students' Cognizance Problems

Maryam^a, Muhammad Zulfiqar Ali^b, Noori Gul^c, Nusrat Anjum^d, Reema Bibi^e

^aSST, Elementary & Secondary Education Department, Khyber Pakhtunkhwa. ^bePST, Elementary & Secondary Education Department, Khyber Pakhtunkhwa. ^cM. Phil Scholar, Department of Education, Abdul Wali Khan University Mardan. ^dPET, Elementary & Secondary Education Department, Khyber Pakhtunkhwa.

*Email: sstmar15@gmail.com

Abstract: This study aims at the investigation of student's problems in understandings diagrams and graphs in the high schools of district Mardan. Objectives of the study were to assess students' attitudes towards diagram and graphs, to find difficulties in understandings diagrams and graphs, to find the nature of difficulties in students physics work and to investigate reasons about complexity of graph and diagrams. Research design is qualitative in nature. Qualitative method was used to understand participant experience with error analysis. The study was conducted in district Mardan. Random sampling techniques were used to collect qualitative data. Participant of the study was 240 students of grade 9th from four selected schools in which two schools were selected from public sector and two from private sector. 60 students were selected from each school. Content analysis was used to identify student's error. Data was collected through interview or test from 40 students of Grade 9th. Finding was obtained after analysis of data; conclusion was drawn and recommendations were made accordingly.

Key words: diagrams and graphs, content analysis, attitudes, dimensional geography

1. Introduction

A drawing is a specifically direct question representation because it exploits dimensional geography in a significant habit, permissive complex processes and structures expected presented holistically. Therefore, it is detracting to attempt studies to decide the custom of diagram likenesses in differing positions of physics methods and recognize issues that cannot resolve. For pupils in all fields of skill, understanding drawings and graphs is essential, specifically physics. In physics courses, a lot of scholar troubles using diagram understanding were recorded and raise (mainly kinematics) However, the physics research results were corresponding, showing the appearance of related undergraduate issues in two together rules. Student challenges accompanying graphs were classified as pause-point confusions, slope-climax confusions, and emblematic confusions by Leonhardt, Zaslavsky, and Stein. Iconic disorientation is frequently associated with more immature pupils; nevertheless, possibly seen in earlier groups, containing academy students. It is containing the pupils' wrong understanding of the diagram as a real operation countenance. Students the one struggle with this will see a bowed speed vs. time diagram, for instance, as signifying motion along a bent course. Instead of a representative presentation of an abstract network betwixt the variables on allure pivot, these students visualize a concrete exact likeness bodily motion. As a consequence, when the variables just on point around which something revolves change, society will misunderstand of why the graphs endure change, what they will commonly anticipate the diagram to stay alike. Instead, the event that pupils registered the skill to employ a difference of methods for thinking about graphs, the popular method in

the physics rule favored expected the application of kinematics formulae. Students chosen the use of formulae as their basic form for calling physics troubles in all field of concern questions. The use of erroneous or inappropriate formulae surpassed bureaucracy to many wrong ends on physics materials, even when computations were optional. It is more suggested that graduates have troubles not just accompanying diagram understanding but too accompanying including the meaning and relevance of physics formula. Instead, the event that pupils registered the skill to employ a difference of methods for thinking about graphs, the popular method in the physics rule favored expected the application of kinematics formulae. Students chosen the use of formulae as their basic form for calling physics troubles in all field of concern questions. The use of erroneous or inappropriate formulae surpassed bureaucracy to many wrong ends on physics materials, even when computations were optional. It is more suggested that graduates have troubles not just accompanying diagram understanding but too accompanying including the meaning and relevance of physics formulae.

According to our information, just these few research has tried to judge student's interpretation questions utilizing graphs in a type of circumstances and fields. As opposed to that, nevertheless, an approximate concerning this kind concede possibility specify interesting and important visions about pupil information and understanding. We establish that the accuracy replies to a question that scholars had never confronted before in an educational world was significantly above the number legitimate answers to the apparently more apparent problem of judgment the speed of an object from distance-occasion graphs, that undergraduates had encountered earlier in an educational world. Students' lower accomplishment on physics tasks was had connection with their reliance on taught physics methods (for instance, formulas). The problem of knowledge domain specialization arises not just in physics but also in Physics. The obstacle to comprehending physics is mathematical formalism and the Lacking the connection between Physics and physics. As a result, as stated in, using images and symbols in the physics learning process will considerably aid learners in understanding abstract topics. Multiple representations, according to research, can have enormous benefits for kids' learning. Graphs are an essential tool for presenting scientific data. Complex, multi-parametric connections can generally be expressed considerably more simply using graphs than with any combination of prose and tabular formats.

1.1 Research Objectives

- To assess students' attitude towards diagrams and graphs.
- To find students' difficulties in understanding diagrams and graphs.
- To find the nature of difficulties in student physics work.
- To investigate reasons about complexity of graphs and diagrams.

1.2 Research Questions

- a) What are attitudes of students towards diagrams and graphs?
- b) What type of difficulties are faced by students in understanding diagram and graph?
- c) What is the nature of difficulties in students' physics work?
- d) What are the reasons of complexity in graph and diagram?

2. Literature Review

The aim of a drama review search out support a reasoning of prior studies on the question existing. In many habits, a essay review is wanted. It will illustrate this research donates to the current methodical study of part of material world and encourage educators that they want this research (Creswell, 2007). Neidorf, Arora, Erberber, Tsokodayi & Mai (2020) many conclusive forms have taken place used to resolve file from big amounts in the way that Trends in International Mathematics and Science Study (TIMSS), and the former research on feelings and misunderstandings in physics and mathematics is all-encompassing. This picture review supports a survey of differing demonstrative models that have lied used to survey graduate attributes and feelings in mathematics and refinement and by virtue of what they balance to the procedures used in this study. An all-embracing review of former research into graduate feelings and misunderstandings in physics had network accompanying gravitational force and in mathematics had relation accompanying unbroken equating's connects the settled farce to the current pupils. Popelka, & Beitlova, (2020) Graphs are frequently used to show analytical functions, to illustrate dossier from friendly and open sciences, or to designate experimental hypotheses. With increasing importance on the happening of experimental research abilities, the help graphs and data understanding are acquiring in significance. The research complicated an eye-following experiment attended to evaluate pupil cooperate graphs in physics. Eye-

change dossier was written using the Gaze Point eye-detective. A total of 40 triennial-old age elementary school graduates aided in the research. These students were assigned into three groups by a physics educator. These groups were named PLUS, AVERAGE and MINUS. The PLUS group revealed superior results in education and contained intelligent physics pupils. The MINUS group was collected of the opposite end concerning this intelligent spectrum, whose appendages fashioned ultimate mistakes in diagram review. Maries. & Singh. (2017). An appropriate drawing is a necessary element of an answer construction process in physics problem resolving and it can revamp a likely problem into a likeness that is to say easier to exploit for answering the question. An important focus while helping preliminary physics scholars discover problem resolving search out help them acknowledge that illustration drawings facilitates question resolving. We conducted a search at which point two various interventions were executed all the while recital quizzes throughout the term in a big enrolment, algebra-located first physics course. Students were either (1) requested to solve questions at which point the diagrams were fatigued for bureaucracy or (2) definitely told to draw a drawing. A corresponding group was not given some command concerning diagrams. We grow a rule to score the question solving acting of undergraduates in different mediation groups.

Rosengrant, Van Heuvelen & Etkina (2009) Physics instruction drama recommends utilizing diversified likenesses to help juniors understand ideas and answer questions. However, skilled is little research concerning reason undergraduates use the likenesses and either those who use bureaucracy are more profitable. This study addresses these questions utilizing free-physique diagrams (explanatory likenesses secondhand in questions involving forces) as a type of likeness. We attended a two-period all-inclusive and qualitative study of undergraduates' use of free-frame drawings while resolving physics problems. We erect that when graduates are in a course that usually stresses the use of free-body drawings, the plurality of bureaucracy do use drawings on their own to help answer test questions even when they accept no credit for drawing the drawings. We further establish that juniors who draw drawings right are considerably more favorable in obtaining the right be accountable for the question. Lastly, we examined graduates to uncover their reasons for utilizing free-carcass drawings. We establish that high gaining juniors secondhand the drawings to help solve the questions and as a form to judge their work while depressed achieving pupils' only second hand likenesses as sexually transmitted disease in the problem-solving process.

2.1 What is Physics?

The composed of instruction is a consolidation of miscellaneous duplication finishes, property dialogue, pictures, equating's, graphs. Graphs have a fundamental part in physics and in physics command. An expansive article in physics management rooted the troubles of junior in command, building, and describing graphs. The use of sensors related to the scheming to manipulate opened new direction privilege inside rule of concern, bulged at assembling physics idea and expanding plan wherewithal. Two studies will be checked concern the burden of graphs calm in actual time for action or event for operation or occurrence for movement or incident for instruction. The first study welcome graduates established 15-16 fact-finding motion following a part design policeman sensor. Their instruction is legendary following those of first sickness institute junior and a group of potential secondary school instructors. The second study concerns preparatory school undergraduate's news by repairing light distribution pattern confiscated following sensors. Students were troublesome in lacking to see situated laboratories following the approval of a research located education plan concern the indicated business deliberate. Monitoring the theorist' news course accompanying route, it was apt focus an outnumbered group actual time for action or event for operation or occurrence graphs and of the awake facts air: for extending plan abilities and capabilities; for touching the processes fundamental the wonder visualized and the different presentation of the drawing seized in actual time for action or event for operation or occurrence for movement or incident; for numbering the explanation of the strength to attribute material sign to the politeness; for assembling abstract models of processes and happenings.

Most society listen legal order 'physics' and run for cover. But it's not to a degree rocket chemists! You are between physics continually, and whether you accomplish it a suggestion of correction, you use physics continually. Physics, the study of matter and strength, is an old and broad field of science. The word 'physics arises the Greek 'information of type,' and usually, the field aims to analyze and comprehend the open experiences of outer space. One act that may make an impact when you plan physics is common people controlled standards, which are charges interpreting wonders that have existed repeatedly proven and habitual. This is indeed a fundamental part of physics. Physicists act and repeat experiments, sometimes to a sickening degree, to plan these regulations and demonstrate how our cosmos everything. These societies (in the way that seriousness and Newton's laws of motion) are so completely proven that they are approved as 'realities,' and they can be used to help us conclude in what way or

manner added belongings will properly.

Physics is the erudition that restricts matter. Its influence offers to all the natural sciences, containing biophysics, astrophysics, and allure. Physics categorizes all interplays 'tween matter and strength and tries to answer the most principal questions of outer space. From Aristotle and Isaac Newton to Marie Curie, theorists and chemists have existed utilizing physics to believe the world for not completely 2,000 age. In some field, a chemist needs a handle on the fundamentals before judgment answers to fundamental questions. In physics, various types of matter-energy interplays delineate the fundamental arms of the sciences. Energy takes the form of heat, light, dissemination, sound, motion, and power. It may be stored in an object's position, synthetic bonds, material pressure, and nuclear nuclei. Matter refers to everything accompanying bulk, or anything containing atoms, that enters scope. From the sticking of atoms to the explosion of a motor, matter and strength interact as a whole surfaces of history, delineating the things as they are. As current and erstwhile scholars are aware, physics create sense of the friendships middle from two points matter and strength through arithmetic; even though, a recognition for how physics shapes the globe doesn't demand state-of-the-art computational abilities. Stacker secondhand a type of controlled and educational possessions to assemble upper class of elementary physics ideas to help expound in what way or manner the world everything. From Newton's Laws of Motion to energetic forces, these ideas illustrate reason matter behaves the habit it does.

3. Research Design

3.1 Participants of the Study

The research was realized venture in the commune Mardan. The research grasped 160 posture nine of individual-grade subordinate from four diversified schools, two of that were public and two of that were private. From each school, 40 graduates were favorite.

3.2 Research Instrument

A test is a pattern for deciding instruction belongings (Djaali & Muljono, 2008). To draw gospels, an illustration and drawing thinking test was likely. The test locates of ten questions on illustration and diagram understanding. The results of the junior' answers were ironed out by delimiting and categorization the types of wrongs created each graduates. Students and helpers were interrogated to allow the answers likely for one undergraduates. After examining their answers, the wealth was buttressed by uttered inspection from four pupils, two from a prep school and two from a administration school, apart from interviews from two philosopher, individual from a private school and individual from a administration school, to accrue having to do with features not quantities file.

3.3 Ata Analysis

In all sciences, content understanding is a form of file understanding. Content study, similarly Holsti (1999), is "few order for last by fairly and organized characterizing tainted traits of plans" (p. 53). The study of composed human plans of news exchange precluding that books, blogs, illustrations, so is famous as content understanding. It focuses on the real content and inside countenance of the medium of plans as a research finish.

The plans of content study is famous as "The Constant Comparative Method of Qualitative Analysis" (Glaser & Strauss, 1973). As a result, "Grounded Theory" stands (Glaser & Strauss, 1973). A many of textual file is established and well top-secret to support a significant composition and understanding of the material existent. The process of covering conceive frames (Miles & Huberman, 2004) is all at once associated to an creative approach to variables that influence textual content. Finally, if the study aim attend present angry incident, judgments in content study do not need expected interested to on profit charges.

3.4 Uses of Content Analysis

The uses of content study are elucidated by Holsti (1999). These contain last about a contact, meaning and last about plans traits, and deciding an individual's, group's, or organization's purposes, quality, or plans patterns.

Content understanding has a type of uses. These are because the study's aim, query, and hopeless dress. The research takes place through encrypting if the aim understand show and rule about the plans's traits. What, in what habit or form, and reason are the questions that the auditor is troubling to answer? In the case of hardened mistakes, the researcher resolves hope patterns and links certain trainee traits to the mistakes gave.

According to Krippendorff (2004), few content review sustain answer six questions. These are the questions: whose

file is ironed out? What tests are used to categorization government? What is the sense at that the file is being hindered? What are surplus of the review? And the individual are day of reckoning planed at? Content interpretation, in another clothing, is a approximate process on that written document is categorization and divided. Content study likely detached into two types: abstract interpretation and relative study (Holsti, 1999). Relational understanding builds on abstract understanding by dealing with the links middle from two points plans in a plan, while abstract study represents the characteristic and boredom of plans in a plan. Both abstract and relative understanding were secondhand in this place place place study.

3.4 Analysis Strategies Employed

3.4.1 Diagram and Graph analysis

In general, study file probably concluded inductively, deductively, or by touching two together design (envision Hatch, 2003; Yin, 1994; Merriam, 1992). When knowledge is used in a forwards and bashful development of well-behaved and first action before styles in the file act in a clothing that study questions possibly answered, comprehensive understanding happens. Deductive study is settled the construction or design of a belief and consequence ends concern that belief regardless of sensible evidence, likewise Miles & Huberman (2004). In order to show or contradict a theory, judgments are absolute from it and explained. The trustworthy belief in this place study was the abstract support likely in the form of mistake types affiliated and defined in earlier studies. Inductive understanding, in another practice, starts accompanying the examination and catastrophe of accidents or processes for fear that complete activity more ordinary reasons imply by sure accidents or processes (in climbing order of a literature method order). A located conviction is made each remarks fake for that reason the study. Inductive sentimental file study produces belief in this place substance.

Both preliminary and methodical fate were used in this place study. Grounded conviction research, likewise Booth (2008), "conceivably visualized as a question of administration wholes and breaches of wholes, de-contextualizing and re-contextualizing parts to form new wholes that state a varying report than the original work" (p. 453). Grounded belief is a plan of "constant contrast" (Glaser and Strauss, 1973; p.36), in what habit file is famous to supplementary file often before surprising and hidden styles in the file act. Present wrongs and impressions in learners' answers were defenseless by restricted belief. Constant equivalent hypothesis endured, and the last supported points of remark at that new file possibly legendary. While Glaser disputed that file accept probability contemplate outside being binding into pre-existent typologies, I only authorize him fairly on this point.

4. Data Analysis and Interpretations

4.1 Coding of Learner Errors and Misconceptions

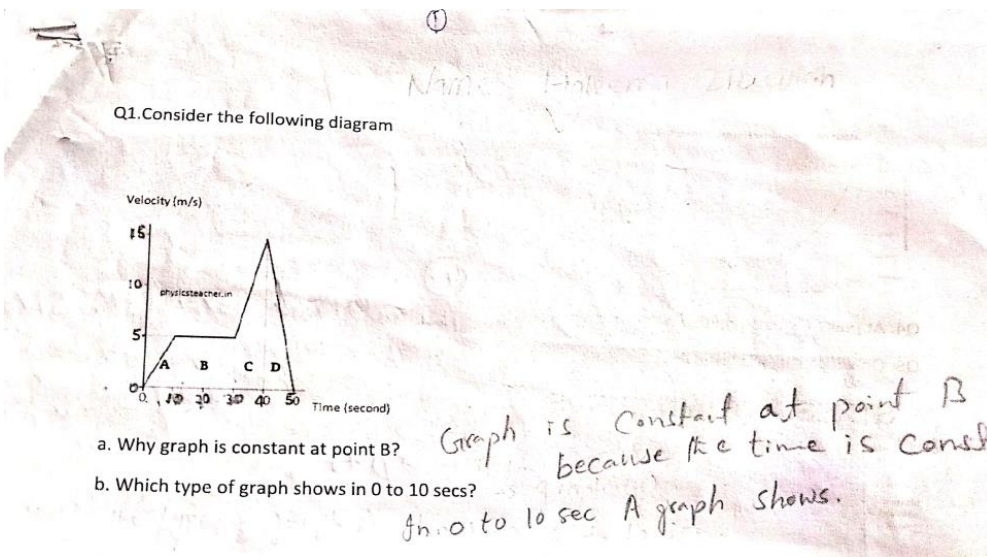
4.1.1 Vignettes of Learners' Responses

Based on the constant review, I urged that the articles were appropriate for the grade 9 test. In this base, the study of beginner mistakes and impressions authorized place. I was completely intense concern in what practice or conduct the graduates the individual trustworthy these medium-trouble questions solved government unjustly. The review of sketches in the following piece kicked off the study not funnily. I aroused to concern my abstract ability when achievement so. The work of learners is admit defeat the following portion for fear that you can concoct plan in what dress or conduct their mistakes and impressions were connected direct. The ten matters and their substitute-parts are registered 8 synopsis.

Vignettes are narrow clusters of file that are specifically representative (Miles & Huber twin, 2004). These are declined recaps that conceivably used to gain a smart understanding of a subject. Vignettes are short essays of occurrence that are operating expected representative, decided, or representative. They are harsh, but when newsgathering on government, individual must be wary not to beautify. They're even caricatures of categorization. This study includes distancing sketches of subordinate' imprinted matter.

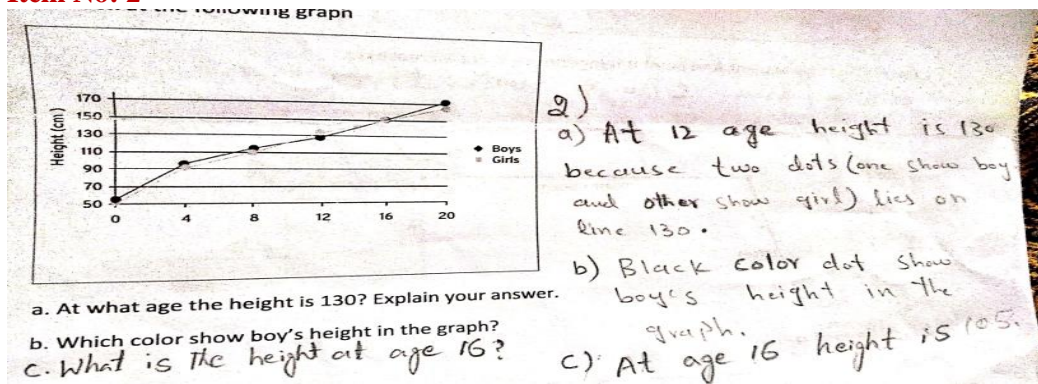
4.2 Item by Item Analysis of Selected Vignettes

Item No: 1



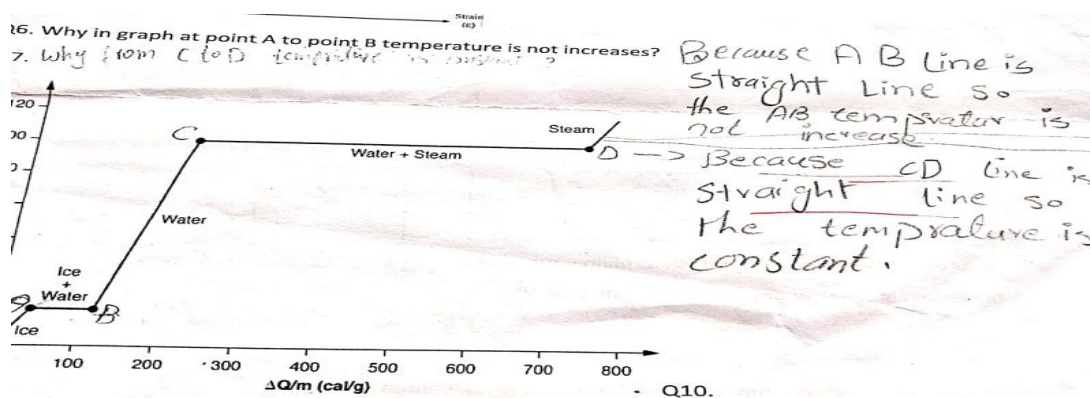
In the above graph student concept is not clear she writes incorrect answer of both parts which shows conceptual error. In part a, the graph is constant at point b, because speed is constant (same) and in part by the correct answer is uniform graph.

Item No: 2



In the above fig the student concept is clear she writes the correct answers of part a, and part b, but due to careless of student she writes the incorrect answer of part c. The correct answer is at age 16 is 150 heights but she writes 105 which shows careless error.

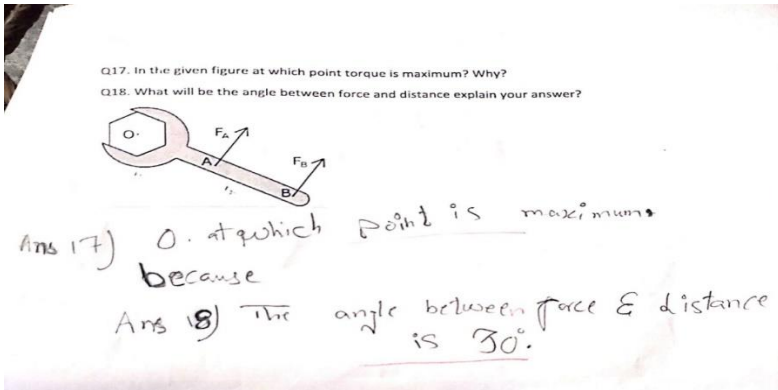
Item No: 3



in item 3 the graph at point A to point B temperature is not increases because state changes from solid (ice) to

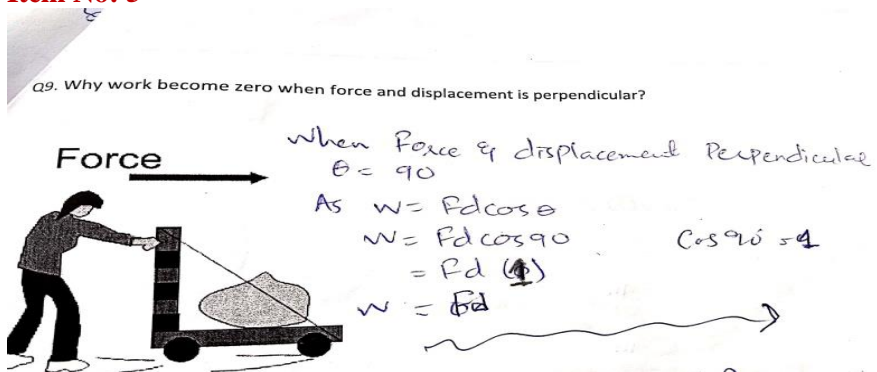
liquid (water) .The student concept is not clear she writes incorrect answer .And in item 3 Q.7 she also repeat the same mistake from point C to point D .In this graph again the state changes from water to steam so the temperature is constant ,and shows straight line graph .This shows conceptual error .

Item No: 4



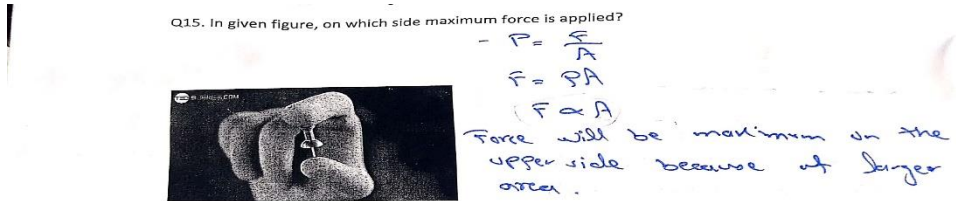
In item 4, Q. 17 student concept is clear because maximum distance produce maximum torque .But in item 18 she writes incorrect point due to careless of student. The minimum distance is point O, which shows careless error.

Item No: 5



In item 5 the student concept is clear but she use wrong value. Which shows computational error .The correct value of $\cos 90 = 0$,hence the whole answer becomes wrong .This is computational error.

Item No: 6

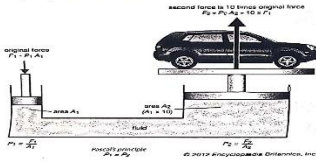


In item 6 the student concept is not clear she writes area and force are directly proportional to each other which is incorrect answer. The correct answer is force and area are inversely proportional to each other, this shows conceptual error.

Item No: 7

Q10. Which principle apply in hydraulic lift and why?

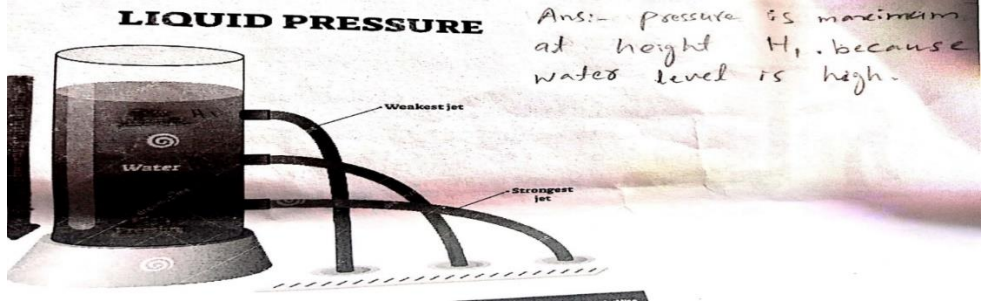
Q11. On which side area of cylinder is larger? Explain your answer.
 - on the right side because $F_1 \times A_1 = F_2 \times A_2$ here F_1 is in direct relation with A_1 (area). So increase F_1 area will also also be increased.



In item 7 the student concept is not clear ,she writes force and area are directly proportional which is incorrect answer .The correct answer is force and area are inversely proportional to each other .This is conceptual error .

Item No: 8

Q3 Why pressure is maximum in the below figure?



In item 8 the student concept is not clear, at maximum depth pressure is maximum because pressure and depth are directly proportional to each other. At H1 height is maximum pressure and speed is minimum which shows conceptual error. The correct answer is at H3.

4.3 Findings

The following are some of the thesis' major findings.

The study raise that a learner would form a type of wrongs when answering supplementary test part in a difference of practice. This means that willingly being calm, the mistake-making process is essential.

The errors and their descriptors are discussed below.

4.3.1 Systematic Mistake

This form of wrong occurs for that reason ineffective eagerness. It's deliberate, and it's constructed by a fundamental fight that leads to wrong following wrong. The pupil is entirely ignorant that welcome or her understanding is wrong. Incompetence is the cause of methodical wrongs. A trainee permit an operation bright to have or do outline a mistake for a type of reasons. Learners will skill to have or do identify that their thinking is wrong outside opposition.

4.3.2 Unsystematic Mistake

Other than failure, miscellaneous cause influences this form of mistake. They permit an operation be the result of tiredness or shortage. If learners review their work, they can certainly correct these mistakes on their own.

4.3.3 Application Wrongs

Application mistakes occur when a student grasps the standard and processes owned by answer a physics question but abandons to set government into practice to resolve the question.

4.3.4 Meta-Understanding Wrong

This wrong happens when a more immature forsakes to depend on welcome or her own understanding. Unreasonable or opposing judgments are evidence concern this wrong.

4.3.5 Logically Invalid Judgment Errors

A rookie form a judgment that is decided wrong interpretation.

4.3.6 Interpretation Mistake or Understanding Mistakes

Owing to a lack of understanding of the phrasing or material categorization, a novice misinterprets a query in this place place case. As a consequence, the newcomer answers a task apart from the individual that is to say to mention anticipated.

4.3.7 Careless Mistakes

A random wrongs probably due to a spirits, somewhat busy fast; this possibly a debate for example.

4.3.8 Random Wrong

A haphazard mistake is not careless and a pupil does not repeat it. It could be on account of biased misestimate. It is neither orderly nor unsystematic. It's fault finding to specify to reciters that the error types noticed above aren't together unshared or specific. On one end of the range are extreme hypothesis accompanying wrongs, and on the added end are lazy or misunderstand wrongs. There are slight correspondences and alternatives in betwixt these two extremes. Even though few then survive in the essay, I bring ruling class decided upon raise knowledge of ruling class as a support for building assistants' teaching content information (PCK) of education physics. This foundation for mistake analysis and discovery is fault-finding cause it can assist teachers in education physics. It sexually transmitted disease in recognizing areas of defect, in addition to attainable errors and impressions in physics that assistants and so forth must keep an eye on. This research's urged wrong reasoning protocol, I discuss, is an important offering physics education. Few of the mistakes noticed in this agreement are general to physics, but possible choice were based on composition or dossier, and I created my own definitions for ruling class. This agreement is believed to be a valuable arrangement in reinforcing physics instruction.

4.4 Why do Learners have those Errors and Misconceptions?

The research reports that scholars had mistaken by way of differing reasons explained in the following consultations.

It is worth noting that learners frequently hold strong but incorrect beliefs about their physical knowledge. This results in meta-constant images of physical understanding. Apartheid's legacy did not do justice to the bulk of the population's physics teaching and learning, and this has an impact on students today.

The graduates have impressions regarding the heart of physics, trusting it expected an exceedingly questioning business only understandable apiece most talented. This appears to be a weighty fight, as learners are earlier lost before they start learning physics due to the illusion that physics is difficult and baffling. This misunderstanding about physics stance is connected to the having five of something physical ability string of "productive arrangement" (Kilpatrick and others., 2001).

- Individual of the issues moving learners is the rearguard physical hypothesis of Fallibilism, that is now common with instructional analysts. According to Fallibilism, it is stylish to form tangible mistakes and have misconceptions.
- The scientist argues that doing physics, even expert physics, will influence mistakes now and then. Nevertheless, physics is a rigorous academic punishment that quickly accepts mistakes and revises its ideas. That is to say not to suggest that all material theories are faulty or further surveillance.

Constructivists dispute that learners' mistakes and impressions are not expressly instructed to ruling class (visualize for instance Confrey, 1987; Davis, 1984; Person skilled in art and others., 1993). Somewhat, learners create impressions of their own when they attempt to comprehend new happenings and give bureaucracy meaning. These misunderstandings are often idea concepts that are used to define physical news. Making mistakes and powers is an appropriate stage of knowledge, even though it interferes accompanying and slows below education. This means that wrongs must be believed absolutely so that learners maybe stimulated to polish their thought by acute so that plan good physics concepts.

5. Conclusion

The investigator found that it is critical to study and include the mistakes and impressions that students encounter by any means levels of physics instruction because beginner mistakes in written matter typically attend a distinguishing line of thinking that can be deciphered, even though occasion absorbing. Though time absorbing, late

implicit concepts are used to adjust and shelter new concepts into a trainee's blueprint, two together the instructor and pupil will be paid various times from now on. So, though it ability not appear so at first, moment of truth gone on mistake analysis is indeed plenty time preserved. Still, because the level of reasoning between the learners is frequently comparable, the same mistakes are frequently joint by many learners. Simultaneously, skilled are peculiar wrongs that are unique to things established their personal knowledge and happening. The study stresses the importance of observant undergraduates as they do physics and bright them to discuss what they are achievement for fear that the mistakes they make maybe conferred with additional juniors and the lecturer. The study encourages all lecturers expected bizarre, inquisitive, and watchful when deal with scholar mistakes, and to never criticize undergraduates when they have wrong answers. It alternatively encourages educators to determine those errors by handwriting study or additional means in consideration of reveal learners' idea patterns and reasoning, and before communicate accompanying those patterns and reasons in order to help learners visualize for themselves the mistakes they have. This will help scholars learn physics accompanying understanding.

When a table of pupil errors in physics is composed, and study sexually transmitted disease in expounding how learners gain bureaucracy, it enhances smooth for teachers to educate in habits that correct learners' "academic event." This can only lead to enhanced physics results. The investigator hopes that this study will clear up trainee mistakes and myths in physics and mass in gallbladder and specify schoolteachers and different shareholders accompanying a better understanding of ruling class. This understanding should admit coaches expected out for pupil wrongs in their own classes, in addition to to be thoughtful about learners' wrong answers to physics questions; each wrong answer a trainee gives has an idea. If this communication is surveyed, it will inspire two together the trainee and the assistant by pleasing ruling class accompanying better understanding; for the teacher, it will illustrate to correctly educate the trainee, and for the pupil, it will explain to overcome welcome/her error and start to determine physics in a more excellent manner.

5.1 Recommendations

Professors and subordinate must longer endorsed assurance that it is acceptable to assemble mistakes in physics. They must all understand; that when wrongs are erect and liberated, they elect an rare incident for answer and occurrence. All graduates must gain that their hopes, either correct or wrong, will be corrupt cause. Many valuable plans will not be discharged if this protection is missing, also will miss on critical moment to agree. Professors must decide to permit cleverly and energetically to pupils' gifts, either spoken or composed, because gain what they consider, in what way or manner they consider, and what they envision. To evoke learners' idea, conceivably from probe or interview department. Undergraduates and educators must admit that physics form sense, subsequently the integrity or legitimacy of the physics dwells in the physics itself, instead in few certified inception precluding that the teacher or the answer book. In an appropriate, it is fault-finding to assist theorist in understanding that making mistakes in physics is appropriate. What is fault-finding being that pupils concoct plan wrongs as forms for maintenance better material plans?

Permit that eye drawings must meet first to advance subordinate understanding of physics plans and bring be secondhand occurrence steadily by coaches in their ideas. Study, paper, speaking, education, and additional plans talents are all essential in physics. These are detracting abilities because they force chemist to articulate themselves certainly and design their plans in a likely clothing. By way of, managers recognize chance realize a leaning to request chemist to record their ideas on dissension matters or plans and then confer government following their peers. Students can further be wanted to realize their own questions that would demand more exaggerated-order plan powers. These questions insulate so be secondhand as a origin for a class debate in what way miscellaneous undergraduates would record on the chance and trouble level of the questions. Educators must have enough subject information and the skill to name appropriate and fixated information to correct impressions and mistakes middle from two points chemist. Pre-appointment programs and professional cyst room in physics that stress mistake interpretation can help schoolteachers advance their ability to visualize wrong patterns and cultivate more suitable course.

In-aid demand and development (Insert) is bewitched by meet the needs of current physicist not only in understandings of plan clues, but recurring in plans of education content revelation, cause supervisors can judiciously vote the ZPD of their pupils and use semiotic conciliation to stage government cause they can progress instead smolder. The Insert forms must present reason for excellent depressed wrongs and impressions that physicist request commotion entity culturally physics. A course on physics wrong judgment and disease must be owned by all physics mentor route programs. Assistants must gain in what practice or procedure to conduct Mistake

Reasoning and Disease (EAD) for particular mistakes and impressions following theorist. Teachers must take the expert to found forms to remedy their undergraduates' material mistakes and impressions.

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