

SCIENTIFIC INSTRUMENT BASED QUESTIONNAIRE

B.H.S. Thimmappa
Manipal University, INDIA

Abstract. In this paper, interesting questions related to common instrument systems with a specialized approach is presented as a supplementary study material for the benefit of young students who have the spirit of inquiry. This questionnaire is a mix of the right technical words and some specific logical analysis, designed to develop mental concentration, boost basic instrument awareness, enrich scientific thinking process and improve understanding of the true meaning of the terms used. The straight and universal answers to practice quiz of 126 selected instrument-centered questions each highlighting unique property measured using an instrument are listed at the end of the text. The momentum of change from traditional instruments to modern measuring and viewing instruments demonstrates the potential for different activities including high-technology research in several fields.

Keywords: interdisciplinary education, instrument questionnaire, educational analysis, measuring instruments, supplementary material, scientific information

Introduction

Recent rapid technological advances and constantly evolving technology has improved the quality of our lives to a great extent and advancements in digital instruments have changed a large part of technological applications. One can encounter simple machines to metalworking machines, smart and specialized machines, computer assisted machines, sophisticated telephone systems, electronic communication systems, high-pre-

cision electronic devices, photographic instruments and other delicate intelligent instruments in some scientific institutions, industrial development centers and university departments. It is difficult to imagine life today without using a wide variety of instruments under different situations, ranging from simple ammeter to most complex optical spectrometers. The convergence of functional features, applications and products has been exponential in the recent past that signals the importance of several smooth measurements using a single instrument system. There are instruments specially designed to figure out whether the gold we plan to purchase is pure enough or to provide weather information to fishermen before heading out to sea or diagnostic information to medical specialists. The major measurements using some medical instruments can provide early warning of trouble ahead and may indicate practical strategies to build physical activities into daily life that substantially reduce the risk of developing lifestyle diseases. We do not have any direct sensory experience of the light beyond vision and heat sensation. The importance of modern instrumental methods of chemical analysis is highlighted by the fact that most of our knowledge about electromagnetic radiation is derived from their use. Analytical measurements using sophisticated computer controlled instruments are of increasing importance in solving several chemical, environmental, medical and pharmaceutical problems. The continued improvements in using these instruments and development of more efficient techniques give rise to increasingly important use in characterizing modern materials such as smart materials, polymeric materials, composite materials and products produced by different artificial chemical reactions and in various process control applications. There are some general purpose field instruments, health care and diagnostic instruments, meteorological equipments and more specialized scientific instruments with dedicated analytical applications used in various fields ranging from materials characterization to medical imaging technologies.

The educational purpose of this paper is to present the names of the most commonly used instruments in university departments, industrial laboratories and domestic sectors to give a broad view to develop scientific curiosity. One general objective is to create awareness in students about well-established instruments to learn how to solve a particular chemical or structural problem using available instruments. There are some unique expressive terms or language associated with the instrumental methods that give immediate comprehension of complex scientific ideas. This focus on instrument interests creates resonance conditions for the students to develop actual passion for research and to remain motivated enough to carry out quality research that makes impact on global research equations. It is well known that a range of structured questions sharpens critical mental faculties, improves information processing skills and creates a certain momentum to engage the students in learning process. The ready-to-test specialist ques-

tions relate primarily to the instruments that we observe in our day-to-day life and in this case the questionnaire plays a primary role for food-for-thought process using illustrative instruments. The answers to these questions in the form of interesting words help in vocabulary building process and act as a teaching tool for expanding knowledge of students through active participation. Each question deals with particular instrumental technique and concerted effort required to have the breadth of understanding is essential to create mental reflex due to sensory stimulation process of students of a wide ability range. It includes a number of important points about instrument construction, working, use or consequences that are instrumental in question design adding value to the sense of measurement and create mental impression in our subconscious by connecting related terms to one another.

Interestingly, the modern internet has changed the parameters of learning through readily accessible open source college course materials to enable new kinds of interactive education. Its main focus has been on extending learner friendly environment to find and retrieve information, graphic images, text, animations, video clips, music bits, snippets and the process of computer aided learning helps the prospective students to move forward meaningfully on the learning curve. The most obvious plus point is that they are free and the reader can take a print out whenever necessary. One of the best features of internet teaching is quick and increased accessibility to information from anywhere in the world. Specifically designed e-learning materials add value to the teaching-learning process and the experience is stimulating enough to engage the attention of readers. This type of learning through question-answer formats is particularly useful to those interested in browsing, reading content and downloading with a robust spirit of self-improvement. This activity also introduces students to the idea of instruments to an initiative to interact with instruments by raising their curiosity about them.

Today, we have a better choice of instruments to gain hands-on experience and we could judiciously choose the required instrument from the list of available ones. The students in universities dedicated to research and academics in different fields can have joint application of several different instruments to get maximum bytes of useful information output. I am thoroughly enjoying the actual experience of preparing questionnaires as a learning module and it would be interesting to the students as well to compare the various properties measured using different instruments at the time of experimentation. This was specially designed and developed as a reference supplement for an analytical instrumentation course and was well received as indicated by the active behavior response by students in the class. This quiz could act as the first step towards examining the various aspects of a problem from all possible perspectives. This material could be useful as supplement in a short-duration course in 'Instrumental Systems' and 'Instru-

mentation and Control Engineering' curricula. This could be a useful resource for those conducting online competitive examinations or in a smart class presentation where students can be asked to answer questions one by one instead of the self-learning practice. Some of the questions may be useful to conduct quiz program on television while others could trigger the desire to invent novel instruments by science students. Also, a particular interesting question can tilt the balance in favor of right thinking process and this will help to develop the curiosity in science to spread scientific spirit among the general public interested in science.

The multiplicity of instruments needs careful understanding and established instrumentation centers at various premier international institutes provide enormous research benefits. Judicious choice of instruments for their joint application to exploring solutions to various research problems could have impact in a wide variety of fields including medical diagnostics, agricultural technology, mechanical and manufacturing engineering, electronics and electrical engineering, civil engineering, materials science and geology. An effort has been made to highlight the significance of instruments as vital tools in science and technology that makes the students actually read the related text to gather more knowledge. This may be an additional approach that one could take in the modern day mechanical life, teach them to learn by creating enough curiosity to continue the learning process, an important long-term consequence. The particular importance is mental characterization of instrument systems to achieve higher impact on memory, and word recognition capability of selected unfamiliar words that lead to improvements in fluid intelligence. Instruments that fall into the interesting musical instruments category such as woodwind, brass, percussion, key-board, electrical and electronic instruments are not considered. The basic considerations involved with instruments in the introduction section and concluding comments with considerations involved with applications along with future prospect signals give the students a broad view. The topic is defined in a broader sense including categories shown in word picture that depict various instrument types (Fig 1). The Fig.2 gives common parameters like length, volume, area, current and amount of substance that are measured using these instruments. The paper is organized under six sections, i.e. mechanical, medical, physical, electrical and electronic, civil and miscellaneous, for the purpose of convenience and this classification is not rigid as some instruments could be considered in two categories. Each section enumerates a set of questions related to instruments more commonly used in that particular category and the advantage of exciting features interspersed facilitate the acquisition of reasoning skills and to learn new instruments that endorse the strong link between the instrument class and the parameter measured. The detailed descriptions of different aspects of specific instrumental designs, principles of operation of instrument systems, instrumental charac-

teristics, sample cells and sampling techniques, signal detection devices, data processing and analysis, interpretation of experimental data, directions of the use in actual practice, maintenance of equipment and performing certain repairs can be obtained from the selected references provided at the end.

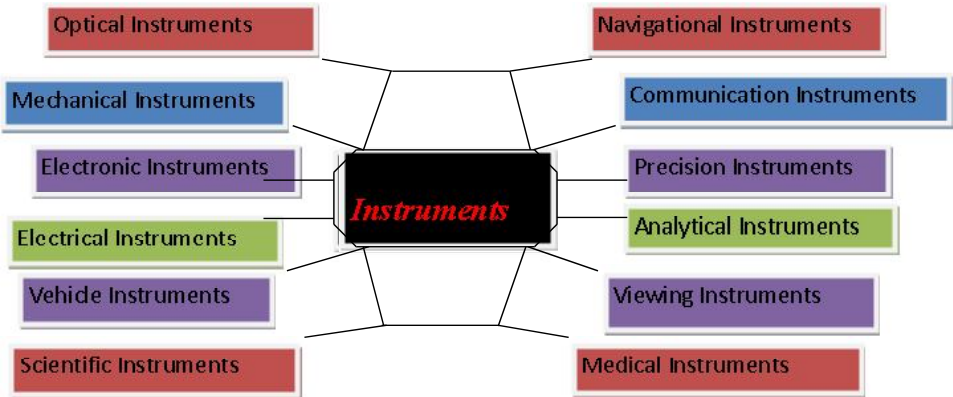


Fig 1. Word picture indicating the diverse range of instrument types used in various fields

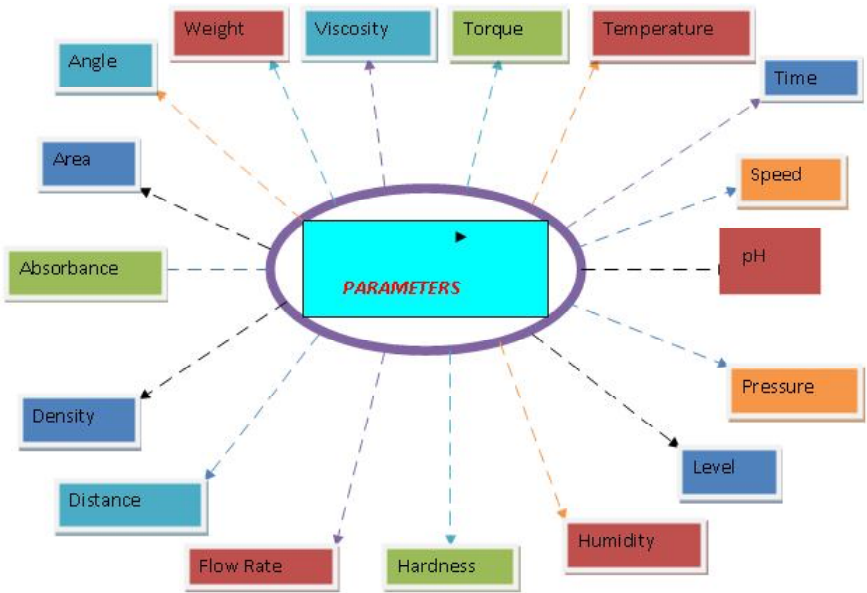


Fig 2. Schematic diagram showing general properties measured using different instruments

List of Questions

Mechanical Instruments [1-5]

1. What is the instrument used for measuring the atmospheric pressure and the changes in it, in short-term weather prediction by surface weather analysis?
2. Name the instrument used for measuring vibration on vehicles, machines, and buildings.
3. Which movable instrument with a pointer generally mounted on vertical poles that show the direction of wind and this parameter is an important component for measuring weather conditions?
4. Which hydrostatic instrument by which one can measure the pressure of gases near to atmospheric and can also be used for measuring system pressure in low or high vacuum conditions?
5. Which instrument that has a cup-like structure is used for measuring mechanical velocity of wind which is also one of the devices used in airports and weather stations for weather forecasting since the force of wind can cause different degrees of destructive effects?
6. What is referred to as the “Beaufort Scale” on the basis of which fishermen get a warning against venturing into the sea?
7. Which instrument is favored for measuring the torque and rotational speed (rpm)?
8. Mention the common name of a typical mechanical gauge to measure internal pressure of tires of vehicles to maintain optimal pressure.
9. Which is the most commonly used instrument for measuring rainfall over a particular period of time and this amount of liquid precipitation, reported normally in millimeters, is useful mainly for meteorologists?
10. What is the common device used for determining the weight of an object on the earth and for measuring gravity as the earth’s gravity attracts objects on to its surface depending on the weight?
11. Which is the high degree precision instrument for mass measurement?
12. What is the instrument that indicates the rotational speed of a shaft in unit time and used in motor-boats or aeroplanes to know the number of revolutions made?
13. Suggest an instrument which is significant for the determination of scratch hardness of materials by a diamond pyramid scratch.
14. What is the instrument used for measuring the depth of an indentation to indicate the hardness of a material and is also commonly used for measuring the hardness of elastomers or other polymeric substances?
15. Which device is used for measuring mechanical properties of soil to check terrain suitability for wheeled vehicles?

16. What is the instrument used for precise measurement of length/distance which is also applicable to determine inner and outer diameter of cylindrical objects and depths of slots?

17. Mention the device used for measuring relatively high temperatures on the surface of the object and thus useful to measure temperature of the hot furnace.

18. Which instrument in a vehicle indicates the instantaneous speed of a land vehicle in kilometers per hour?

19. Which mechanical device is designed to pump liquids at adjustable flow rates and a part of high performance liquid chromatography (HPLC) instrument systems?

20. What expressive word indicates the instrument widely used in steel industry for measuring temperature/temperature gradient very accurately?

21. Which machine is commonly used in measurement of vibrations of the ground and is also useful in detecting earthquakes or nuclear explosions?

22. What is the best known gauge of earthquake intensity which depends on the height of the seismic waves recorded and the magnitude indicates probable effects from slight damage to severe destruction?

23. Name the first instrument for recording earthquakes.

24. Which mechanical/electronic device is used to measure and to indicate the distance traveled by a vehicle in kilometers till that instant?

25. Mention an instrument for measuring the altitude of an object such as the aircraft's height above some reference level (sea level) and helps to avoid air accidents by flying at different heights.

26. Give the two names of an instrument that measures the rate of evaporation of water in the atmosphere.

27. Which sensitive instrument is used for detecting and for measuring the energy of incident electromagnetic radiation by means of rise in temperature and is also known as resistance thermometer or infrared detector?

28. Which instrument is used to determine the amount of relative humidity of air from dryness to dampness which is useful in meteorological studies especially in weather forecasting?

29. Which instrument is used for determining the specific gravity of liquids and is extensively used in the field of science?

30. Indicate the use of the instrument which gives profile of a surface and hence can be used for measuring the thickness of thin films i.e. length/depth in micrometer/nanometer level.

31. Name the instrument used for measuring heat of chemical reactions/physical changes and commonly used for measuring the heat of combustion reaction.

32. Which instrument measures character of flow of fluids/deformation of solids under the influence of stress/strain that is useful in product development, research and quality control applications?

33. Which instrument is used for measuring the viscosity and flow properties of a fluid?

34. Write the proper word for the device to determine amount of fluid that travels in a given location.

35. Which is the most common instrument used for measuring the magnitude and/or direction of magnetic field and hence useful in iron deposit detection and detection of submarine/shipwreck?

36. Suggest the name of sonic depth finder used for determining the depth of the ocean or a submerged object by eco sounding system.

37. What is the name of the flow measuring instrument that measures the amount of mass flowing through a tube in the device?

Medical Instruments [6-9]

38. Which device comprising the mercury manometer as a component is used by medical doctors to determine blood pressure in the human body that assists in disease diagnosis?

39. What well-known everyday instrument did Galileo invent?

40. Mention the three different types of scales of measuring temperature.

41. Which thermal conductivity device is used in determining one gas in a binary mixture and also useful in lung function testing equipment in medical science?

42. Name the medical device used by a physician to listen to amplified internal body sounds during the physical examination process to know whether the internal organs like the heart or the lungs are functioning properly.

43. Which is the common instrument that uses visible light beam and shows a large magnified image of very small objects or organisms not visible with the naked eye thus making the invisible world visible?

44. Which instrument uses beams of electrons and can be used for viewing highly magnified and high resolution images to study microorganisms like viruses and bacteria or to obtain information about crystal morphology of the sample by detailed analysis?

45. Name a diagnostic imaging instrument that produces cross-sectional pictures with a detailed view of the internal body parts with extraordinary clarity and helps in diagnosis of cerebral ischemia, identification of secondary metastasis or encephalitis.

46. Which medical instrument is used for testing and assessing the hearing loss or power of hearing by generating a sound of known frequency?

47. What instrument is useful for detecting and recording minute electrical currents produced by brain activities and has clinical significance in the detection of brain diseases?
48. Which tool can be used to evaluate bioelectric events inside the heart to detect any abnormalities in its working by observing changes in the normal pattern?
49. Name the viewing medical instrument that allows ENT specialist to look inside the ears to examine different regions.
50. Which device do you think is useful for measuring the cumulative exposure to radiation by an individual?
51. Which medical equipment allows the doctor to see inside the eyes of a patient from the outside?
52. What is the name of optical instrument that allows a physician to visually examine the surfaces of certain internal body parts by inserting a flexible tube?
53. Which medical device measures the oxygen-saturation of blood indirectly?
54. Which instrument is used for measuring the volume of air inspired and expired by the lungs that indicates individual's breathing capacity?

Physical Instruments [10-13]

55. What is the measurement scale which compares the intensities of sounds and helps to distinguish faint sound, normal conversation, traffic noise, loud music or sound of explosion?
56. Which apparatus is useful for determining the density of a fluid in the laboratory by weighing method and using reference fluid like water?
57. What is the appropriate term to describe any instrument that measures light intensity?
58. Which instrument measures the absorbance of a solution at a selected wavelength of incident radiation and commonly used for determining the concentration of the solute in a solution?
59. Name the measuring instrument that is used for analyzing the structure of crystalline substances from the scattering pattern produced when a beam of radiation or particles (X-rays/ neutrons/ electrons) interacts with it.
60. Which optical instrument is used for measuring the intensity of electromagnetic radiation and hence used extensively in analysis of materials to obtain structural information?
61. Which scientific instrument is used for measuring the polarization of electromagnetic radiation or optical rotation and thus useful to study optically active substances?

62. Mention the instrument that is used for determining the refractive index of a substance.

63. Name the instrument that measures the mass to charge ratio of charged particles and useful in the analysis of samples for masses and relative concentrations of individual molecules or atoms.

64. Mention the device designed to measure the osmotic strength of a solution or colloid.

65. Which device provides simultaneous double image of the same object giving an illusion of depth and solidity in an image?

66. Name the most popular communication instrument that helps two persons to talk to each other while traveling which is used by people from all walks of life and that leads to nomophobia in roughly half the users of this display device.

67. Write the term that describes the instrument for measuring total scattering by suspended particles in colloids.

68. Which non-destructive testing device is used to check the purity of precious metals like gold using X-rays?

69. Name the sensitive optical instrument which works on the principle of constructive and destructive interference that can measure path length of electromagnetic radiation.

70. Mention the laboratory equipment to measure solutions, solvents or other liquids to perform various experiments.

71. Which optical device measures the degree of darkness (relative density) of a photographic film or a reflecting surface?

72. Which optical instrument is used for close-up magnified image views of distant astronomical objects like stars and galaxies in deep space? (Clue; the Saturn rings, Jupiter moons, for example, were detected based on careful observation through this instrument)

73. Mention the common instrument to measure and display time and may be linked intimately to trigger an alarm or time bomb and has analogy in our body that performs particular actions in response to a particular time by a built-in mechanism.

74. Which is the most accurate time measuring high-tech device?

75. Which single instrument is used to measure both viscosity and surface tension of liquids together rather than using separate instruments for individual parameters?

Electrical and Electronic Instruments [14-17]

76. Write the expressive word that describes the electrical instrument designed to measure electric charge/very small voltages.

77. Which instrument is commonly used for measuring the electric current in a circuit and they are also commonly used in automobiles, appliances and large machines?

78. Write the name of the instrument for detecting the presence of electrostatic charges.

79. What is measured using galvanometer, an electromechanical transducer that produces analog rotary deflection and useful in positioning and control operations in laser systems?

80. Which instrument is used for measuring the potential in a circuit and also commonly used in potentiometric titrations of two solutions.

81. Give a term describing an instrument designed to measure conductance of ionic solutions and also useful in detection of salinity in soil/water samples to find out suitability to agriculture.

82. What is so special about the instrument Wattmeter in a circuit?

83. Which instrument is used for measuring and displaying the amount of electrical energy consumed by a customer in residential or commercial premises continuously?

84. Which direct reading instrument measures the value of electrical resistance of a conductor?

85. Which electronic equipment is used to display voltage signals graphically on a screen where potential difference is plotted as a function of time and can also be used to provide a visual representation of the sound wave on screen?

86. Which obsolete instrument functions on the basis of electromagnetic induction principle that uses Morse code in the field of communication?

87. Which electrical instrument is used for measuring the power in an alternating current electric circuit?

88. Name the electrical instrument designed to measure voltage or currents in several specified ranges and is commonly used for electrical repair or maintenance work by service persons.

89. Which instrument is watched by millions of audience around the world that gives auditory and visual stimuli and it can also be used for the purpose of education, entertainment and information?

90. Which instrument is used as a combination instrument that combines the functions of ammeter, voltmeter and ohmmeter?

91. Name the instrumentation system that uses software to replace a major part of conventional hardware system for measurement function.

Civil Instruments [18-22]

92. Mention the widely used navigation system that uses precise microwave signals to determine location, direction, speed and time of objects and generally applied in land surveying, air traffic control and map design.
93. What is the term used to describe reflecting navigational instrument that measures the altitude of a celestial object above the horizon?
94. Which instrument is employed primarily in the surface area measurement of a graphically represented two dimensional region?
95. What is the instrument that has telescope-component intended to observe celestial bodies as they pass across the meridian called?
96. Which optical instrument measures horizontal and vertical angles useful in surveying, rocket launching and other civil engineering works?
97. Name an instrument to measure the length of arbitrary curved lines and to measure the length of roads and rivers.
98. Which optical instrument measures the angle of inclination or slopes of an object by referring to the spirit level or a plumb pendulum used by civil engineers?
99. Suggest an instrument used mostly by masons in building construction activities to indicate the horizontal level of a surface.
100. Mention a modern tool comprising spirit level in combination with laser, useful for surveying purposes such as to bring forest land to near flatness for cultivation.
101. Which instrument is used to measure long distances that has military application to locate the enemy targets and civil engineering applications to find the range of objects?
102. What is the name of the electronic device that uses ultrasound eco location principle to reveal objects like a submarine under water, finding shoals of fish and to measure the depth of the sea and the method used in nature by dolphins and bats to find out the insects or the obstacles?
103. What is the term that is used to describe detection and ranging instrument system that uses high frequency radio waves to detect distant objects such as enemy ships/aircrafts, celestial objects and measure their distances and directions?
104. Name a navigational instrument to find directions which consists of magnetized pointer free to align with the Earth's magnetic field and thus assists pilots in aircraft and ships to find their way. (Clue: in nature migratory birds, dolphins and snails have a built-in magnet)
105. Which surveying instrument consists of the compass for measuring an angle that is still in use?

106. Name the popular digital optical communication device that has an electronic chip interacting with light instantaneously to produce the picture format that could be transmitted anywhere in the world.

107. Which optical instrument works on reflection principle to enable the user to view objects surrounded by obstacles and also assists the sailors inside the submarine to see what is on the surface of water?

108. What for the water meter used in public or private water supply systems famous?

109. Which device is commonly used to measure the volume of fuel gases by gas supply systems in domestic and industrial sectors?

110. Name the instrument used for measuring the curvature of a surface.

111. Which geophysical instrument measures the rate of change of a geomagnetic field or gravity?

Miscellaneous Instruments [23-27]

112. Which electronic instrument is capable of measuring and displaying acidity or alkalinity of solutions through a special probe and helps to control chemical processes more efficiently to get better quality products or industrial waste water analysis in the field?

113. What is the name of the instrument that can find out whether a person is lying or not by recording variations in nerves, blood vessels and helps police in criminal investigation?

114. What is noticed when we cut the perennial tree trunk like oak or mango and can be considered as an example of natural instrument with no name to estimate the age of a tree by counting their number?

115. What is meant by 'meter' in Latin and the several derived words ending with meter reflect distinct meaning with reference to instrument education and learning?

116. What does the 'scope' when added as suffix refer to?

117. What is the name of the simple semicircular tool found in ordinary geometry boxes used to measure an angle in degrees?

118. Name the first machine to exhibit moving pictures before the invention of the motion-picture film projector and is now a thing of the past.

119. Which class of instruments generates sound waves when played that travel through air to reach our ears such as electric guitar, piano and synthesizer?

120. What is the instrument by which text messages were transmitted to each subscriber that can be printed and stored and now obsolete because of the internet?

121. Which portable instrument can be used to exchange for voice messages while traveling and this two-way transceiver is used mainly by policeman and soldiers?

122. Name the compact device that can receive messages within a limited frequency range.

123. Suggest an instrument with photo scan ability that could send and receive photos to distant places.

124. Name the modern optical device used to obtain digital image of a printed text or other documents.

125. What is the instrument system that allows us to conduct videoconferencing and comprises a telephone, a video camera, speakers, mike, picture devices, modem and data conversion system?

126. Which electro-mechanical device with a stamping mechanism produces the postage evidence?

Conclusion

One of the most effective ways to make our brain sharp is to stimulate different parts of the brain by mental gymnastics to induce the continuous change in the thinking process by the flow of thoughts. This type of questionnaire may prove to be a catalyst that can actually activate the brain cells and allow free flow of information through different local area neural networks leading to improvements in the brain function and thinking ability to a great extent by interrelated ideas. The focus is to teach the young open mind in brain acrobatics through quizzing in a particular aspect to enable specific learning mechanism that helps the brain perform better. It helps in recharging the brain to function more effectively and can change thought pattern of a person to become more productive. It is also helpful in extended learning experience in a more relaxed and stress-free surrounding. Even small learning behavior changes in a student, gives way to a more competent learning environment, are significant. In fact, some students would like to involve themselves in the activity of answering such simple instrument related questions and learn useful words in the scientific language. These questions give students an opportunity to actively participate in the scientific thinking process by focusing on the core information presented and the answers remind them of the connection between various instruments. That can be a starting point for the study of modern instrumental principles and practical problems involved in the field.

The increasing popularity of internet educational services all around the world is one of the factors responsible for the demand of different e-learning processes. It makes educational sense to introduce new questionnaires through web medium rather than the regular classroom practices. It will be useful in transformation workshops or in after-

school activity centers or quizzing and knowledge based service providers. It would create interest and awareness among general public inclined toward scientific sector and they experience the purpose of education by repeated exposure from one question to the next that have neuro-scientific relevance. Emphasis here is on the exploration of the names of scientific instruments and it is relevant in many undergraduate analytical courses conducted in certain educational institutions.

Many scientific instruments have proved invaluable to those involved in research and medical instruments have helped to improve diagnosis and treatment options. Modern instruments that are available from several commercial sources have immensely motivated to move on in life and certain advanced products could significantly improve the way we live our lives. The basic general awareness and understanding of names of instruments will go a long way in enhancing the quality of performance and controlling optimal conditions for a healthy mind in day-to-day operations. Today, instruments encountered in core research activities and industrial development centers are increasingly becoming a source of information in different fields of investigation. An image album showing different contemporary instruments with convincing photographic expression is a powerful instrument for acquiring analytical knowledge. However, the configuration of complex instruments and proper interpretation of every aspect of the data collected can have more powerful impact on the right conclusions drawn in tackling problems. We feel that every young student should have a scientific temper and this questionnaire is a short motivator step towards igniting young minds to produce teaching and research faculty or involve them in industrial activities on breakthrough innovations. It is a learning exercise for students with reference to names of common instruments in the form of question-answer format that sets a momentum for the mental thinking process, sustains the interest of the student and more effective motivator to develop a keen interest at applying them to find quick solutions to instrument use related problems later in their career. This paper emphasizes the drive to drill measuring or viewing instruments related words into the minds of students with some dedication through an open resource education system. The questionnaire is expected to impact personality development through a technique of broadening knowledge by a subconscious link of the science with the instruments where essential empirical verification process possible.

We have seen a wide variety of instruments ranging from those related to agricultural operations to those useful in surgical operations. A cursory examination at some of the instruments will speak volumes of the growing importance of some key developments and the desire to bring continuous innovation in providing sophisticated new instruments for the betterment of mankind. The key is to maintain a balanced approach towards instruments and use them to gather information in creating new processes that

are efficient and eco-friendly. Even today some industries devoted to the manufacture of instruments import several valuable spare parts or components and assemble them into marketable products of measuring value. The process of learning and self evaluation through relevant questions may be useful in academic and industrial job-oriented learning of general knowledge about scientific instruments to make a lasting impact as a conceptual tool. Further, the concept of the questionnaire of the month on different themes could inspire people and make mental impression by asking the right questions and getting the correct answers. One could use these questions with proper involvement to learn more words and to have better retention depending on the unique learning patterns of the individual. The serious readers can click on an alphabetical listing of measuring instruments in Wikipedia for further details on various aspects of instrumentation. An elaborate alphabetical list of definition of scientific instruments is available on the internet site for readers keen to look for specific examples of instruments used in various fields (<http://phrontistery.info/instrum.htm>). It is expected that such questionnaire acts as a catalyst in development efforts in education to initiate and support slight transformation in the learner. Alternatively, it is possible to provide the subject matter in other useful manners by the type of pertinent questions that could be asked and may play a major role in one of the most essential transformations through step by step approach and integrative thinking process useful in day-to-day activities. The science communicators with significant domain experience can add more meaningful questions related to basic terms and concepts associated with the science of measurement and control aspects using various technical instruments. It remains to be seen if the extension of the use of question and answer format approach to accommodate more number of novel instruments helps draw lessons for the future. Constant questioning may lead to Instrument Quiz Book (IQB) that acts as a vehicle for the improvement of ability to use technical words properly and helps to reconnect terms with each other. The interesting question is whether it is possible to design sensory instrument, for measuring the degree of pain and pleasure due to various reasons, similar to skin receptors called free nerve endings. Probably, we have more questions than answers if we consider the subtle energy fields believed to be possessed by certain supernatural elements of the universe or extrasensory perception (ESP) of people possessing predicting powers. This continues to be a key challenge on the right tract that promises to serve as a particular yardstick for measuring standards of scientific evidences. We can look forward to development toward three-dimensional nano-engineering of ultramodern molecular instruments for certain measurements or viewing instruments producing a more sophisticated image that provides a visual barometer of relevant parameter. The mentally digestive advantage supplements formula could be summed up in six 'Is': institutes, instruments, innovation, invention, import and interpretation.

Answers to questions

1. Barometer 2. Accelerometer 3. Wind/Weather vane 4. Manometer or Vacuum gauge 5. Anemometer or Wind gauge 6. Wind strength scale (calm, breeze, gale, storm, hurricane) 7. Dynamometer 8. Tire-pressure gauge 9. Rain gauge/Udometer 10. Balance 11. Analytical balance 12. Tachometer 13. Sclerometer 14. Durometer 15. Bevameter 16. Micrometer 17. Pyrometer 18. Speedometer 19. Metering pump 20. Thermocouple 21. Seismometer or Seismograph 22. Richter scale 23. Seismoscope 24. Odometer 25. Altimeter 26. Atmometer or Evaporimeter 27. Bolometer 28. Hygrometer or Psychrometer 29. Hydrometer 30. Profilometer 31. Calorimeter 32. Rheometer 33. Viscometer or Viscosimeter 34. Flowmeter or Venturimeter 35. Magnetometer 36. Fathometer 37. Mass flow meter 38. Sphygmomanometer or B.P.meter 39. Thermometer 40. Celsius (C), Fahrenheit (F) & Kelvin (K) 41. Kathatometer 42. Sthethoscope 43. Optical microscope 44. Electron microscope 45. Magnetic Resonance Imaging (MRI) 46. Audiometer 47. Electroencephalograph (EEG) 48. Electrocardiograph (ECG) 49. Otoscope or Aurioscope 50. Dosimeter 51. Ophthalmoscope 52. Endoscope 53. Pulse-oximeter 54. Spirometer 55. The decibel scale 56. Pyknometer 57. Photometer 58. Colorimeter 59. X-ray/Neutron/Electron diffractometer 60. Spectrometer 61. Polarimeter 62. Refractometer 63. Mass spectrometer 64. Osmometer 65. Stereoscope 66. Cell phone 67. Nephelometer 68. Karat meter 69. Interferometer 70. Measuring cylinder 71. Densitometer 72. Telescope 73. Clocks or Watches 74. Atomic/Cesium clock 75. Servismeter 76. Electrometer 77. Ammeter 78. Electroscopes 79. Electric current 80. Potentiometer 81. Conductometer 82. Measures electric power 83. Electricity meter 84. Ohmmeter 85. Oscilloscope 86. Telegraph 87. Wattmeter 88. Multimeter 89. Television 90. Multimeter 91. Virtual instrumentation 92. Global Positioning System (GPS) 93. Sextant 94. Planimeter 95. Transit instrument 96. Theodolite 97. Opisometer 98. Inclinator/Clinometer 99. Spirit/Bubble level 100. Laser line level 101. Range finder 102. SONAR (Sound Navigation and Ranging) 103. RADAR (Radio Detection and Ranging) 104. Mariner/Magnetic compass 105. Graphometer 106. Digital camera 107. Periscope 108. Display volume of water usage 109. Gas meter 110. Spherometer 111. Goniometer 112. Digital pH meter 113. Polygraph or Lie detector 114. Growth rings (a series of concentric rings) 115. Measure 116. Viewing/Observing instruments 117. Protractor 118. Kinetoscope 119. Musical instruments 120. Telex 121. Walkie-Talkie 122. Pager 123. Fax machine 124. Image scanner 125. Videophone 126. Postage meter.

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✉ **Prof. B.H.S. Thimmappa,**
Manipal Institute of Technology,
Manipal University, Manipal, India – 576104
E-Mail: bhs.thims@manipal.edu