



KWAME NKRUMAH UNIVERSITY OF
SCIENCE & TECHNOLOGY, KUMASI

PROFESSORIAL INAUGURAL LECTURE

TOPIC:

"THE IMPORTANCE OF PHYSICS IN
SOCIOECONOMIC DEVELOPMENT:
A CHALLENGE TO ASPIRING YOUNG
SCIENTISTS"

LECTURER:

PROFESSOR ABOAGYE MENYEH
BSC. (KUMASI), MSC, PHD (NEWCASTLE) CPHYS, MINSTP (GH)
COLLEGE OF SCIENCE, DEPARTMENT OF PHYSICS

SEPTEMBER 28, 2012
@ 4.30 PM PROMPT

@THE GREAT HALL, KNUST

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CHAIRMAN:

PROFESSOR W.O. ELLIS

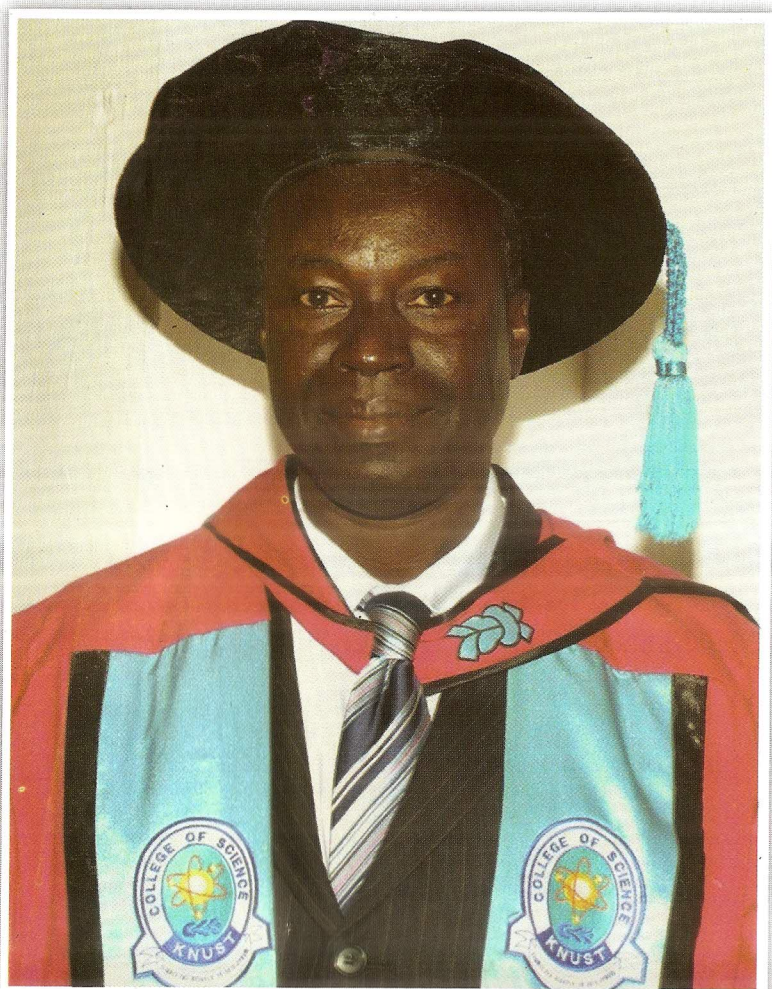
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INAUGURAL LECTURE PROGRAMME

Opening Prayer

Introduction of Chairman

Musical Interlude

Introduction of Speaker

Lecture

Musical Interlude

Announcements

Closing Prayer

University Anthem

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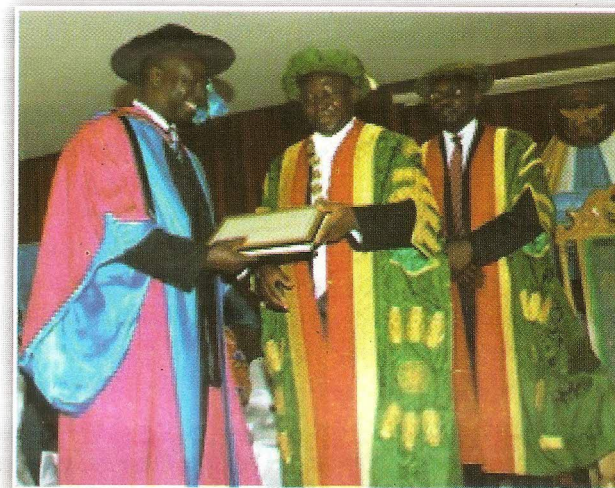
ABOUT THE LECTURER

Prof. Aboagye Menyeh is the immediate past and foundation Provost of the College of Science, KNUST. He was born at Abiriw, in the Akwapim North District of Ghana. He had his basic education at the Asikasu Presbyterian Primary School and the Jumapo Methodist Middle School, all in New Juaben, in the Eastern Region of Ghana. He had his G.C.E "O" and "A" Level certificates, respectively from Asankrangwa Secondary School in the Western Region and Adisadel College in Cape Coast.

Having successfully passed his "A" Level examinations, Professor Menyeh was admitted into the then University of Science and Technology (UST), now KNUST, to pursue a bachelor degree programme in Physics. After graduating with a Second Class (Upper Division) in Physics in July 1980, he did his National Service and thereafter, was appointed as a regular Teaching Assistant in October 1981 in the Department of Physics. By dint of hard work and academic excellence, he joined the teaching staff of KNUST as an Assistant Lecturer in October 1982, and subsequently was appointed Lecturer in October 1984. In 1984, he had a scholarship from the Commonwealth Scholarship and Fellowship Plan (CSFP), UK. Consequently, he was granted study leave for further studies at the University of Newcastle Upon-Tyne, UK. He completed his Master of Science degree in Geophysics in December, 1986 and returned to Ghana in January, 1987. As an outstanding student, he was awarded another scholarship from the CSFP in 1991 to pursue a PhD programme in the same University, which he completed in July 1995. A patriot as he was and still is, he turned down all lucrative offers to stay on for engagements, and he returned to KNUST from study leave in August, 1995, exactly a month after graduation.

Since his appointment as Assistant Lecturer in 1981, he has risen through the ranks to become a Senior Lecturer in October, 1991, Associate Professor in October, 1999, and Full Professor in October, 2008. He served continuously for ten years, as the 8th and the last Dean of Faculty of Science (2001-2004) and as the Foundation Provost of the College of Science (2006-2010). Thus, for three decades since graduation, he has devoted his service to the nation, the cause of the university in general and the College of Science in particular, a service he has selflessly rendered with affection and devotion.

On the occasion of the Long Service Award held by the University on 9th October 2009, Professor Aboagye Menyeh was awarded a certificate of Long Service in recognition of his loyal and devoted service to KNUST. Due to his distinguished service to the University and the College of Science in particular, and his role in the construction of the Science Building Complex, he was awarded with the ***Distinguished Service (Medal)*** by the Chancellor, Otumfuo Osei Tutu II, during the Special Congregation to commemorate the 60th Anniversary of KNUST in November, 2011.



Following the successful completion of two terms of office as Provost, from 2004 to 2010 and, in recognition of his devoted and outstanding service to the College of Science, his contribution to science education in Ghana, and in honour of his commitment to public and community service, Professor Aboagye Menyeh was honoured by staff and students of the College with a citation on 1st October, 2010 in appreciation of the meritorious work for the College.

In the scheme of administration of the university, he was the Professorial Member of the University Council of KNUST from January 2003 to December 2005. He also served on a number of sub-committees of the University Council. He has also served the University extensively and in several capacities such as Acting Vice Chancellor on several occasions in the absence of the VC and Pro-VC in his capacity as the Professorial Member of the University Council. He has served on several statutory and non-statutory committees of the university.

As Dean of the then Faculty of Science and the first Provost of the College of Science, he spearheaded and trail-blazed a number of breakthroughs and development that have made the College of Science one of the most enviable and distinguished centres of excellence for Science-based education in the country.

Some of the landmarks of his achievements include the refurbishment and modernization of a number of laboratories in the College, to the tune of about GH¢12 Million; the initiation of the construction of a multi-purpose Science Building Complex to provide permanent accommodation for four departments in the College; the acquisition of three buses to facilitate academic work; the establishment of the French Resource Centre with assistance from the French Embassy; the establishment of a College Centralized Laboratory, equipped with a modern Gas Chromatograph-Mass Spectrometer (GC-MS) and a High Performance Liquid Chromatograph (HPLC) both costing over \$200,000.00; facilitating the award of scholarships to some academic staff and teaching assistants, for PhD studies in foreign universities;

creation of a centralized College Fund to support income generating activities, and many others.

One other major contribution to the Department of Physics and for that matter to the University was his initiative for the establishment of a geophysics section to provide a career-oriented programme for students at both undergraduate and postgraduate levels. The initiative has produced several geophysicists including some of the current crop of academic staff in the Department of Physics, as well as graduates who are currently employed in various sectors of the economy, such as the Ghana National Petroleum Company and, the water and mining industries.

He initiated collaborative links, leading to the signing of Memorandum of Understanding (MOU), with a number of foreign universities for the mutual benefit of KNUST and those foreign institutions, particularly, in the areas of teaching and research.

Under the MOU co-initiated between the College of Science and the Wageningen University and Research Centre in the Netherlands, the Molecular Biology Laboratory in the Department of Biochemistry and Biotechnology as well as the Food Analysis Laboratory, have received a generous donation of a consignment of assorted modern laboratory and office equipment worth about GH¢600,000.00 to support teaching and research in the College.

The MOU with the Ramapo College of New Jersey, USA resulted in the exchange of Academic Staff; the donation of 300 computers and accessories, science text books and journals and laboratory equipment worth about \$800,000.00; donation of books and journals to the newly established Nursing Department of SMS, and donation of several text books to the main University Library.

The MOU with Indiana University of Pennsylvania (IUP) in 2001 led to exchange of staff, and donation of several text books to the College of Science Library.

The co-initiation of the Ghanaian-German Collaboration between the Department of Physics, and three German Universities of Frankfurt, Munich and Kiel facilitated geophysical research on Lake Bosumtwi and its environs as well as donation of modern geophysical equipment, computers and accessories and a field vehicle.

He also co-initiated the Lake Bosumtwi Crater Drilling Project within the framework of the International Continental Scientific Drilling Programme (ICDP), between the Physics Department and the Geological Survey Department on one hand and, the ICDP on the other, in July, 2004. The academic benefits derived from the Drilling Project which brought together geoscientists and climatologists from Ghana, Germany, Canada and the USA include the:

- Availability of drill cores of the lake crater for paleo-environmental, geophysical and impact studies as well as training of postgraduate students on drilling and coring techniques;
- Establishment of link with the University of Ackron, U.S.A., through which two of KNUST Physics students in Geophysics pursued MSc. Programmes in the USA, with assistantship from the University of Ackron and, the
- Establishment of Link with the University of Toronto and University of Alberta in Canada for Staff Exchange.
- Professor Aboagye Menyeh has participated in several international training programmes, workshops and symposia including the following:
- Training in Modern Seismic Exploration for oil and gas organized by British Petroleum, University of Leeds, UK, 1985.

- Training at the 2nd International Workshop in Gravimetry to promote the use of gravimetry as an effective geophysical tool in the exploration for economic minerals in Africa organized by the African Gravity Network Committee in collaboration with ICTP, Trieste, Italy and IUGG, University of Jos, Nigeria, 1990,
- Training in Magnetic Measurement Techniques organized by the Institute of Physics (UK), at the Royal Institution of Great Britain, London, 1992,
- Training in Advanced Leadership at Haggai Institute, Maui, Hawaii, USA, 2004
- Training at the Workshop on the implementation of Science and Technology Education Policy organized by the Ghana National Commission for UNESCO, in Accra, 2004.
- Participating in the CGIAR Challenge Programme on Water and Food Implementation Workshop jointly organized by KNUST and University of Copenhagen in Kumasi, 2005.
- Participating in the Workshop on Gender mainstreaming into Ghanaian Universities organized by the World Bank Institute, at Greenland Hotel, Swedru, 2005, and
- Serving as KNUST representative, for the First Annual Symposium and Inauguration of the New Alliance for Earth Sciences, Engineering and Development (AESEDA), Pennsylvania State University, USA, 2003.

On the national scene, he has served in various capacities as a member of the Ghana Science Association, including the position of National Secretary from 1996-1997, and the National President, from 2001-2003. He initiated the publication of the Journal of the Ghana Science Association and subsequently became the Founding Editor-in-Chief in 1998, a position he holds till date. He also played a key role in the initiation for the construction of a permanent office block for the GSA national secretariat in Accra. He has been a member of the National

Executive Committee of the Ghana Science Association, from 1996 to date.

He was a member of the Working Group on Science & Technology Management of the Ministry of Science and Environment between 2002 and 2008 and a member of the Implementation Planning Committee on the aspect of the Science, Mathematics and Technology Education, of the National Science and Technology Policy Document in 2002.

Research Interest

His research interest spans over three areas, the first being, *"Rock and Mineral Magnetism"* which focuses on the experimental study of minerals, particularly, the magnetic properties of pyrrhotite (Fe_7S_8) mineral which has the economic potential for industrial use as a magnetic recording medium. Pyrrhotite is also commonly associated with gold mineralization and therefore of importance in geophysical exploration of gold-bearing sulphide bodies in Ghana and also studying rock samples from the environs of the Bosomtwi Crater. The second aspect of his research is in the area of the *"Experimental study of the physical properties of Ghanaian rocks"*. Knowledge of the physical properties of rocks is vital for the interpretation of geophysical exploration data for economic minerals and potential reservoirs for hydrocarbons. The third and final aspect of his research is in the area of the *"Application of geophysical techniques to explore for groundwater, economic minerals and hydrocarbons"* and this has led to the sinking of boreholes at appropriate sites for some rural communities in some regions in Ghana, as well as the delineation of gold deposits in some areas within the gold-belt of Ghana.

He has, over the years, taught several courses at both undergraduate and postgraduate levels and has also designed and supervised several undergraduate and postgraduate theses, including the co-supervision of a PhD thesis. He has presented several scientific papers at both

local international conferences in universities in Ghana, UK, USA and South Africa. He has to his credit, several peer-reviewed research publications, most of which were published in reputable international journals in Europe, USA, and Japan.

It is very gratifying to note that most of his publications have been recognized internationally and thus contributing significantly to scientific knowledge and have therefore received several citations worldwide, including NASA, the publishers of *"The Encyclopedia of Geomagnetism and Paleomagnetism"* and in some international books published by the well acclaimed publisher, **Nature** among others. A few of such citations are listed below:

- Citation by NASA of his paper on: *"Thermoremanence in monoclinic pyrrhotite particles containing few domains"* co-authored with W. O'Reilly, published in *Geophysical Research Letters*, Volume 25, Issue 18, p. 3461-3464 (1998)
- Citation by "The Smithsonian/NASA Astrophysics Data System" of his co-authored paper *"Magnetic properties of synthetic analogues of pyrrhotite ore in the grain size range 1-24 μm (O'Reilly, W.; Hoffmann, V.; Chouker, A. C.; Soffel, H. C.; Menyeh, A.) published in: Geophysical Journal International, Volume 142, Issue 3, pp. 669-683 (2000)*
- Citation by "The Smithsonian/NASA Astrophysics Data System" of his co-authored paper: *"The Coercive Force of Fine Particles of Monoclinic Pyrrhotite (Fe_7S_8) Studied at Elevated Temperature between 77 K and 600 K"* which he wrote together with W. O'Reilly published in: *Physics of the Earth and Planetary Interiors*, Volume 89, pp. 51-62 (1995)

- Citation of his paper "*The magnetization process in monoclinic pyrrhotite (Fe_7S_8) particles containing few domains*" (Geophysical Journal International, Vol. 112, 359-380 (1991) in: Encyclopedia of Geomagnetism and Paleomagnetism (ISBN 1402039921, Eds. David Gubbins, Emilio Herrero-Bervera – 2007, 1054 pages
- Cited in: "Rock Magnetism- Fundamentals and Frontiers - ISBN 052100098X by David J. Dunlop and Özden Özdemir - 2001 - Nature - 596 pages (Menyeh and O'Reilly, 1991).
- Cited in "Rock Physics & Phase Relations: a handbook of physical constants –ISBN 0875908535 by Thomas J. Ahrens - 1995 - Nature - 236 pages
Menyeh, A., and W. O'Reilly, The magnetization process in monoclinic pyrrhotite (Fe_7S_8) particles containing few domains, Geophysical. J. Int., 104, 387-399, 1991.

Professor Aboagye Menyeh is a member of the Ghana Science Association (GSA), American Geophysical Union (AGU), Institute of Physics (Ghana), and the University Teachers Association of Ghana (UTAG).

He is a member and a former Presbyterian of Christ Congregation, KNUST, of the Presbyterian Church of Ghana.

He is happily married to Adelaide (Principal Technician, Department of Computer Science, KNUST) and together they have been blessed with four children, Theodosia (Postgraduate, Brunel University, UK), Emmanuel (Flying Officer, Ghana Air Force), Godfried (Graduate, ICT, PUC, Abetifi) and Elizabeth (University of Ghana, National Service Personnel).

THE IMPORTANCE OF PHYSICS IN SOCIOECONOMIC DEVELOPMENT: A CHALLENGE TO ASPIRING YOUNG SCIENTISTS

SUMMARY

The subject of Physics involves the study of matter, energy and their interactions. It is one discipline of science which is fundamental and cuts across other scientific and technological disciplines. It was initially referred to as Natural Philosophy and this was during the era of Aristotle, Galileo, Newton and others for the mere fact that the subject of philosophy was regarded as man's attempt to explain and make sense of all that happens in nature and to find the root cause behind all phenomena. In fact, Isaac Newton titled his famous book published in 1687 the *Mathematical Principles of Natural Philosophy*. The word "Physics" is derived from the Greek word "physis" or "physus" which means "nature". Fundamentally, the goal of Physics is to search for the Physical laws of nature or the laws that govern the universe. Nature in this context refers to the "whole system of the existence, arrangement, forces, and events of all physical life that are not controlled by man" as defined by World English Dictionary.

The Physics World has so far, been dealing with two main branches of Physics, **Classical Physics** and **Modern Physics**. However, a contemporary branch referred to as **Applied Physics** or Interdisciplinary Physics has also emerged.

The theories in Physics developed from the 16th century to the end of the 19th century (1900) collectively, are termed *Classical Physics*, sometimes referred to as Newtonian Physics. Classical Physics typically involves Mechanics, Heat and Thermodynamics, Electricity

We take internet connectivity for granted but it will be of interest to know that it was through the laws of optics (which describe the way light behaves) that have led scientists to develop optical fiber networks for internet connectivity, which now covers almost the entire globe.

In the same way, we may take things for granted when it comes to the use of household appliances. We may not know that a refrigerator, for example, operates on the principle of thermodynamics and that other domestic appliances such as a simple door bell, telephone, electric kettle, microwave oven, washing machine, television, etc, all operate based on the application of the principles of Physics.

The application of modern Physics, particularly, quantum Physics, has contributed to our deeper understanding of the behavior of solids leading to the creation of highly efficient semiconductors and computer chips, and the phenomenon of nuclear magnetic resonance (NMR) which is used to identify chemical species in chemistry and biology. Apart from x-rays, magnetic resonance imaging technique, which is an extension of NMR, has become a vital tool in providing noninvasive view into the body to locate tumors, and to understand blood circulation based upon the precession of protons in a magnetic field. Also the innovation in particle accelerators has led to the application of suitable high energy beams for cancer treatment in patients.

Advances in Physics have tremendously led to innovations in laser technology, electron microscopy and super computers and superconductors. Today, what will life be like without the application of Physics in computers? Could we build the electronics that modern computers rely on without the knowledge of Quantum Mechanics?

Indeed, there are many more examples of research in Physics by which the development of important technologies for our comfort have emerged. However, it is envisaged that current research in areas such as *nanstructures* (these are structures a billion times smaller than a meter), quantum information or *photonics*, which basically, deals with

electronics with light, will lead to the next generation of technologies including faster and more robust computers and communication systems.

When it comes to stock exchange or the financial markets, it is a fact that financiers have long used statisticians to forecast fluctuations on the stock market, but in recent years, they have also employed models developed by high-energy physicists and statistical physicists. During the financial crisis in 2009, an article published in the New Scientist titled "*Physicists successfully predict stock exchange plunge*" revealed that a team of physicists and financiers successfully predicted a steep fall in the Shanghai Stock Exchange. They used a financial model based on concepts from the physics of complex atomic systems. The secret behind this feat is the fact that physicists have an edge over their equally numerate colleagues, such as the economists and mathematicians, in that they are used to solving problems pragmatically, due to their analytical skills, which they can combine with any useful mathematical and computing tools with observations of real life situations - the markets. The Physicist can therefore help in business management and in predicting stock exchange behavior in the financial markets. There are therefore other useful applications or benefits of Physics which may not be directly visible as in technology.

There is no doubt that the world economic booms are driven by new technologies and certainly, the contributions from Physics cannot be over emphasized because they help to generate many trillions and trillions of dollars for the world economy and therefore aid in improving our daily life immeasurably.

Indeed, Physics plays an important role in our health, socioeconomic development, education, energy, and the environment. Physics also has played a major role in finding solutions to some of the many of the contemporary problems facing the human race such as climate change and in particular, the development of cleaner and renewable energies, to mitigate climate change.

Despite the importance of Physics to society, it is not a popular subject to students at the basic and secondary levels. The lecture gives some basic reasons why Physics is unpopular to students. These challenges have affected the level and quality of enrolment of aspiring young scientists to pursue careers in Physics. The lecture therefore aims at challenging aspiring young scientists to take their studies in Physics seriously, and to pursue career-oriented programmes in Physics in the university. The lecturer does this by sharing his personal research activities and contributions to scientific knowledge, in some of the areas of his scientific career spanning a period of about three decades, such as Applied Geophysics, in the areas of Rock and Mineral Magnetism, Groundwater and Mineral Exploration and Geophysical Research on the Lake Bosumtwi Impact Crater.

Appeal is made to current and future governments, through the Ministries of Education, the Ministry of Science and Environment, to pay much more attention to the study of the basic sciences, particularly, Physics, at both secondary and tertiary levels.

Further, and in order to motivate and to attract brilliant SHS students to pursue Physics at the public universities, government is encouraged to institute attractive scholarship schemes for qualified applicants. It would also be a laudable idea to extend government full sponsorship to qualified applicants wanting to pursue Masters and PhD programmes in Physics and other basic science programmes in order to increase postgraduate intake to at least, 20% for such programmes.

It is also recommended that such sponsorship packages should be matched by support from government to strengthen the Physics departments in the public universities and other national institutions such as CSIR and GAEC, by providing the necessary funding for capacity building of staff through fellowships and for research. It is also important to emphasize the need to provide state of the art laboratory facilities to undertake teaching and advanced research in the public universities, which run Physics programmes as well as the relevant

institutions in the CSIR and GAEC which undertake research related to Physics. It is further suggested that strategic and well equipped national laboratories should be set up as central facilities to support cutting edge research in the basic sciences to move forward, our developmental agenda.

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PEER-REVIEWED JOURNAL PUBLICATIONS

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2. Menyeh, A. and O'Reilly, W. (1991). The magnetization process in monoclinic pyrrhotite (Fe₇S₈) particles containing few domains, *Geophysical Journal International*, 104, 387-399.
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12. O'Reilly, W., Hoffmann, V., Chouker, A. C., Soffel, H.C., and Menyeh, A. (2000). Magnetic properties of synthetic analogues of pyrrhotite ore in the grain-size range 1-24 μm . *Geophysical Journal International*, 142, 669-683.
13. Menyeh, A. (2000). Electrical resistivity of quartzite obtained from the gold-belt of the Tarkwaian rock formation in South – Western Ghana, *Journal of the Ghana Science Association*, 2 (2), 114-120
14. Among, K, Aning, A.A, Menyeh, A, and Danuor, S.K. (2002). Groundwater prospecting in the Sekyere-West District using the Electromagnetic Method, *Journal of the Ghana Science Association*, 4 (1), 70-77
15. Preko, K, Danuor, S.K., Menyeh, A. (2004). Preliminary results of soil radon gas survey of the lake Bosumtwi impact crater, *Journal of the Ghana Science Association*, 6 (1), 156-172.
16. Menyeh, A., Noye, R., and Danuor, S. (2005). Prospecting for groundwater in the Voltaian sedimentary basin of the Gushiegu-Karaga District of the Northern Region of Ghana, using the

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2. Menyeh, A. and O'Reilly, W. (1993). Magnetic properties of monoclinic pyrrhotite at high temperatures. In: Proceedings of the 17th United Kingdom Geophysical Assembly, University of Oxford, 14-16 April 1993, JAG publication, 3, 12.
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10. Danuor, S.K. Menyeh, A. (2007) Enhancing sustainable development through Geophysical research: A case of Lake Bosumtwi, Ghana. Paper presented at the First International Conference on Environmental Research, Technology and Policy, La Palm Royal Beach Hotel, Accra, 16-19 July, 2007.
11. Participant, 2nd African Regional Conference of Vice-Chancellors, Provosts and Deans of Science, Engineering and Technology (COVIDSET), Johannesburg, South Africa, 25th to 27th September 2007. The theme for the conference was "Relevance of Science,

12. Participant, 3rd International Conference on ICT for Development Education and Training, Accra, 28-30 May, 2008
13. Menyeh, A. (2008). Religion and Science: Are they Compatible? Paper presented at the 1st National Conference on Religion and science on the theme "Interrelationship between Religion and Science in the 21st Century and Beyond", KNUST, Kumasi, 18th – 21st June, 2008.
14. Menyeh, A. (2009). Post-Basic Science Education and Technology Education in Ghana. Paper presented at the African Regional Conference on " meeting the Challenges to Sustainable Development in Africa through Science and Technology Education", Abuja, Nigeria, 24th – 29th May 2009.
15. Participant: 7th National Congress of KNUST Alumni Association of North America, Chicago, U.S.A., 3rd – 7th July, 2009.
16. Participant, 3rd African Regional Conference of Vice-Chancellors, Provosts and Deans of Science, Engineering and Technology (COVIDSET), Speke Resort/Makerere University, Kampala, Uganda, 23rd – 25th November, 2009.

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GAUDEAMUS (UNIVERSITY ANTHEM)

LOUD

1. Gaudeamus igitur
Juvenes dum sumus
Gaudeamus igitur
Juvenes dum sumus
Post Jucundam juventutem
Post molestant senectutem
Nos habebit humus
Nos habebit humus

LOUD

2. Vivat academia
Vivant professores
Vivat academia
Vivant professores
Vivat membrum quod libet
Vivant membra quae libet
Sparsos congregavit
Sparsos congregavit
3. Alma Mater Floreat (soft)
Quae nos educavit
Alma Mater Floreat (mod louder)
Quae nos educavit
Caros et commilitones (getting louder)
Dissitas in regiones
Semper sint in flore (very loud)
Semper sint in flore

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