**UNIVERSITY OF SWAZILAND**

**FACULTY OF EDUCATION**

**MAIN EXAMINATION PAPER**

**MAY/JUNE 2015**

**B. Ed. 111 and PGCE F/T**

**TITLE OF PAPER:** Curriculum Studies in Physics

**COURSE NUMBER:** EDC 382

**TIME ALLOWED:** **Three (3) hours**

**INSTRUCTIONS:**

1. This paper contains five (5) questions.
2. Question 1 is COMPULSORY. You may then choose ANY THREE questions from questions 2,3,4 and 5
3. Each question carries 25marks
4. Any piece of material or work which is not intended for marking purposes should be clearly CROSSED OUT.
5. Ensure that responses to questions are NUMBERED CORRECTLY

**SPECIAL REQUIREMENT:** Attached Copy of the SGCSE Physics Syllabus 6888.

**THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.**

This paper consists of **5** printed pages

**Question 1 {Compulsory}**

**A Multiple Choice**

Identify the choice that best completes the statement or answers the question. Write the letter in the answer book provided.

1. In science, what is a scientific theory?
   a. The first idea to explain an observation
   b. An explanation for many hypotheses and observations
   c. The best idea to explain an observation
   d. An explanation for many questions and answers
2. At the end of an investigation, what should you do if you conclude that your results do not support hypothesis?
   a. Buy new measurement tools
   b. Change the topic you are studying.
   c. Repeat your investigation and the change your hypothesis if necessary.
   d. Repeat your investigation over and over until you get results that support your original hypothesis?
3. Which tools can be used for collecting and analyzing and collecting data?
   a. If the answers are right
   b. If the results support your hypothesis
   c. If the answers can be corrected
   d. If the results can be changed
4. Conclusion for an experiment are only valid if
   a. The experiment was controlled (fair test)
   b. The conclusion are based on evidence
   c. The conclusion are based all on available evidence
   d. All of the above
5. What is a scientific model?
   a. a representation of an object, but smaller
   b. an exact representation made of similar material
   c. a representation of an object or system
   d. a familiar copy of an object
6. Which of the following is the best definition of science?
   a. the process of memorizing answers about the natural world
   b. the process of gathering knowledge about the natural world
   c. the process of reading the of the known world
   d. the process of gathering knowledge about the ancient world

7. What must you find out after conducting an experiment and collecting data?
   a. if the results support your hypothesis
   b. if the answers are right
   c. if the answers can be corrected
   d. if the results can be changed
8. Where do scientists publish the results of their experiments?
   a. in letters to friends
   b. on television, radio, and the internet
   c. in academic papers, science magazines and on internet
   d. in books, magazines and comic books

(1 mark each) [8]

**B.** Answer using **True/False** the following statements.

a. Scientists usually expect an experiment to turn out in a certain way.
b. When being scientific one must have faith only in what is justified by empirical evidence.
c. Science is just about facts, not human interpretations of them.
d. Scientists manipulate their experiments to produce particular results.
e. Science proves facts true in a way that is definite and final.
f. Science is partly based on beliefs, assumptions and the non-observable.
g. A scientific law is a theory that has been extensively and thoroughly confirmed.

**(1 mark each) [7]**

**C.** There are so many social issues which are affected by human development. Select and discuss two social issues in which the knowledge of science is necessary for decision making. **[10]**

**Question 2**

Using Bybee's 5E's framework for a science lesson, develop activities, in tabular form, that you can carry out in teaching a concept of your own choice for a named class. Choose a topic from the attached copy of the SGCSE Physical Science syllabus 6888. **[ 25 ]**

**Question 3**

a. What are the challenges women faces in science education in Swaziland? **[10]**
b. Describe how the family can assist to promote the girl child to join science related fields at school and later in life? **[5]**
c. Describe how the physics education teacher in Swaziland can help to overcome barriers to equity for women? **[5]**
d. What efforts are being done by the Government of Swaziland to overcome these barriers? **[5]**

**Question 4**

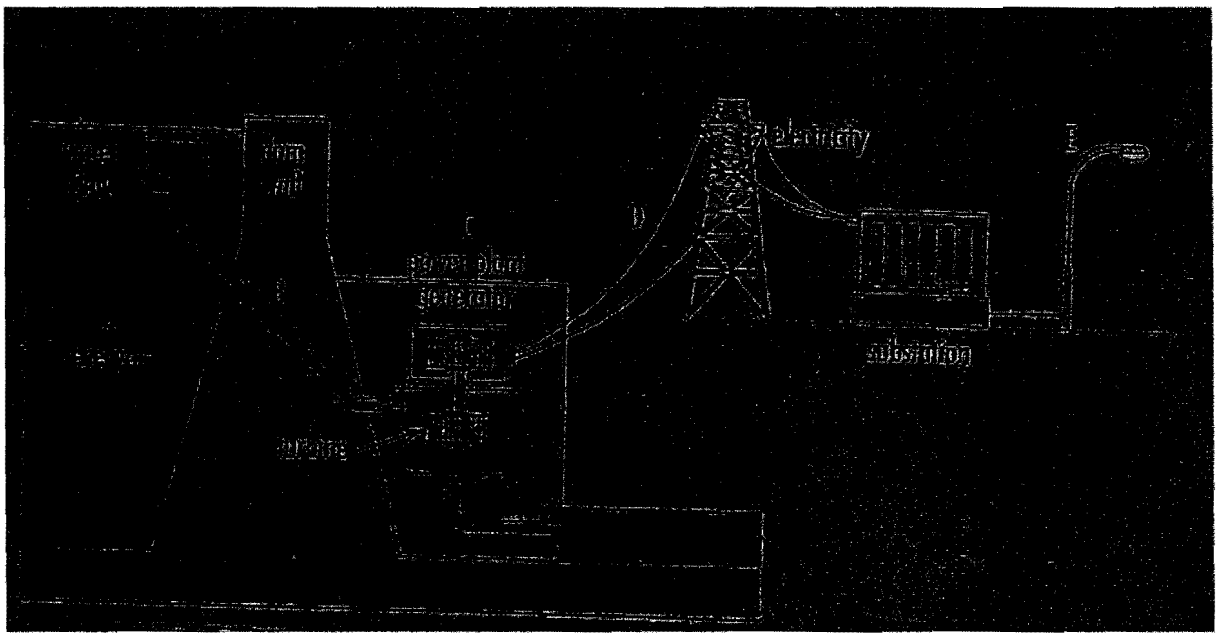

**Figure 1**

a. i. What is the context of the picture in Figure 1? **[1]**
   ii. Write two physics concepts that could be taught from the given picture? **[4]**
   iii. Describe three ways in which this method of teaching benefits learners of a physics class. **[6]**
   iv. What is the assumption made in using this method? **[2]**
b. Describe how a teacher can use this method of contextualization in teaching a concept of your choice? (You could choose a concept from the given copy of the Physical Science syllabus) **[12]**

**Question 5**

Students are each provided with the following material for an experiment to find the focal length of a biconvex lens:

i) a biconvex lens of focal length about 10cm fixed with plasticine. It is assumed that all candidates are provided with lenses of similar focal length;
ii) an illuminated object such as a candle or small light bulb;
iii) a screen which can be a piece of white card;
iv) a metre rule;
v) some plasticine.

Avoid placing candidates in strong sunlight for this experiment. Plasticine is used to fix the lens at right angles to the metre rule.

**Task:**

a. Design a test where students are required to find the focal length of the lens provided and then use this value to investigate the position and type of image produced when an object is placed at different distances from the lens. **[15]**
b. State **Five** benefits of using practical work as one the teaching strategies in physics? **[10]**

**NB:** All drawings necessary should be included

| PHYSICS SECTION | |
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| CORE | EXTENDED |
| **P1. Introduction to physics** | |
| All learners should be able to:<br>- use and describe how to use metre rules micrometers, vernier scales and calipers to determine length.<br>- use and describe how to use clocks and other devices for measuring an interval of time including the period of a pendulum.<br>- measure the volume of an irregular object using the displacement method.<br>- name and recognize quantities and units.<br>- draw and interpret graphs.<br>- work with significant figures. | |
| **P2. Speed, velocity and acceleration** | |
| All learners should be able to:<br>- define speed and calculate it from:<br>$\frac{\text{total distance}}{\text{total time}}$<br>- define acceleration and velocity.<br>- recognise from a speed-time graph when a body is (a) at rest, (b) moving with constant speed, (c) moving with constant acceleration and calculate the acceleration.<br>- plot and interpret speed-time graphs.<br>- calculate the area under a speed-time graph to determine the distance travelled for motion with constant acceleration.<br>- state that the acceleration of free-fall for a body near to the Earth is constant. | - recognise motion for which the acceleration is not constant.<br><br>- describe qualitatively the motion of bodies falling in an uniform gravitational field with and without air resistance (including reference to terminal velocity). |
| **P3. Mass and force** | |
| All learners should be able to:<br>**P3.1 Mass and weight**<br>- define mass as the amount of substance in a body.<br>- measure the mass and weight of a body using appropriate balances.<br>- perform and describe an experiment to determine the density of a liquid and of regularly and irregularly shaped objects and make the necessary calculations.<br>- state that weight is a force.<br>-state that an object floats when put in a liquid of higher density than it.<br>- describe, and use the concept of weight as the effect of a gravitational field on a mass. | - demonstrate an understanding that mass is a property which resists change in motion. |

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| calculate the weight of a body from its mass.<br>demonstrate understanding that weights (and hence masses) can be compared using a balance.<br>**P3.2 Forces and stretching**<br>- perform and describe extension load experiments.<br>- plot and interpret extension load graphs (Hooke's Law as such is not required).<br>- use limit of proportionality in simple calculations.<br>**P3.3 Forces and motion**<br>- describe the ways in which a force may change the motion of a body.<br>- use the relationship between force, mass and acceleration (F = ma).<br>**P3.4 Moments**<br>- describe the moment of a force as a measure of its turning effect and give everyday examples.<br>- calculate the moment of a force given the necessary information.<br>- describe qualitatively the effect of the position of the centre of mass on the stability of simple objects.<br>- perform and describe an experiment (involving vertical forces) to verify that there is no net moment on a body in equilibrium. | - recognise the significance of the term, limit of proportionality for an extension-load graph. |
| **P4. Work, energy, power** | |
| All learners should be able to:<br>**P4.1 Work and Energy**<br>- recall and use the equation work done = force x distance moved.<br>**P4.2 Energy conversion and conservation**<br>- use the terms kinetic and potential energy in context.<br>- give examples of conversion and conservation of energy and apply the principle of conservation to simple examples.<br>- describe energy transfer in terms of work done and make calculations involving F x d<br>- describe processes by which energy is converted from one form to another, including reference to:<br>• chemical/fuel energy (a regrouping of atoms),<br>• energy from water (hydroelectric energy, tides, waves),<br>• geothermal energy,<br>• nuclear energy (fission).<br>• Solar energy (fusion of atoms in the sun).<br>**P4.3 Power**<br>- recognize that power is energy transferred per unit time. | - recall and use the expressions k.e.= ½ $mv^2$ , p.e. = $mgh$<br>- express a qualitative understanding of efficiency.<br>- recall and use the equation P = E/t in simple systems. |
| **P5. Thermal Physics** | |
| All learners should be able to:<br>**P5.1 Expansion**<br>- describe qualitatively the thermal expansion/contraction of liquids, solids and gases.<br>- identify and describe some of the everyday applications and consequences of thermal expansion. | - explain in terms of intermolecular forces the relative order of magnitude of the expansion of solids, liquids and gases |
| **P5.2 Thermometry**<br>- describe how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties.<br>- state the meaning of melting point and boiling point in terms of energy input without change in temperature.<br>- recognise the need for and identify fixed points<br>- describe the structure and function of liquid-in-glass thermometers including the clinical thermometer.<br>**P5.3 Change of state**<br>- describe the difference between boiling and evaporation.<br>**P5.4 Thermal energy transfer**<br>- describe experiments to demonstrate the good and bad conductors of heat:<br>- relate convection in fluids to density changes and describe experiments to illustrate convection.<br>- identify infra-red radiation as part of the electromagnetic spectrum.<br>- describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-red radiation.<br>- identify and explain some of the everyday applications and consequences of conduction, convection, and radiation. | - apply a given property to the measurement of temperature.<br>- demonstrate understanding of sensitivity, range and linearity.<br>- describe the structure and action of a thermocouple and show understanding of its use for measuring high temperatures and those which vary rapidly.<br>- distinguish between boiling and evaporation.<br>- give an account of heat transfer in solids, in terms of vibrations and free electrons. |
| **P6. Properties of waves** | |
| All learners should be able to:<br>**P6.1 Wave properties**<br>- describe what is meant by wave motion.<br>-name and identify longitudinal and transverse waves as illustrated by vibrations in ropes, springs and by experiments using water waves, and distinguish between longitudinal and transverse waves.<br>- use the term wavefront.<br>- give the meaning of speed, frequency, wavelength and amplitude.<br>- describe the use of water waves to show:<br>• reflection at a plane surface,<br>• refraction due to a change of speed.<br>**P6.2 Light**<br>- perform and describe experiments to find the position of an optical image formed by a plane mirror.<br>- perform simple constructions, measurements and calculations to show reflection of light and formation of images by a plane mirror. | - interpret reflection, diffraction and refraction using wave theory.<br>- recall and use the equation V = f x λ.<br>- determine and calculate the refractive index using n = sin i / sin r.<br>- use and describe the use of a single lens as a |

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| use the law of angle of incidence = angle of reflection.<br>- describe refraction, including the angle of refraction, in terms of the passage of light through a parallel sided glass block.<br>- describe the action of a thin converging lens on a beam of light.<br>- use the term focal length.<br>**P6.3 Electromagnetic spectrum**<br>- describe the main features of the electromagnetic spectrum and state that all e.m. waves travel at the same speed in vacuo.<br>- state the approximate value of the speed of the electromagnetic waves in a vacuum.<br>**P6.4 Sound**<br>- state the approximate range of audible frequencies.<br>- state that sound waves are longitudinal.<br>- show understanding that a medium is required for the transmission of sound waves.<br>- relate the loudness and pitch of sound waves to amplitude and frequency.<br>- describe how the reflection of sound may produce echoes.<br>- describe an experiment to determine the speed of sound in air and make the necessary calculations. | magnifying glass.<br><br>- use the term monochromatic. |
| **P7. Magnetism** | |
| All learners should be able to:<br><br>**Basic magnetism**<br>- state the properties of magnets.<br>- describe experiments to investigate magnetic fields.<br>- give an account of induced magnetism.<br>- distinguish between ferrous and non-ferrous materials.<br>- describe experiments to identify the pattern of field lines round a bar magnet.<br>- distinguish between the magnetic properties of iron and steel. | - explain magnetism using simple domain theory. |
| **P8. Electrostatics** | |
| All learners should be able to:<br><br>- describe simple experiments to show the production and detection of electrostatic charges.<br>- state that there are positive and negative charges.<br>- state that like charges repel and unlike charges attract.<br>- state that charge is measured in coulombs.<br>- carry out and interpret experiments with the gold leaf electroscope. | - explain in simple terms the occurrence of the phenomenon of lightning. |

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| **P9. Electricity** | |
| All learners should be able to:<br><br>**P9.1 Current and potential difference**<br>- show understanding that current is related to the rate of flow of charge.<br>- use and describe the use of ammeters and voltmeters in measuring current and potential difference.<br>- state that e.m.f. of a source of electrical energy is measured in volts.<br><br>**P9.2 Resistence**<br>- state that potential difference across a circuit component is measured in volts.<br>- state that resistance is = p.d/current.<br>- describe an experiment to determine V/I characteristics.<br>- plot and interpret the V/I characteristic graphs for metallic conductors.<br>- recall and use the equation V = IR | - recall and use the equation I = Q/t<br><br>- show understanding that e.m.f. is defined in terms of energy supplied by a source in driving charge round a complete circuit.<br>- distinguish between e.m.f. and potential difference.<br><br>- recall and use quantitatively the proportionality between resistance and the length and the inverse proportionality between resistance and cross-sectional area of a wire. |
| **P10. Electric Circuits** | |
| All learners should be able to:<br><br>**P10.1 Basic circuits**<br>- draw and interpret circuit diagrams containing sources, switches, resistors (fixed and variable), ammeters, voltmeters, magnetising coils, bells, fuses, relays.<br>**P10.2 Resistors in series and parallel**<br>- state that current is the same at every point in a series circuit.<br>- state that for a parallel circuit, the current from the source is larger than the current in each branch.<br>- calculate the combined resistance of two or more resistors in series.<br><br>- state that the combined resistance of two resistors in parallel is less than either resistor by itself. | - draw and interpret circuit diagrams containing diodes and rectifiers.<br><br>- recall and use the fact that the sum of the potential differences across the components in a series circuit is equal to the total p.d. across the source.<br>- recall and use the fact that the current from the source is the sum of the currents in the separate branches of a parallel circuit.<br><br>- calculate the effective resistance of two resistors in parallel. |
| **P11. Practical electricity** | |
| All learners should be able to:<br><br>- describe how to wire a three pin-plug.<br>- describe the uses of electricity in heating, lighting (including lamps in parallel), motors<br>- state the hazards of:<br>• damaged insulation,<br>• overheating of cables,<br>• damp conditions. | - recall and use the equations P = IV, E = IVT<br>- describe the use of fuses and earthing as safety measures. |