UNIVERSITY OF SWAZILAND

FACULTY OF EDUCATION

MAIN EXAMINATION PAPER DECEMBER 2013

PGCE (Full Time)

TITLE OF PAPER: Curriculum Studies in Physics

COURSE NUMBER: EDC 282

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 REQUIREMENTS

SGCSE Physical Science Syllabus 6888 (part of the Physics Section)

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

Question 1 **COMPULSORY.**

Instructions: Read the passage below and answer the questions that follow.

> Eleven years ago, M was referred to the Feuerstein Institute for life-long placement in custodial care. At the time of his referral, he was 15-years-old and his IQ, according to the reports, was in the 35–44 range. His vocabulary consisted of 40–50 words and he manifested severe impairment of spatio-temporal orientation, imitation, retention, and social behavior. Echolalia (repetition of words) and echopraxia (repetition of movement) were observed, but no psychotic-autistic signs were detected. Trainability had been considered very poor, and custodial care seemed unavoidable.
>
> M was the second of three brothers. His father, a schizophrenic, alcoholic, and poorly adjusted Foreign Legion soldier, met and married M's mother in an Asian country. The mother was retarded and illiterate and died as a hospitalized, diagnosed psychotic. M suffered from brain damage caused by prematurity and low weight at birth and required prolonged incubator care. His infancy was marked by nutritional difficulties and by repeated and prolonged separations in nurseries and foster homes. His early adolescence was spent largely in socially and educationally restrictive environments (Feuerstein, 1980, p. 10).

a. i. Which two factors from M's history are regarded as innate? **(2)**
   ii. Which two factors are due to environmental issues? **(2)**
   iii. Explain the Theory of structural cognitive modifiability. **(3)**

b. Feuerstein believes there are two approaches of looking at such cases as M's, that is, a passive acceptance approach and an active modification approach.
   Compare the two approaches in relation to the case of M. **(6)**

c. Explain what each of the following concepts means to the teacher in the process of modifiability:

   i. child responsivity

   ii. Transfer skills
   iii. Examiner effort. **(12)**

(25 marks)

Question 2

The computer has become such a common resource in most schools in Swaziland.

a. Explain **five** ways in which the computer can be used effectively in the teaching of Physics concepts in Swaziland. **(15)**
b. What challenges are teachers likely to face in using the computers to teach Physics in Swaziland? **(10)**

(25 marks)

Question 3

a. Explain with the help of a simple illustration or example what you understand by conceptual model. **(7)**
b. What two assumptions are made when the model of a pendulum is used in the classroom? **(4)**
c. Describe three stages followed when using models to teach Physics concepts. **(6)**
d. Explain three purposes of using models in the teaching and learning session in Physics**(6)**
e. What precaution can a teacher make in using models during a teaching and learning session in Physics? **(2)**

(25 marks)

Question 4

a. Describe five pedagogic content knowledge components a teacher has to know if he is to be an effective Physics teacher according to Magnusson, Krajcik and Borko (1999). **(15)**
b. The following alternative conceptions related to electric circuits have been identified:
   - Current gets used up by elements in a circuit
   - A battery is the source of the current
   - Batteries go flat when all their current is used up (Shipstone et.al. 1988)

   Describe a teaching sequence to help students develop a sound understanding of the concepts associated with electric circuits in order to address the alternative conceptions. (Refer to the attached copy of the 2013-2014 SGCSE Physical Science syllabus: Sections P9 –P11) **(10)**

(25 marks)

Question 5

a. Explain, using dimensional analysis, how you would help a student who questions why the units of Work and Energy are the same. **(6)**

b. i. What is the role of language in physics concept formation? **(4)**

ii. With respect to physics teaching, describe two classroom practices that may promote language problems. **(6)**

Iii. What steps might a teacher take to assist students to learn the language of science? **(9)** **(25 marks)**

P5.2 Thermometry - describe how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties. - state the meaning of melting point and boiling point in terms of energy input without change in temperature. - recognise the need for and identify fixed points - describe the structure and function of liquid-in-glass ,thermometers including the clinical thermometer.	- apply a given property to the measurement of temperature. - demonstrate understanding of sensitivity, range and linearity. - describe the structure and action of a thermocouple and show understanding of its use for measuring high temperatures and those which vary rapidly.
P5.3 Change of state - describe the difference between boiling and evaporation.	- distinguish between boiling and evaporation.
P5.4 Thermal energy transfer - describe experiments to demonstrate the good and bad conductors of heat. - relate convection in fluids to density changes and describe experiments to illustrate convection. - identify infra-red radiation as part of the electromagnetic spectrum. - describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-red radiation. - identify and explain some of the everyday applications and consequences of conduction, convection, and radiation.	- 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: **P6.1 Wave properties** - describe what is meant by wave motion. name and identify longitudinal and transverse waves as illustrated by vibrations in ropes, springs and by experiments using water waves. - use the term wavefront. - give the meaning of speed, frequency, wavelength and amplitude. - describe the use of water waves to show: • reflection at a plane surface, • refraction due to a change of speed.	- interpret reflection, diffraction and refraction using wave theory. - distinguish between longitudinal and transverse waves and give suitable examples.
P6.2 Light - perform and describe experiments to find the position of an optical image formed by a plane mirror. - use the law of angle of incidence = angle of reflection. - describe refraction, including the angle of refraction, in terms of the passage of light through a parallel sided glass block. - describe the action of a thin converging lens on a beam of light. - use the term focal length.	- recall and use the equation $V = f \times \lambda$. - perform simple constructions, measurements and calculation to show reflection of light and formation of images by a plane mirror. - determine and calculate the refractive index using $n = \sin i / \sin r$.
P6.3 Electromagnetic spectrum - describe the main features of the electromagnetic spectrum and state that all e.m. waves travel at the same speed in vacuo. - state the approximate value of the speed of the	- use and describe the use of a single lens as a magnifying glass.

P9.2 Resistence - state that potential difference across a circuit component is measured in volts. - state that resistance is = p.d/current. - describe an experiment to determine V/I characteristics. - plot and interpret the V/I characteristic graphs for metallic conductors. - recall and use the equation V = IR	- 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: **P10.1 Basic circuits** - draw and interpret circuit diagrams containing sources, switches, resistors (fixed and variable), ammeters, voltmeters, magnetising coils, bells, fuses, relays. **P10.2 Resistors in series and parallel** - state that for a parallel circuit, the current from the source is larger than the current in each branch. - calculate the combined resistance of two or more resistors in series. - 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. - 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. - 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. - calculate the effective resistance of two resistors in parallel.
P11. Practical electricity	
All learners should be able to: - describe how to wire a three pin-plug. - describe the uses of electricity in heating, lighting (including lamps in parallel), motors - state the hazards of: • damaged insulation, • overheating of cables, • damp conditions.	- recall and use the equations P = IV, E = IVT - describe the use of fuses and earthing as safety measures.
P12. Electromagnetic effects	
All learners should be able to: **P12.1 Electromagnets** - state the factors affecting the strength of an electromagnet. - state that a current carrying wire has a magnetic field. **P12.2 Electromagnetic induction**	- describe an experiment which shows that a changing magnetic field can induce an e.m.f. in a circuit. - state the factors affecting the magnitude of the induced e.m.f.