FACULTY OF EDUCATION

MAIN EXAMINATION PAPER

MAY 2019

B.Ed. III and PGCE (Full Time)

TITLE OF PAPER: Curriculum Studies in Physics II

COURSE NUMBER: CTE334 / CTE 534

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

INSTRUCTIONS:

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

SPECIAL REQUIREMENT: Attached Copy of SGCSE Physical Science 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)

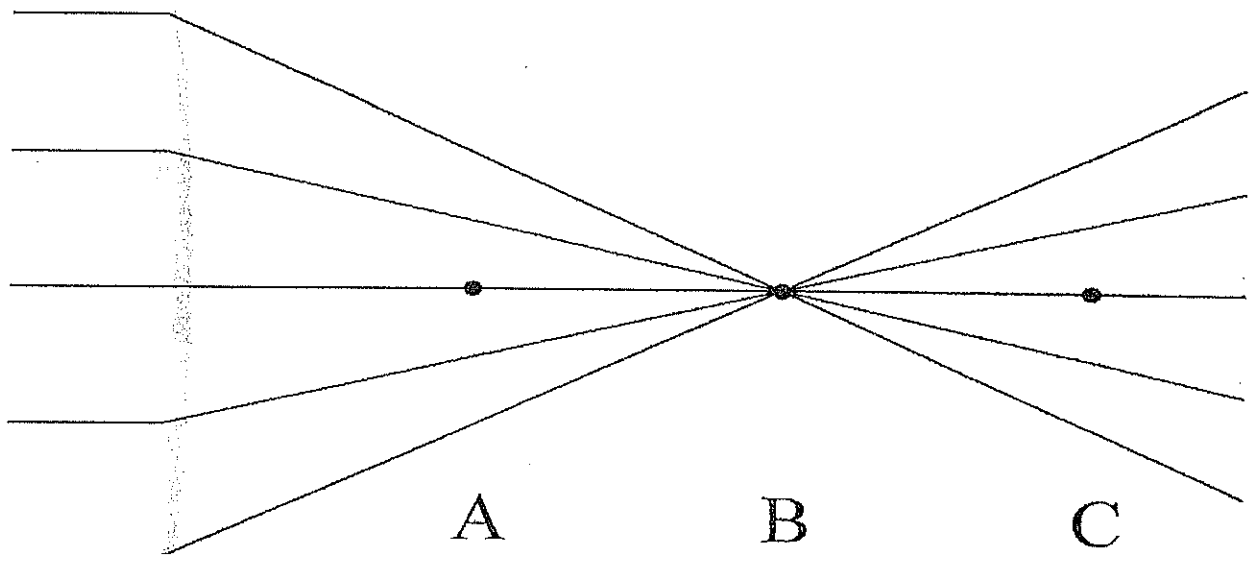
1. The following are multiple choice items for measuring cognitive higher order – level objectives such as: application, analysis, comprehension and evaluation.

I. A pendulum consists of a sphere hanging from a string. What will happen to the period of the pendulum if the mass of the sphere is doubled? (Assume that the effects of the air friction and the mass of the string are negligible and the angle of swing is less than 20^0)

i. It will increase.
ii. It will decrease.
iii. It will remain unchanged.
iv. More information is needed.

II. In the diagram below, parallel light rays pass through a convex lens and converge to a focus. They can be made parallel again by placing a:

i. Concave lens at B.
ii. Concave lens at C.
iii. Second convex at A.
iv. Second convex at B.
v. Second convex at C.



From the two multiple choice items above:

a. Which cognitive higher order level objective would best describe each multiple choice item? **(4)**

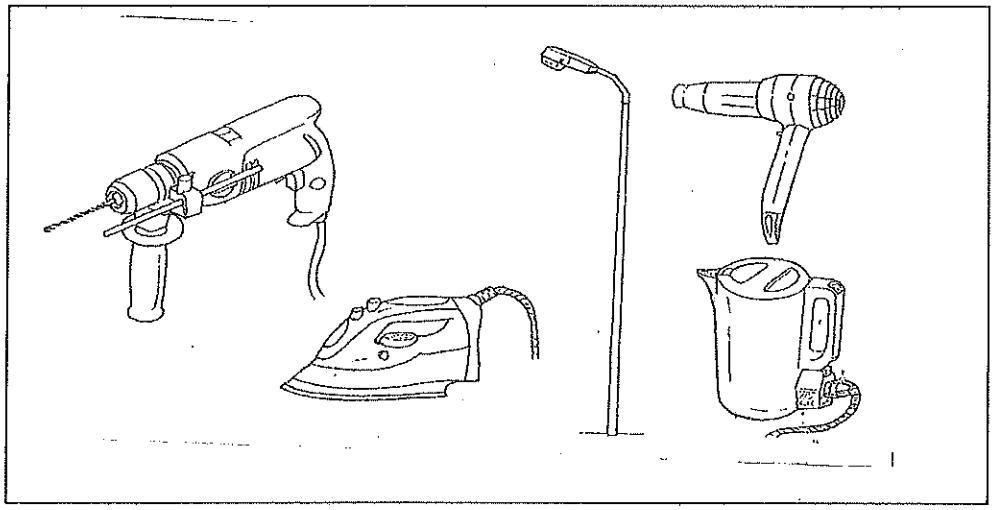
b. Explain why you chose that objective for each item? **(4)**

c. Which response would best answer each item? **(2)**

d. Using the extract from the Physics syllabus 6888 attached, design **TWO** {2} multiple choice questions complete with four {4}possible answers. **(10)**

e. What challenges do teachers face in preparing Multiple Choice Questions? **(5)**

Question 2



The following questions refer to the diagrams above:

a) What topic could be taught from the above diagrams? **(1)**

b) Write any Three concepts that could be taught from the above context. **(3)**

c) What assumptions does a teacher in Shiselweni make when using this context? **(2)**

d) What Four (4) considerations should the teacher of Physics take when using this method in teaching? **(4)**

e) Despite contextualization being a useful practical approach to teaching science, give five reasons why it is still not a popular teaching method in Eswatini? **(5)**

f) Explain five (5) design features that support contextualization **(10)**

Question 3

The following statements/questions seem to be raising some aspect about the Nature of Science. Explain what aspect of the Nature of Science is being illustrated.

A. a) After scientists have developed a theory (atomic theory), does the theory ever change? **(2)**

b) What does an atom look like? How certain are scientists about the structure of the atom? **(2)**

c) Is there a difference between a scientific theory and a scientific law? **(2)**

d) Is there a difference between scientific knowledge and opinion? **(2)**

e) Scientists perform experiments / investigations when trying to solve problems. Other than planning and designing of these experiments, do scientists use their creativity and imagination during and after data collection? **(2) [10]**

B. Researchers have begun to show that in an attempt to teach the Nature of Science, linking to process skills can be an effective way, Bell, (2004).

In Tabular form, show five of the process skills and the relevant Nature of Science Concepts**(15).**

Question 4

a. In your school, you are asked to lead a discussion with your colleagues on the challenges faced by teachers in integrating Science-Technology and Society (STS) in Science teaching in Swaziland. What challenges are likely to be mentioned by the teachers in the discussion? **[10]**
b. Choose one social problem from the community you live in and describe the sequence through which you, as a teacher, could teach it through STS science. **[10]**
c. Give two goals you consider most important in STS education. State one reason you say they are important? **[5]**

Question 5

Students are each provided with the following material for an experiment to investigate the potential difference across different lengths of a resistance wire.

i. Voltage source, approximately 3.0 V. Two 1.5 V cells are suitable.
ii. Voltmeter, capable of measuring voltage with minimum precision of ± 0.1V (Full scale deflection of 3.0 V – 5.0 V),
iii. Ammeter capable of measuring current with a minimum precision of ± 0.1 A (full scale deflection of 1.0 A)
iv. Switch (which can be an integral part of the power supply)
v. Approximately 110 cm of straight, bare constantan wire, diameter 0.2 mm – 0.5 mm, taped to a meter rule,
vi. Two suitable terminals attached to the constantan wire at points **D** and **F** so that suitable connections can be made to the circuit as shown in Fig. 5.1,
vii. A crocodile clip to act as a sliding contact,
viii. Eight connecting wires or leads.

Notes

1. Small screws or drawing pins can be used to tape constantan wire on to meter rule,
2. The circuit shown in Fig. 5.1 must be set for the candidates.

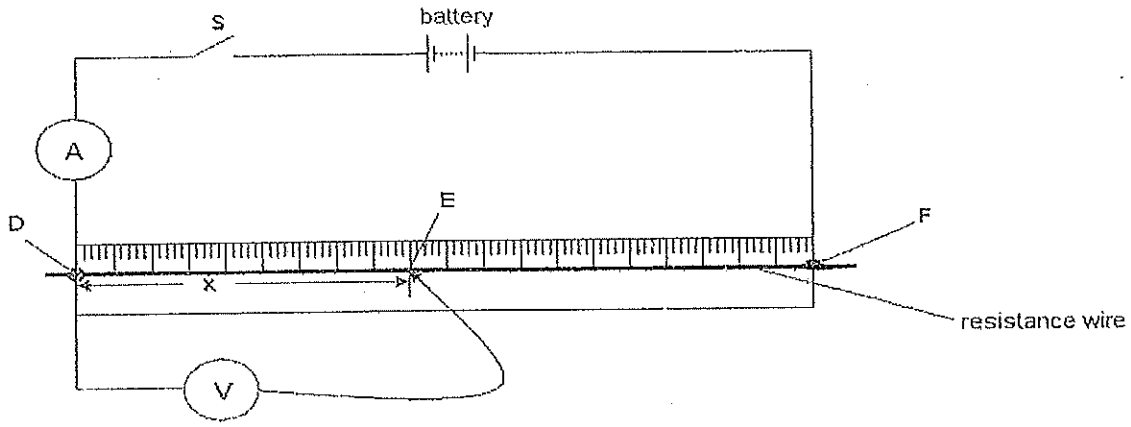


Fig 5.1

Task:

a. Design a test where candidates are required to (i) investigate the potential difference across different lengths of a resistance wire (ii) find the relationship between the length of wire and its resistance. **[15]**

b. State Five benefits of using practicals as one of the teaching strategies in Physics? **[10]**

NB: All necessary illustrations/ drawings should be included.

PHYSICS SECTION

P1.0 Introduction to Physics

All learners should be able to:

1. name quantities and their units including base SI units
2. use and describe how to use metre rules, micrometer screw gauge, vernier callipers to determine length and volume of regular objects
3. use and describe how to use clocks and other devices for measuring an interval of time including the period of a pendulum
4. use suitable balances to measure mass of solids and liquids
5. measure the volume of regular and irregular objects using the displacement method
6. determine density
7. state that an object floats when put in a liquid of higher density than it
8. work with significant figures

P2.0 Speed, velocity and acceleration

All learners should be able to:

1. calculate speed/velocity from:

$$\frac{\text{total distance}}{\text{total time}}$$

2. identify speed as a scalar quantity and velocity as a vector quantity
3. define acceleration, speed and velocity
4. 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
5. plot and interpret speed-time graphs
6. calculate the area under a speed-time graph to determine the distance travelled for motion with constant acceleration
7. state that the acceleration of free-fall, g, for a body near to the Earth is constant ($g = 10 m/s^2$)
8. recognise and interpret graphs of motion for which the acceleration is not constant
9. describe qualitatively the motion of bodies falling in an uniform gravitational field with and without air resistance (including reference to terminal velocity)
10. describe some applications on terminal velocity including reference to parachutes and hailstorms

P3.0 Mass and Force

All learners should be able to:

P3.1 Mass and weight

1. define mass as the amount of substance in a body
2. measure the weight of a body using appropriate balances
3. state that weight is a force
4. describe, and use the concept of weight as the effect of a gravitational field on a mass
5. calculate the weight of a body from its mass ($w = mg$)
6. describe how weights (and hence masses) can be compared using a balance

P3.2 Forces and stretching

1. perform and describe extension load experiments
2. plot and interpret extension load graphs (Hooke's Law as such is not required)
3. identify and interpret the significance of the term, limit of proportionality for an extension-load graph
4. use limit of proportionality in simple calculations

P3.3 Forces and motion

1. describe the ways in which a force may change the motion of a body
2. state the advantages and disadvantages of friction
3. use the relationship between force, mass and acceleration ($F = ma$)

P3.4 Moments
1. describe the moment of a force as a measure of its turning effect and give everyday examples
2. calculate the moment of a force given the necessary information
3. define centre of mass
4. describe qualitatively the effect of the position of the centre of mass on the stability of simple objects.
5. perform and describe an experiment (involving vertical forces) to verify that there is no net moment on a bod in equilibrium (including calculations)

P4.0 Work, energy, power

All learners should be able to:

P4.1 Work
1. recognise that work is done against an opposing force
2. recall and use the equation work done = force x distance moved in the direction of force

P4.2 Energy
1. relate energy transfer to work done and state the unit of energy as the joule
2. identify different forms of energy including kinetic and potential energy

P4.3 Energy conversion and conservation
1. use the terms kinetic and potential energy in context
2. give examples of conversion and conservation of energy and apply the principle of conservation to simple examples
3. describe energy transfer in terms of work done and make calculations involving F x d
4. describe processes by which energy is converted from one form to another, including reference to:
- chemical/fuel energy (a regrouping of atoms)
- energy from water (hydroelectric energy, tides, waves)
- geothermal energy
- nuclear energy (fission)
- solar energy (fusion of atoms in the Sun)

5. recall and use the equations k.e.= ½ mv^2 , p.e. = mgh
6. identify examples of energy changes that are less than 100% efficient and explain why this happens

P4.4 Power
1. define power as energy transferred (work done) per unit time
2. recall and use the equation P = E/t = W/t in simple systems

P5.0 Thermal Physics

All learners should be able to:

P5.1 Expansion and contraction
1. describe, using the kinetic theory, the thermal expansion/contraction of liquids, solids and gases
2. identify and describe some of the everyday applications and consequences of thermal expansion/contraction including bimetallic strips in thermostats
3. explain in terms of intermolecular forces why solids, liquids and gases expand with temperature at different rates

P5.2 Thermometry
1. describe how a physical property which varies with temperature may be used for the measurement of temperature and state examples of such properties (volume, potential difference, resistance)
2. describe how to determine the fixed points and use them to calibrate the thermometer
3. describe the structure and function of liquid-in-glass thermometers
4. demonstrate understanding of sensitivity, range and linearity
5. 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
1. describe the difference between boiling and evaporation
2. interpret a cooling and heating curve
3. state the meaning of melting point and boiling point in terms of energy input without change in temperature
4. describe how thermal energy is transferred in solids in terms of molecular vibrations and free electrons

P5.4 Thermal energy transfer
1. describe experiments to demonstrate the good and bad conductors of heat
2. relate convection in fluids to density changes and describe experiments to illustrate convection
3. identify infra-red radiation as electromagnetic radiation
4. describe experiments to show the properties of good and bad emitters and good and bad absorbers of infra-

red radiation
5. identify and explain some of the everyday applications and consequences of conduction, convection, and radiation

P6.0 Waves

All learners should be able to:

P6.1 Wave properties

1. describe what is meant by wave motion
2. 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
3. define and draw wave fronts
4. state what is meant by wave speed, frequency, wavelength and amplitude
5. demonstrate the use of water waves to show:
   - reflection at a plane surface,
   - refraction due to a change of speed
   - diffraction
6. describe reflection, diffraction and refraction in water
7. recall and use the equation $V = f \times \lambda$

P6.2 Light

1. perform and describe experiments to find the position of an optical image formed by a plane mirror
2. perform simple constructions, measurements and calculations to show reflection of light and formation of images by a plane mirror
3. use the law of angle of incidence = angle of reflection
4. describe refraction, including the angle of refraction, in terms of the passage of light through a parallel sided glass block
5. describe the action of thin lenses (concave and convex lenses) on light rays
6. perform an experiment to find the focal point and the focal length of a thin converging lens
7. perform simple constructions to show the action of a thin converging lens on light rays
8. determine and calculate the refractive index using $n = \sin i / \sin r$
9. use and describe the use of a single lens as a magnifying glass

P6.3 Electromagnetic spectrum

1. describe the main features of the electromagnetic spectrum and state that all e.m. waves travel at the same speed in vacuum
2. state the approximate value of the speed of the electromagnetic waves in a vacuum
3. state the everyday applications of e.m. waves

P6.4 Sound

1. state that sound waves are longitudinal
2. state the approximate range of audible frequencies
3. explain why a medium is required for the transmission of sound waves
4. relate the loudness and pitch of sound waves to amplitude and frequency
5. describe how the reflection of sound may produce echoes
6. describe an experiment to determine the speed of sound in air and make the necessary calculations

P7.0 Electrostatics

All learners should be able to:

1. describe simple experiments to show the production and detection of electrostatic charges
2. state that there are positive and negative charges
3. state that like charges repel and unlike charges attract
4. state that charge is measured in coulombs
5. carry out and interpret experiments with the electroscope
6. explain in simple terms the occurrence of the phenomenon of lightning

P8.0 Electricity

All learners should be able to:

P8.1 Current and potential difference

1. define current as the rate of flow of charge
2. recall and use the equation I = Q/t
3. use and describe the use of ammeters and voltmeters in measuring current and potential difference
4. state that e.m.f. of a source of electrical energy is measured in volts
5. describe how e.m.f. is defined in terms of energy supplied by a source in driving charge round a complete circuit
6. distinguish between e.m.f. and potential difference

P8.2 Resistance

1. state that resistance = p.d/current.
2. describe an experiment to determine V/I characteristics for ohmic conductors
3. plot and interpret the V/I characteristic graphs for metallic conductors
4. recall and use the equation V = IR
5. recall and use qualitatively the proportionality between resistance and the length and the inverse proportionality between resistance and cross-sectional area of a wire

P9.0 Electric circuits

All learners should be able to:

P9.1 Basic circuits

draw and interpret circuit diagrams containing sources, switches, resistors (fixed and variable), ammeters, voltmeters, magnetising coils, bells, fuses, lamps, relays and diodes (LEDs) and rectifiers.

P9.2 Resistors in series and parallel

1. state that current is the same at every point in a series circuit
2. state that for a parallel circuit, the current from the source is larger than the current in each branch.
3. the combined resistance of two or more resistors in series
4. state that the combined resistance of two resistors in parallel is less than either resistor by itself
5. 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
6. 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
7. calculate the effective resistance of two resistors in parallel
8. recall and use the fact that the p.d. across separate branches of a parallel circuit is equal to p.d across a battery

P10.0 Practical electricity

All learners should be able to:

1. describe how to wire a three pin-plug
2. describe the uses of electricity in heating, lighting (including lamps in parallel), motors
3. state the hazards of:
   - damaged insulation
   - overheating of cables
   - damp conditions
4. recall and use the equations P = IV, E = IVt
5. describe and explain the use of electrical safety measures, to include:
   - fuses
   - double insulations
   - earthing
   - switches