THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/1

PHYSICS 1

(For Both School and Private Candidates)

Time: 3 Hours **7 November 2001 a.m.**

Instructions

1. This paper consists of sections A, B and C.
2. Answer ALL questions in Section A and B and any TWO (2) questions from Section C.
3. Write your answers neatly and systematically in the answer booklet(s) provided.
4. Marks for questions or part thereof are indicated beside the question.
5. Write your Examination Number on every page of your answer booklet(s).
6. Wherever necessary use the following constants:

Speed of light	c	=	3.0×10^8 m/s
Acceleration due to gravity	g	=	9.8 m/s^2
Pi	π	=	22/7

SECTION A (20 Marks)

Answer ALL questions in this section.

1. For each of the items (i) - (x) choose the correct answer from among the given alternatives and write its letter beside the item number. Each item carries 1 mark.

(i) A stop clock P, a millisecond timer Q and a centisecond timer R are used for the measurement of time. Which of the following lists the three in their order of accuracy.

A PQR B QPR C QRP D RPQ E RQP

(ii) A gearwheel X is used to turn another gearwheel Y. X has 15 teeth and Y has 5 teeth. When Y makes 6 revolutions X has made

A 6 revolutions B 2 revolutions C 3 revolutions
D 5 revolutions E 18 revolutions.

(iii) The radiating power of different surfaces may be compared by means of

A Hopes apparatus B conductivity apparatus C bimetallic strip apparatus
D Leslie's cube experiment E convection experiment.

(iv) A liquid at 100°C is as hot as a piece of metal at

A 100°F B 98.4°F C 212°F D 200°F E 32°F.

(v) A material which allows some light to pass through it but one cannot see through it is said to be

A transparent B translucent C luminous D opaque E colourless.

(vi) The positive pole of a dry cell is made of

A carbon rod B zinc can C ammonium chloride
D copper rod E manganese dioxide.

(vii) A freely suspended bar magnet always comes to rest

A with either the N-pole or the S-pole pointing North
B in an East-West direction
C with its S-pole pointing North and its N-pole pointing South
D with its poles pointing in the North-South direction
E with its N-pole pointing North and its S-pole pointing South.

(viii) Which of the following are inner planets?

A Mercury and Venus B Jupiter and Mars C Saturn and Venus
D Neptune and Uranus E Pluto and Mars.

(ix) One use of gamma-rays (γ-rays) is to

A treat neurotics B treat black spots C heal fractures
D kill cancer cells E join broken hands.

(x) The conduction in a semi conductor material is due to

A doping B extrinsic conduction C intrinsic conduction
D motion of charges E movement of holes and electrons.

2. Match the items in list A with the responses in list B by writing the letter of the correct response beside the item number. Each item carries 1 mark.

List A	List B
(i) Vernier calipers	A Are force multipliers
(ii) Smell travels so quickly	B Require fuel to do work
(iii) Convection currents	C Polar caps at the top and bottom
(iv) Mars	D Thick atmosphere with no oxygen
(v) Levers	E As a protection to thieves in supermarkets and big shops and used in shaving salons
(vi) Curved mirrors	F Are reflectors and can cause shallow pool visualization
(vii) Refractive index	G Musical instruments use them to give notes of different frequency
(viii) Vibrations	H Cause volcanoes
(ix) Combing hair in a clear dry day	I A thin stream of water bends towards it and a ping-pong ball on a table is attracted
(x) X-rays and γ-rays	J Tiny sparks of electricity are observed
	K A product of some radioactive elements
	L Travel at a speed of light, have short wavelength and form part of an electromagnetic spectrum
	M A ratio of speed of light in glass to that in air
	N The ratio of speed of light in air to that in a media
	O Heat travels from hot parts to cold parts
	P Movement of water round a central heating system
	Q Readings of lengths and thicknesses
	R Measuring lengths to accuracy of 0.01 cm
	S Gases have to be kept in containers
	T Fast moving gas molecules diffuse to take as much space as possible.

SECTION B (60 Marks)

Answer ALL questions in this section.

3. (a) (i) Define centre of gravity

(1 mark)

(ii) Explain why racing cars should have wide wheel tracks.

(1 mark)

(b) State the conditions for stable, unstable and neutral equilibrium and give one example of each condition.

(3 marks)

(c) (i) Why should a mechanic choose a long spanner to undo a tight nut?

(1 mark)

(ii) A uniform half-metre rule is pivoted at its 30 cm mark. A mass of 50 g hung at the 45 cm mark keeps the rule horizontal. Determine the mass of the half metre rule.

(4 marks)

4. (a) (i) Explain the pressure of a gas in terms of the kinetic theory of gases.

(2 marks)

(ii) How is diffusion explained by the kinetic theory of gases?

(2 marks)

(b) (i) State Charles's Law.

(1 mark)

(ii) Sketch the graph of volume against temperature for a perfect gas.

(2 marks)

(c) (i) What is the absolute zero of temperature?

(1 mark)

(ii) 150 cm^3 of dry gas at 30°C was heated until its volume became 450 cm^3. What was the final temperature?

(3 marks)

5. (a) (i) Name, draw and mention one use of the three different types of diverging lenses.

(3 marks)

(ii) What are the characteristics of the images formed by the diverging lens?

(1½ marks)

(b) Where should an object be placed such that its image as formed by a converging lens will be

(i) at infinity (ii) of the same size (iii) erect?

(1½ marks)

(c) A nail 6.0 cm long is placed 15 cm away from a convex lens of focal length 10.0 cm. The nail is stuck perpendicular to the optical axis of the lens. Determine the position and height of the nail.

(4 marks)

6. (a) State four characteristics of a highly sensitive galvanometer.

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(2 marks)

(b) (i) What are eddy currents?

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(1 mark)

(ii) Give two advantages of eddy currents.

(1 mark)

(c) (i) Explain how a moving-coil galvanometer can be converted into an ammeter and into a voltmeter.

(2 marks)

7. (a) (i) Distinguish between mechanical and electromagnetic waves.

(1 mark)

(ii) Explain why a duck remains floating at the same place as a wave passes by the water in a lake.

(2 marks)

(b) (i) What are ultrasonic vibrations?

(1 mark)

(ii) An FM radio station broadcasts electromagnetic waves at a frequency of 125 MHz. The radio waves have a wavelength of 2.4 metres. calculate the speed of the radio waves.

(2 marks)

(c) Gamma ray bursters are objects in the universe that emit pulses of gamma rays with high energies. The frequency of the most energetic bursts has been measured at around 3.0 x 10^{21} Hz.

(i) What is the wavelength of these gamma rays?

(2 marks)

(ii) What could be their period?

(1 mark)

8. (a) Define the term

(i) half life (ii) atomic number

(2 marks)

(b) Name the three fundamental particles of which atoms of an element are composed. how are these particles distributed in the atom of an element whose atomic number is 3 and mass number is 7?

(3 marks)

(c) A radioactive nucleus is denoted by the symbol $^{226}_{88}X$. Write down the composition of the nucleus at the end of the following stages of disintegration:

(i) emission of an alpha (α) particle (2 marks)

(ii) further emission of a beta (β) particle (2 marks

(iii) further emission of a gamma radiation. (1 mark)

SECTION C (20 Marks)

Answer any TWO (2) questions from this section.

9. (a) Explain the terms potential energy and kinetic energy giving one example of each.

(3 marks)

(b) A pendulum bob of mass 50 g is pulled aside to a vertical height of 20 cm from the horizontal and then released. Find

(i) the maximum potential energy of the bob (2 marks)

(ii) the maximum speed of the bob. (2 marks)

(c) (i) Suppose the length of the thread of the pendulum in discussion was 1.0 m, what could its periodic time of oscillation be?

(2 marks)

(ii) State the principle applied by the pendulum experiment.

(1 mark)

10. (a) Sketch the magnetic field patterns due to a current passing through

(i) a long straight wire (ii) a circular coil (iii) a long solenoid.

Indicate clearly the direction of current and magnetic field.

(4 marks)

(b) Explain briefly how the domain theory of magnetism is used to differentiate a magnetic material from a magnet.

(2 marks)

(c) (i) Describe how sounds are transmitted by telephones, explaining the actions of both transmitter and receiver.

(ii) What additional equipment is needed to ensure good communication over long distances?

(4 marks)

11. (a) Define the following and give one use of each:

(i) Capacitor (ii) Diode. (3 marks)

(b)

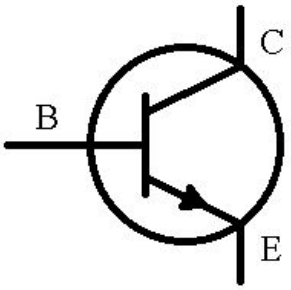

Fig. 1

Use the sketch above (Fig. 1) to answer the following:

(i) What does each symbol represent?

(ii) What type of a device does the sketch represent?

(iii) Write down the current relation for the device.

(iv) Give two common uses of the device. (4 marks)

(c) Draw a sketch circuit for voltage amplification and name the different components used.

(3 marks)