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

131/2

PHYSICS 2

(For Both School and Private Candidates)

Time: 3 Hours

Year: 2020

Instructions

- 1. This paper consists of **six** (6) questions.
- 2. Answer **five** (5) questions.
- 3. Each question carries **twenty** (20) marks.
- 4. Mathematical tables and non-programmable calculators may be used.
- 5. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
- 6. Write your **Examination Number** on every page of your answer booklet(s).
- 7. The following information may be useful:
 - (a) Acceleration due to gravity $g = 9.8 \text{ m/s}^2$
 - (b) Pie $\pi = 3.14$
 - (c) Avogadro's Number, $N_A = 6.0 \times 10^{23} \text{ mol}^{-1}$
 - (d) Density of water = 10^3 kg/m^3
 - (e) Charge of electron = 1.6×10^{-19} C
 - (f) 1 Year = 3.15×10^7 s
 - (g) $1 \text{ MeV} = 1.6 \times 10^{-13} \text{ J}$
 - (h) Permeability of free space, $\mu_0 = 4\pi \times 10^{-7} \, \text{Hm}^{-1}$
 - (i) Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$
 - (j) Permittivity of free space, $\varepsilon_0 = 8.854 \times 10^{-12} \, \text{Fm}^{-1}$
 - (k) Relative permittivity of air $\varepsilon_r = 1$
 - (1) Surface tension of water, $T = 0.072 \text{ Nm}^{-1}$
 - (m) Mass of ${}_{1}^{2}H = 3.345 \times 10^{-27} \text{ kg}, {}_{1}^{3}H = 5.008 \times 10^{-27} \text{ kg}, {}_{1}^{4}He = 6.647 \times 10^{-27} \text{ kg}$ and ${}_{0}^{1}n = 1.675 \times 10^{-27} \text{ kg}$



Answer five (5) questions.

- State two factors which determine the magnitude of viscous force. (02 marks)1. (a)

(05 marks)

- Identify two limitations and three importance of applying Stokes' law in fluids motion. (b)
- A venture meter consists of two identical wide tubes A and B connected by a narrow (c) tube C. The liquid enters through the wide tube A and after passing through the narrow tube C leaves through the other wide tube B. The entire arrangement is as shown in the following Figure.



Use the Bernoulli's theorem at points 1 and 2, to show that an expression for the rate of flow of the liquid is given by $Q = A_1 A_2 \sqrt{\frac{2 g h}{A_1^2 - A_2^2}}$, where all symbols carry their (06 marks) usual meaning.

A cylindrical tank 1 m in radius rests on a platform 5 m high. Initially, the tank was (d) filled with water to a height of 5 m. If a plug of area 10^{-4} m² is removed by an orifice on the side of the tank at the bottom; calculate the initial speed with which the water:

(i) flows from the orifice.			(04 marks)	
(ii)	strikes the ground.		(03 marks)	

What is the importance of each of the following in relation to the production of plane (a) polarized light?

(i)	Dextro-rotatory substance.	(01 mark)
(ii)	Laevo-rotatory substance.	(01 mark)
(iii)	Optically active substance.	(01 mark)
(iv)	Double refraction.	(01 mark)
(ii) (iii) (iv)	Optically active substance. Double refraction.	(01 (01

Differentiate: (b)

(c)

2.

(i)	Polaroid from polarimeter.	(01 mark)
(ii)	Plane of vibration from plane of polarization.	(01 mark)
(iii)	Ordinary light from plane polarized light.	(01 mark)
Desc	ribe the construction of Nicol Prism	(05 marks)

Briefly explain the observations made with regard to the formation of fringes in (d) Newton's ring experiment when:

			(i)	the glass plate is silvered on its front surface.	(02 marks)
			(ii) (iii)	the sodium lamp is replaced by a white light. a few drops of a transparent liquid are introduced between the	(02 marks) lens and the
				plate.	(02 marks)
	(e)		What	govern the radius of the ring in Newton's ring experiment? Give	two factors. (02 marks)
3.	(a)		Briefly	y explain the following observations:	
			(i)	The rise of the liquid is affected if the top of capillary tube is close	d.
		*	(ii)	Rain drops are spherical in shape.	(02 marks) (02 marks)
	(b)	,	(i)	Why brick walls are plastered with cement?	(03 marks)
			(ii)	A barometer contains two uniform capillary tubes of radii 6.5	$\times 10^{-4}$ m and
				1.24×10^{-5} m. If the height of water in narrow tube is 0.2 m more the wide tube, calculate the true pressure difference.	e than that in (05 marks)
	(c)		(i)	What is meant by surface tension? Give its S.I units.	(02 marks)
			(ii)	During the rain, 64 rain drops combined into a single drop. Calcu of the total surface energy of the 64 drops to that of a single drop.	late the ratio (06 marks)
4.	(a)	. La	(i)	Give the meaning of the terms capacitance and relative permittivit	y. (02 marks)
		4	(ii)	Calculate the capacitance of a pair of parallel plate 0.1 m by 0.1 m gap of 5 mm.	with an air (04 marks)
	(b)		(i)	What is a Van de Graaff generator?	(02 marks)
			(ii)	In a Van de Graaff generator, the shell electrode is at 25 x 1 dielectric strength of the gas surrounding the electrode is 5×10^7 V	10^5 V. If the $7/m$, calculate
				the minimum radius of the spherical shell.	(04 marks)
	(c)		(i)	State Coulomb's law of forces.	(02 marks)
			(ii)	An electron is situated in a uniform electric field of field	strength of
				1.2×10^{3} Vm ⁻¹ . Find the force acting on it and its acceleration if it 20 mm from rest.	has travelled (06 marks)
5.	(a)		(i)	Distinguish between diamagnetic, paramagnetic and ferromagnet on the basis of relative permeability μ_{a} .	tic materials (03 marks)
		Ø	(ii)	Give the meaning of intensity of magnetization I for a paramagn and use Curie's law to show how it relates with the absolute tempe	etic material erature (T). (03 marks)

- (i) Why the material used for making the core of a transformer should have narrow hysteresis loop? (02 marks)
 - (ii) A specimen of iron is uniformly magnetized by the magnetizing field of 300 Am⁻¹. If the magnetic flux density in the specimen is 0.4 Wbm⁻², find the relative permeability, susceptibility and the permeability of the specimen.

(06 marks)

- Consider two parallel co-axial circular coils of equal radius R, and number of turns N, carrying equal currents I in the same direction and separated by a distance R. Show that $B = 0.72 \frac{\mu_0 NI}{R}$, where B is the field on the axis around the mid-point between the coils which is uniformly distributed over a distance that is small as compared to R and μ_o is the permeability of free space. (06 marks)
- 6. (a) Differentiate:

(b)

(c)

(b)

(i)	Ionization energy from excitation energy.	(01 mark)
(ii)	Ionization potential from excitation potential.	(01 mark)

(i) State Bohr's frequency condition. (01 mark)

- (ii) Why a very thin gold foil is used in Rutherford's α particle scattering experiment? (02 marks)
- (iii) It is found experimentally that -2.2×10^{-18} J is required to separate hydrogen atom into a proton and an electron. Compute the orbital radius and the velocity of the electron in a hydrogen atom. (04 marks)
- (c) What is meant by the following terms as applied in atomic and nuclear Physics?

(i)	Binding energy curve	(01 mark)
(ii)	Nuclear mass	(01 mark)
(iii)	Nuclear reaction	(01 mark)
(iv)	Artificial radioactivity	(01 mark)

(d)

In an experiment, the activity of 1.6 mg of radioactive potassium chloride (chloride of isotope K – 40) was found to be 180 s⁻¹. Taking molar mass of K – 40 Cl to be 0.075 kg mol⁻¹, find the:

(i)	number of $K - 40$ atoms in the sample.	(02 marks)
(ii)	half-life of $K - 40$.	(02 marks)

(e) How long can an electric lamp of 200 W be kept glowing by fusion of 3.0 kg of deuterium given that the fusion reaction taking place is ${}_{1}^{2}H + {}_{1}^{2}H \rightarrow {}_{2}^{3}He + {}_{0}^{1}n + 3.27 \text{ MeV}?$ (03 marks)