UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

DEGREE IN ENVIRONMENTAL HEALTH SCIENCE

MAIN EXAMINATION PAPER DECEMBER 2019

TITLE OF PAPER	:	PHYSICS FOR HEALTH SCIENCES (NURSING AND ENVIRONMENTAL HEALTH STUDENTS)
COURSE CODE	:	EHS103
DURATION	:	2 HOURS
MARKS	:	100
INSTRUCTIONS	:	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	:	ANSWER **ANY FOUR** QUESTIONS
	:	QUESTION **ONE** IS COMPULSORY
	:	EACH QUESTION **CARRIES 25** MARKS.
	:	WRITE NEATLY & CLEARLY
	:	CALCULATOR, GRAPH PAPERS, RULAR AND A SET OF MATHEMATICAL INSTRUMENTS ARE REQUIRED FOR THIS EXAM PAPER
	:	EXECPT THE GRAPH PAPER, NO OTHER PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
	:	STUDENTS ARE ALLOWED TO USE GRAPH PAPERS AND SCIENTIFIC CALCULATORS
	:	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

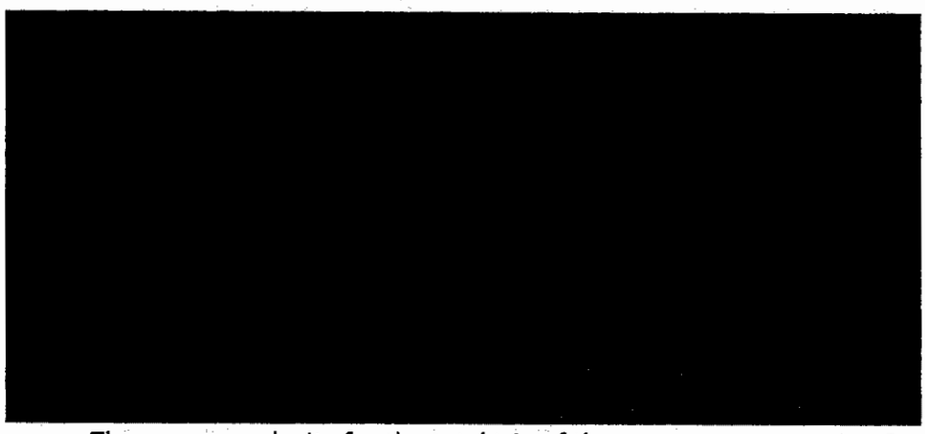
QUESTION ONE

1. Nokulunga and Celumosa are doing a vector walk lab. Starting at the door of Hall 2 where they attend their physics lectures, they walk 2 m, south. They then make a right hand turn and walk 16 m, west. They turn right again and walk 24 m, north. They then turn left and walk 36 m, west.
    a. Draw a sketch of this problem. 2 marks.
    b. Draw the four vectors to show the resultant of their walk 5 marks.
    c. What is the magnitude of their overall displacement? 10 marks.
2. The magnitude of a vector, F, is 10 units and the direction of the vector is 60^0 with the horizontal.
    a. Draw the vector representation to show the components of the resultant. 4 marks.
    b. Find the components of the vector, F. 4 marks.

Total 25 marks

QUESTION TWO

1. List four differences between speed and velocity 8 marks.
2. At 8:15 a.m., Sipho who was driving his car arrive his place of work that is 10 km east of his house. Then at 9:15 a.m., he arrived at his grandfather's house which is 26 km west of his own house to attend to his grandfather who is ill. What is his average velocity for the whole time interval? 4 marks.
3. The figure below represents the motion of a car that moved from points O, A, B and C. study it and answer the questions that following.



    a. The average velocity for the total trip of the car. 3 marks.
    b. The average velocity during the first 4 s of motion. 2 marks.
    c. The average velocity during the next 4 s of motion 2 marks.
    d. The instantaneous velocity at t =6 s. 3 marks.
    e. What is the meaning of instantaneous velocity? 3 marks.

Total 25 marks

QUESTION THREE

1. Define force 2 marks.
2. Name two types of forces and for each, give one examples 4 marks.
3. List any five general properties of forces. 5 marks.
4. State the three Newtonian laws of motion. 6 marks.
5. An object of mass m = 2 kg is attached to a stretched string of length L = 3 cm. The object is held stationary by a horizontal external force F_{ext} at the position where the string makes an angle of $\Theta = 45^0$ with the vertical.
    a. What is the magnitude of the tension in the string? 4 marks.
    b. What is the magnitude of the external force F_{ext}? 4 marks.

Total 25 marks

QUESTION FOUR

1. A steel strut near a ship's furnace is 2 m long, with a mass of 1.57 kg and compression area of $1x10^{-4}$ m^2. During operation of the furnace, the strut absorbs a net thermal energy of $2.5x10^5$J.
    a. Find the change in temperature of the strut.Take the specific heat capacity for steel as 448 J/kg^{0}C. 5 marks.
    b. Find the increase in length of the strut. Take α as $11x10^{-6}/^0$C. 5 marks.
2. Two cells each having an e.m.f. of 1.5 V and an internal resistance of 2 Ω are connected (a) In series, and (b) in parallel.
    a. Draw the circuit diagrams of these two connections if the cells are connected to a 1 Ω resister. 2 marks.
    b. Find the current in each case when the cells are connected to a 1 Ω resistor. 6 marks
    c. If the 1 Ω resistor is substituted with an 11 Ω resistor, calculate the new current in both cases. 7 marks.

Total 25 marks

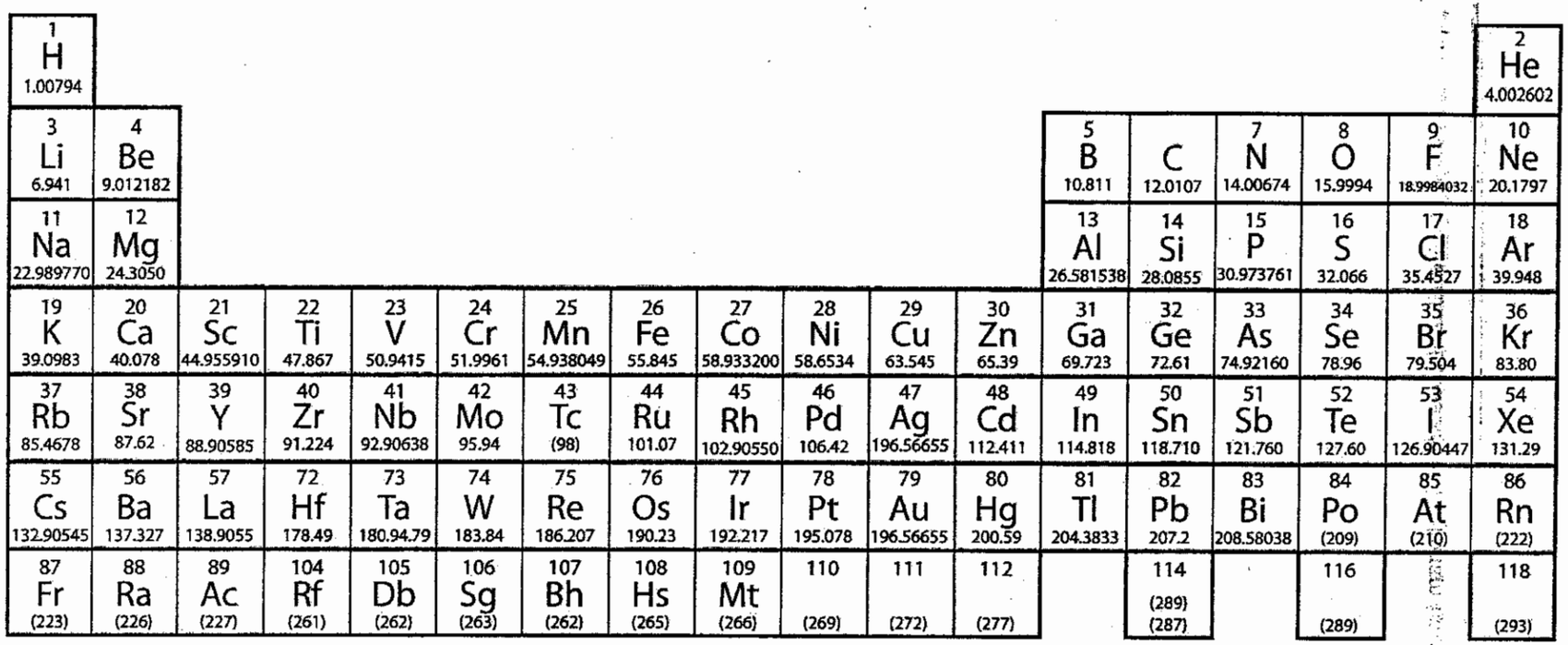
QUESTION FIVE

For this question, where necessary use the periodic table provided at the back of the paper to answer the questions.

1. If a heavy nucleus were to fission into only two product nuclei, they would be very unstable. Explain why. 4 marks.
2. When $^{235}_{92}U$ is bombarded by slow moving neutrons, it decays to produce daughter nuclei that are different from the starting $^{235}_{92}U$. Write the equation of the resulting nuclei fission reaction giving the reactants and the products. 5 marks.
3. Marie Curie earned one of her two Nobel prizes for isolating the element radium, which soon became widely used to treat cancer. Radium – 226, $_{88}Ra$, is an alpha and gamma emitter. Write a balanced nuclear equation for the decay of radium – 226. 3 marks.
4. Strontium – 90, $_{38}Sr$, a beta emitter, is one of the many radio-nuclides present in wastes of nuclear power plants. Write the balanced nuclear decay equation for this. 2 marks.
5. Work out the decay equations for the following:
    a. Americium – 243, $_{95}Am$ (an alpha emitter) 2 marks.

b. Thorium – 230, $_{90}$Th (an alpha and gamma emitter) 3 marks.
c. Technetium, $_{43}$Tc (a gamma emitter) 2 marks.
d. Rhenium – 187, $_{75}$Re (a beta emitter) 2 marks.
e. Krypton – 87, $_{38}$Kr (a neutron emitter) 2 marks.

Total 25 marks



1 H 1.00794																	2 He 4.002602
3 Li 6.941	4 Be 9.012182											5 B 10.811	6 C 12.0107	7 N 14.00674	8 O 15.9994	9 F 18.9984032	10 Ne 20.1797
11 Na 22.989770	12 Mg 24.3050											13 Al 26.581538	14 Si 28.0855	15 P 30.973761	16 S 32.066	17 Cl 35.4527	18 Ar 39.948
19 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6534	29 Cu 63.545	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.92160	34 Se 78.96	35 Br 79.504	36 Kr 83.80
37 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 196.56655	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.29
55 Cs 132.90545	56 Ba 137.327	57 La 138.9055	72 Hf 178.49	73 Ta 180.94.79	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.56655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.58038	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 (269)	111 (272)	112 (277)		114 (289) (287)		116 (289)		118 (293)

58 Ce 140.116	59 Pr 140.50765	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.26	69 Tm 168.93421	70 Yb 173.04	71 Lu 174.967
90 Th 232.0381	91 Pa 231.035888	92 U 238.0289	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)