NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

InSTEM

QUALIFICATION: INTRODUCTION TO SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS	
QUALIFICATION CODE: 04STEM	**LEVEL:** 4
COURSE CODE: IPH402S	**COURSE NAME:** INTRODUCTION TO PHYSICS B
SESSION: JANUARY 2020	**PAPER:** N/A
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	**Ms Ilana Malan** **Ms Oksana Kachepa**
MODERATOR:	**Mr Anthony Apata**

INSTRUCTIONS
1. Answer all questions. 2. Write all the answers in ink. 3. No books, notes, correction fluid (Tippex) or cell phones allowed. 4. Pocket calculators are allowed. 5. You are not allowed to borrow or lend any equipment or stationary. 6. All **FINAL ANSWERS** must be rounded off to **THREE DECIMAL PLACES**. 7. All CONSTANT VALUES and FORMULAS on page 12. 8. Periodic Table on page 13.

THIS QUESTION PAPER CONSISTS OF 13 PAGES (Excluding this front page)

SECTION A – TOTAL MARKS 30

This section consists of nine questions. Choose the correct answer and clearly indicate your answer on your answer sheet.

Question 1 [4]

The primary coil of the transformer in **Figure 1** has 600 turns. How many turns are on the secondary?

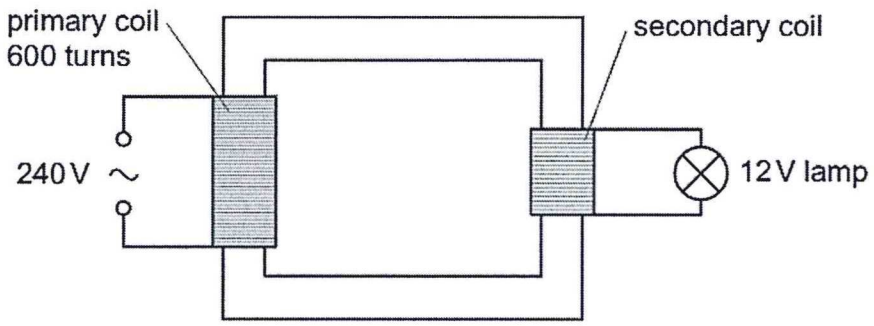


Figure 1

(a) 12
(b) 20
(c) 30
(d) 50

Question 2 [4]

At a depth of 12.5 m of a chemical solvent, the bottom of the storage tank due to the solvent was 306 kPa. Calculate the density of the solvent.

(a) 2 495.413 kg/m^3
(b) 2.495 kg/m^3
(c) 2 495.413 kg/cm^3
(d) 2.495 kg/cm^3

Question 3 **[4]**

Determine the total capacitance between points A and B in **Figure 2** below:

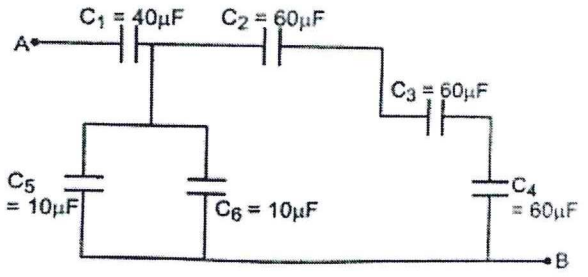


Figure 2

(a) 420 μF
(b) 20.075 μF
(c) 8 μF
(d) 120 μF

Question 4 **[2]**

A swimmer floating in the ocean floats up and down as the waves pass by her. The distance the swimmer moves up and down would be:

(a) twice the amplitude
(b) the wavelength
(c) the amplitude
(d) twice the wavelength

Question 5 **[2]**

Photons that are emitted during radioactive decay are called:

(a) alpha rays
(b) beta rays
(c) gamma rays
(d) x-rays

Question 6 **[2]**

I waves **A** and **B** in **Figure 3** are superposed, the resultant wave is:

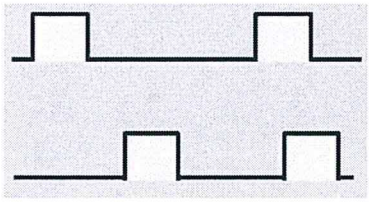
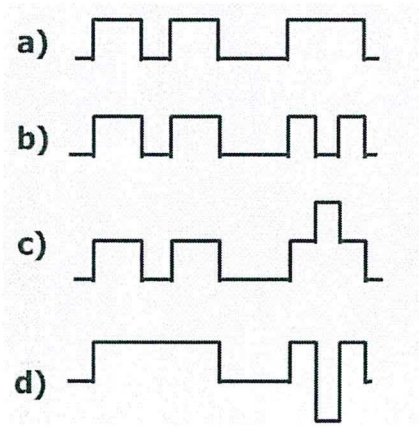


Figure 3



Question 7 **[4]**

If 4×10^{18} atoms decay with a half-life of 2.3 years, how many half-lives will it take for 3.9375×10^{18} of the atoms to decay?

(a) 4
(b) 6
(c) 8
(d) 10

Question 8 **[4]**

A generator produces power for a school. 100 kW of power is produced by the generator with a potential difference of 10 kV across it. In order to reach the school the current produced must flow through cables of resistance 0.12 Ωm/km. The school is 57 m from the generator. The power loss in the cables is:

(a) 648 A
(b) 100 A
(c) 12 A
(d) 684 A

Question 9 **[4]**

A student hears two echoes when she claps her hands. One echo is 0.5 s after the clap and the other is 1 s after the clap. She decides that the two echoes are from buildings in front of her. How far apart are the buildings? (speed of sound in air = 340 m/s)

(a) 340 m
(b) 225 m
(c) 170 m
(d) 85 m

SECTION B – TOTAL MARKS 70

This section consists of six (6) questions. Answer ALL the questions.

Question 10 **[10]**

10.1 How would you arrange the long chain molecules in a polaroid filter if you want to allow only vertical vibrations to pass through the filter? (1)

10.2 The graphs in **Figure 4** show information regarding two strings. Answer the questions 10.2.1 – 10.2.4 with regards to **Figure 4**.

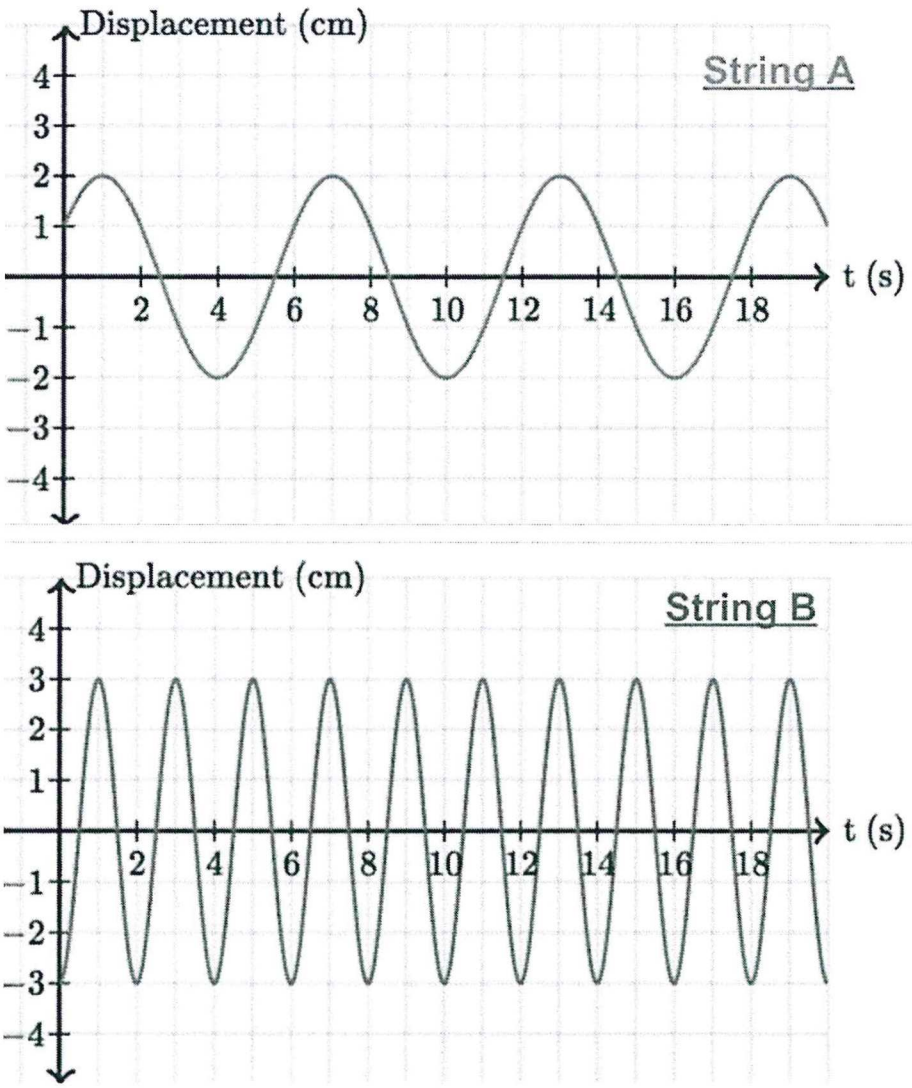


Figure 4

10.2.1 String A moves at a speed of 5 m/s. Draw a displacement-distance graph for string A with three full wavelengths. At time = 0 seconds the wave should have maximum amplitude. Cleary indicate wavelength. (5)

10.2.2 String B moves with the same speed as string A. Determine the wavelength for string B. (2)

10.2.3 Both waves move through the same size gap. Which string A or B will show the most diffraction? (1)

10.2.4 When the two strings are super imposed at t = 10 s, will we see constructive or destructive interference? (1)

Question 11 **[12]**

11.1 A cylinder of a solid material is floating in oil (0.93 g/cm^3). The diameter of the cylinder is 7 cm and the height is 19 cm. If 28 % of the object is submerged, what is the density of the cylinder? (4)

11.2 Relate viscosity of fluids with friction. (2)

11.3 One of the properties that can be compared between fluids is that gases have a low density and liquids a higher density. What property do liquids have that gases do not have? (1)

11.4 Define flow rate. (1)

11.5 During dry season in many places water supply to residential dwellings may be cut to save the supply in the dams. Many citizens make use of water reservoirs (large tanks) to store water for domestic use. A family of four uses on average 315 l of water per day per person. (1 m^3 = 1000 l)

11.5.1 How long will a 5000 l tank give them water for? (1)

11.5.2 How long will it take them to fill the tank after two days of water use if the inlet has a 40 mm diameter and water is pumped at 700 ml / s? (3)

Question 12 **[12]**

12.1 What does the formula $V = \frac{energy}{Q}$ tell you about PD? (1)

12.2 Answer questions12.2.1 – 12.2.5 with regards to **Figure 5**. The battery in **Figure 5** consist of 4 cells connected in parallel. Each cell has an internal resistance of $\frac{33}{16}\ \Omega$ and emf of 1.5 V. Internal voltage drop is 1.65 V.

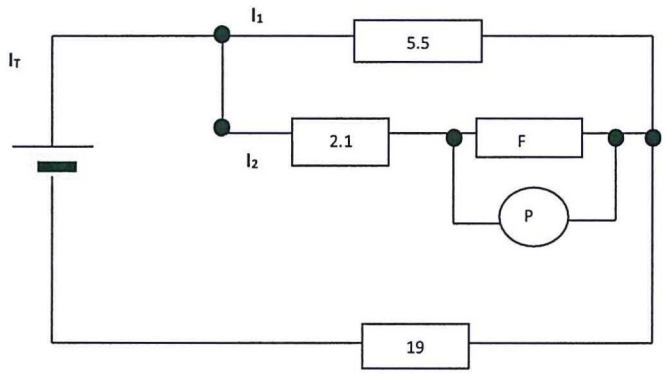


Figure 5

12.2.1 What will P measure? Be specific. (2)

12.2.2 Write an equation that will denote Kirchhoff's second law that includes P. (2)

12.2.3 Determine total current if $I_1 = I_2$. (4)

12.2.4 Determine the total current if the cells were connected in parallel. (3)

Question 13 **[12]**

13.1 Which well known experiment is depicted in **Figure 6**? (1)

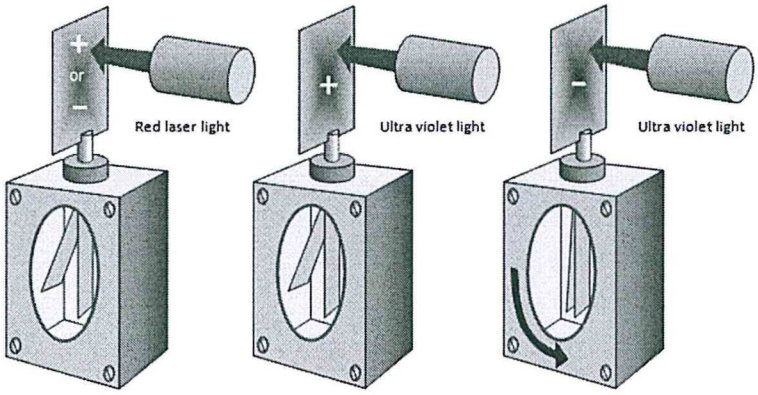


Figure 6

13.2 What did this experiment prove? (1)

13.3 Differentiate between work function and threshold frequency. (4)

13.4 The work function of Ca 2.9 eV and that of Pt is 5.6 eV. Light with a frequency of 9×10^{14} Hz is incident on both metals.

13.4.1 From which metal surface will an electron be emitted? (3)

13.4.2 At what velocity does the emitted electron move? (3)

Question 14 **[8]**

14.1 State the effect depicted in **Figure 7** and give the definition. (3)

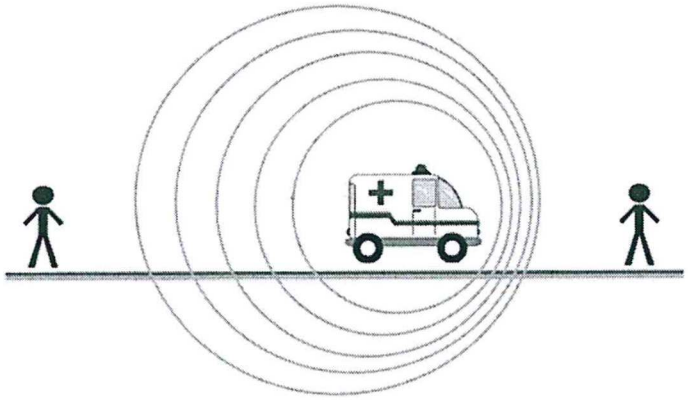


Figure 7

14.2 What happens to the frequency of the ambulance in Figure 7? (1)

14.3 Use the graph in **Figure 8** below to determine the speed that a train passes a passenger standing on the platform. (speed of sound in air = 330 m/s) (4)

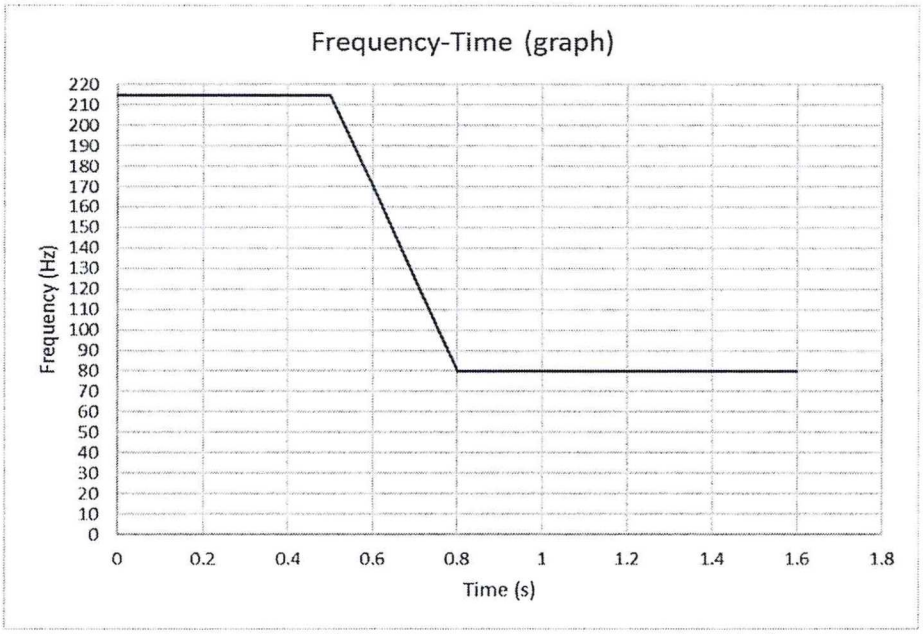


Figure 8

Question 15 **[8]**

15.1 What is the advantage of transmitting power at high voltage via power lines? (2)

15.2 A power station generates power for a factory. The 10 MW power must be delivered to the factory at 40 kV. If the cables have resistance of 5 Ω, how much power must be generated? (3)

15.3 In a step-up transformer the turns ratio is 3:18. The voltage measure in the secondary coils is 8000 V with a current of 0.5 A. There is no power loss in the transformer. What is the current in the primary coil? (3)

Question 16 **[8]**

16.1 Write a one equation to illustrate the decay of Thorium-230 that undergoes radioactive decay by emitting 3 alpha particles and 5 beta particles. (3)

16.2 What is the meaning of activity when used with regards to radioactivity? (1)

16.3 A radioactive sample decays and in a time of 43 minutes out of the original sample of 5000 active particles a total of 4960.9375 undergoes decay. How long is one half-life? Make use of a table and show your working. (4)

The End

Constants and formulas:

10^3	kilo	K	10^{-2}	centi	c
10^6	Mega	M	10^{-3}	milli	m
10^9	Giga	G	10^{-6}	micro	μ
10^{12}	Tera	T	10^{-9}	nano	n
10^{15}	Peta	P	10^{-12}	pico	p

g = 9,81 m/s^2

mass of electron=9.1 x 10^{-31} kg

Planck's constant = 6.626 x 10^{-34} m^{2}kg/s

elementary charge = 1.6 x 10^{-19}

List of equations

$v = f\lambda$

$P = \frac{F}{A}$

$P = \rho gh$

$F_B = W_f$

$\rho = \frac{m}{V}$

$\text{flow rate} = \frac{V}{t} = Av$

$A_1 v_1 = A_2 v_2$

$Q = \frac{I}{t}$

$power = VI$

$f_o = f\left(\frac{v \pm u}{v}\right)$

$f_o = f\left(\frac{v}{v \pm u}\right)$

$emf = (I_T R_T) + (I_T r_T)$

$R = \rho\frac{A}{L}$

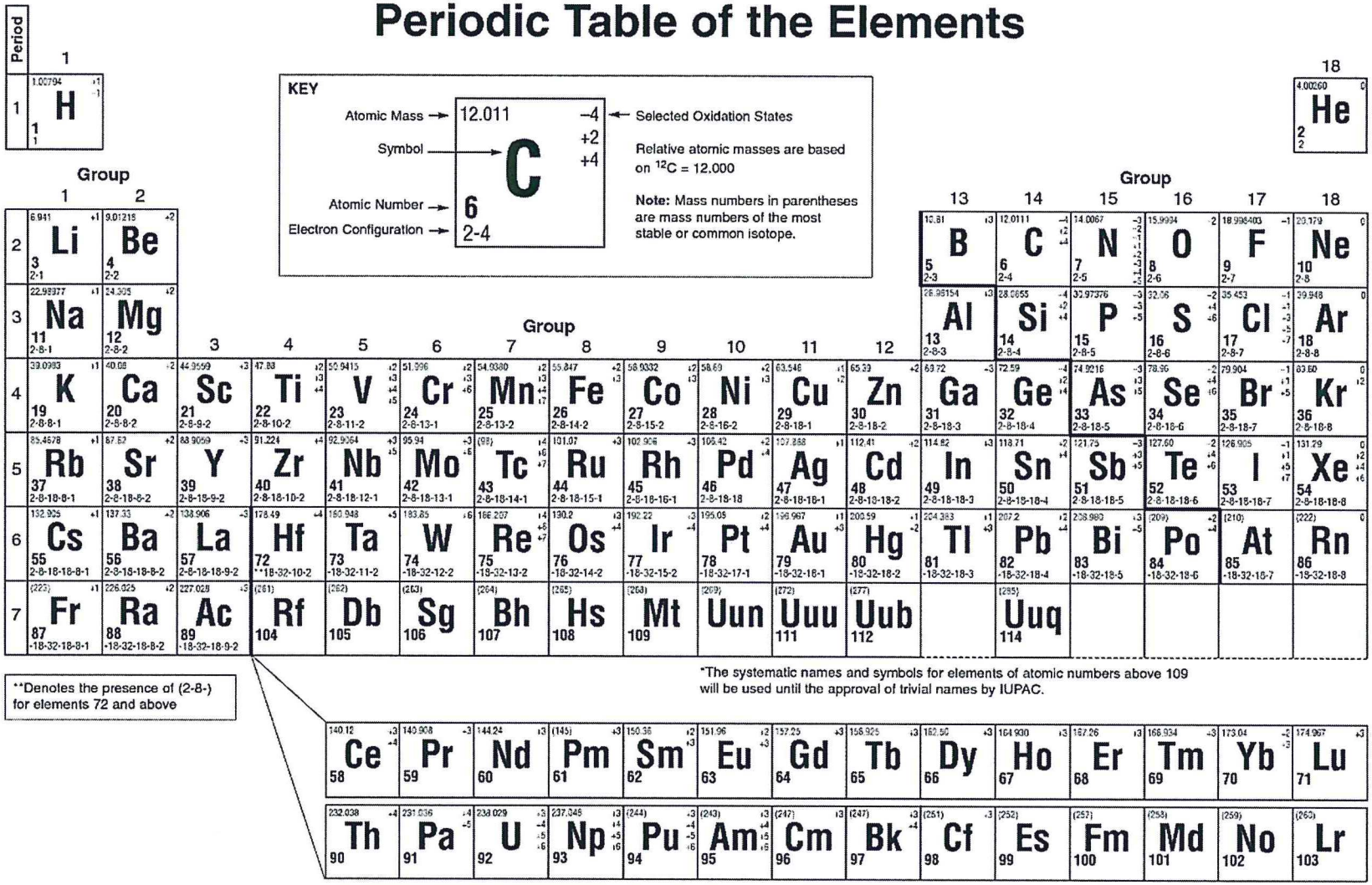
$C = \frac{Q}{V}$

$power_p = power_s$

$E = hf = \phi + KE$

$N_p : N_s = V_p : V_s$

Periodic Table of the Elements



**Denotes the presence of (2-8-) for elements 72 and above

*The systematic names and symbols for elements of atomic numbers above 109 will be used until the approval of trivial names by IUPAC.

Reference Tables for Physical Setting/CHEMISTRY