THE PNG UNIVERSITY OF TECHNOLOGY

ENTRANCE EXAMINATION - 2021

SUBJECT: PHYSICS

TIME ALLOWED: THREE (3) HOURS

INFORMATION FOR STUDENTS

1. You have TEN (10) MINUTES to read this question paper. Do not begin writing this time.
2. There are two parts to the Examination. Part A is Multiple Choice and part B is short and long answer questions.
3. Answer ALL Questions.
4. There are total of 100 Marks from this examination paper.
5. All answers must be written in the answer book supplied. Show all your working in the answer book. COMPLETE THE DETAILS REQUIRED ON THE FRONT COVER OF THE ANSWER BOOK.
   DO THIS NOW.
6. Text books, note books and mobile phones are NOT permitted.
7. TURN OFF YOUR MOBILE PHONES NOW.

SURNAME _____

GIVEN NAME _____

DATE _____

LOCATION _____

STUDENT SIGNATURE: _____

INTENDING COURSE: _____

DO NOT WRITE UNTIL YOU ARE TOLD TO START.

PART A: Multiple Choice (15 marks)

Q1.
Radio waves travel at the speed of light, 300,000 km/s. The wavelength of a radio wave received at 100 Megahertz on your radio dial is (1 marks)

A. 1/3 meters
B. 3.3 meters
C. 3 meters
D. Less than 3 meters

Q2.
A Doppler effect is noted when a source of sound moves (1 marks)

A. At right angles to you
B. Two of the other answers are correct
C. None of the answers is correct
D. Towards you.

Q3.
If an explosion occurs 34 kilometers away, the time it will take for the sound to reach you (Assuming sound travels at 340 m/s) is about (1 marks)

A. More than 15 seconds
B. 2 seconds
C. 5 seconds
D. 10 seconds
E. 15 seconds

Q4.
A cello string 0.75 m long has a fundamental frequency of 220 Hertz. The speed of the waves on the string will be (1 marks)

A. 165 m/s
B. 220 m/s
C. 294 m/s
D. 330 m/s
E. None of the other answers is correct

Q5.
When a distance between a pair of charged particles is halved, the electric force that each experiences is (1 marks)

A. Quadruples
B. Doubles
C. Halved
D. Reduced to one-fourth
E. None of the other answers is correct

Q6.
Work is required to push a solitary electron into an electric field where it attains an electric potential of 1 volt. If you instead push 2 electrons through the same path, the electric potential of the two electrons will be (1 marks)

A. 2 Volts
B. 4 Volts
C. 1 Volt
D. ½ Volts
E. None of the above

Q7.
A cable car rolls along a track with considerable momentum. If it rolls twice as fast, its momentum will be (1 marks)

A. Zero
B. As it was in the first place
C. Doubled
D. Quadrupled
E. None of the answers are correct

Q8.
When you jumped from an elevated position you usually bend your knees upon meting the ground and thereby extend the time your momentum is reduced by about 10 times that of a stiff-legged abrupt landing. In this way the average force your body experiences are reduced by (1 marks)

A. None of these answers
B. Less than 10 times
C. More than 10 times
D. About10 times

Q9.
Two identical freight cars freely roll towards each other on a level track, one at 2 m/s to the right and the other at 1 m/s to the left. The cars collide and couple together and roll towards the right with the speed of (1 marks)

A. 1/3 m/s
B. ½ m/s
C. 2/3 m/s
D. 1 m/s

Q10.
A 110-Volt Heater draws 20 Amps. If electric power cost 10 toeas per kilowatt hour, the cost of running the heater for 10 hours would be (1 marks)

A. 22 toea
B. 55 toea
C. K5.50
D. K2.20

E. The answers above are not correct

Q11
A moving electron in a magnetic field experiences maximum force when its direction (1 marks)

A. Coincides with the direction of the magnetic field
B. Is exactly opposite that of the magnetic field
C. Is perpendicular to the magnetic field
D. None of the other answers is correct

Q12
Which electromagnetic wave listed has the shortest wavelength? (1 marks)

A. Infrared
B. X-Ray
C. Ultraviolet
D. Visible
E. None of the above

Q13.
Which of the following is an acceleration? (1 marks)

A. A decrease in speed
B. All of the other answers are correct
C. A change in direction
D. A change in velocity
E. An increase in speed

Q14.
The force required to maintain a body at constant speed in the absence of all other forces is equal to (1 marks)

A. The weight of the body
B. The mass of the body
C. Zero
D. The force required to stop it
E. None of the other answers is correct

Q15.
According to Galileo's concert of inertia, which is restated as Newton's First Law of Motion, a body not acted upon by an outside force will (1 marks)

A. Eventually stop
B. Move in an elliptical orbit
C. Rise or fall until it reaches its natural place
D. Move in uniform circular motion
E. Move in a straight line at constant speed

Part B: Short and long answer Questions (85 Marks)

Question 1

(8 Marks)

a) Express the following into scientific notation (in SI Unit). (2 Marks)

i) 430000 km ii) 0.0000036μs

b) Convert the following measurements. (2 Marks)

i) 20 MHz to Hz ii) 58.5μm to km

c) Solve the following addition problem and get the final answer to three significant figures. (4 Marks)

i) 235 m + 45.24 m + 325.50 m

ii) 0.0018s + 0.356ms + 200μs

Question 2

(5 Marks)

A tennis ball is projected upwards vertically into the air with an initial speed of 30m/s from a point 1.0 m above the ground.

a) How high does it climb (maximum height)? (2 marks)

b) How long does it climb to maximum height and return to its point of projection? (3 marks)

Question 3

(5 marks)

a) Why a transformer does not work with direct current (dc) signals? (2 marks)

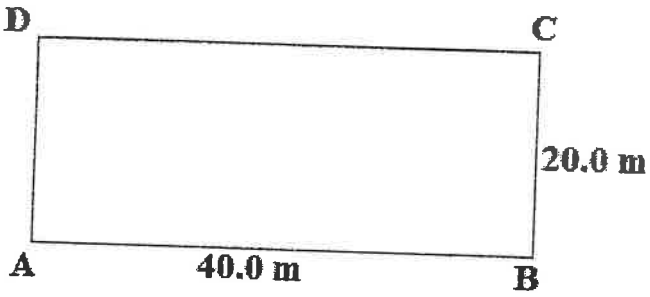
b) How does the current flow in secondary winding of a transformer? (2 marks)

c) What do you call a transformer that increases the voltage in the secondary? (1 marks)

Question 4

(5 marks)

(a) A physics tutor walks from point A to point D in a rectangular field as sown below. What is her displacement? (1 Marks)



(b) From part(a) above what is the total distance if the physics tutor has to travel around the whole field? (1 mark)

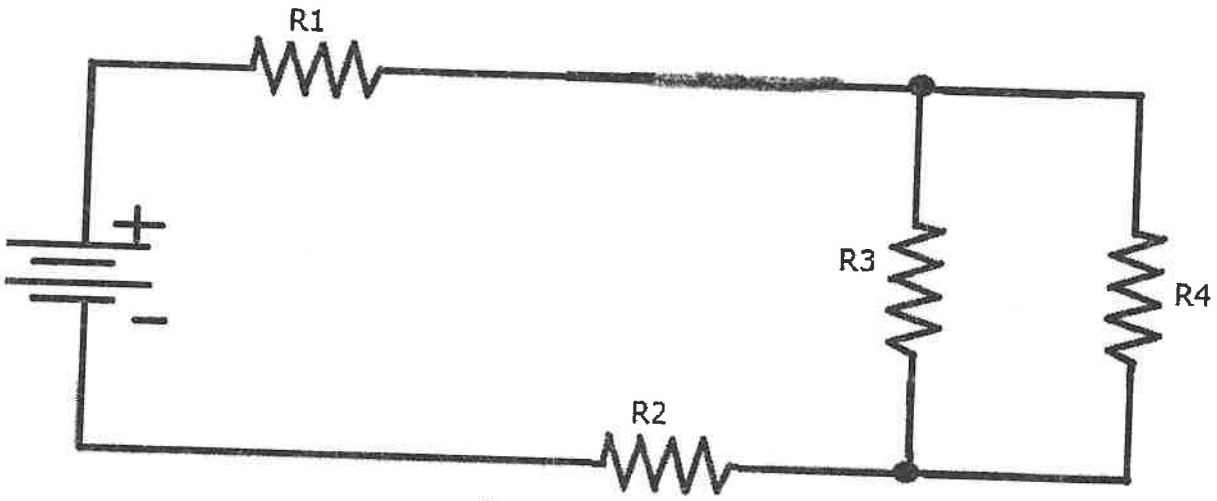
(c) If the physics tutor takes 6.0 minutes to travel the perimeter of the field. What is her average speed? (2 marks)

(d) What is her average velocity if the physics tutor starts from point A and return to point A in a time of 6.0 minutes? (1 mark)

Question 5

(5 marks)

The electrical circuit below has all values of resistance equal to 4 Ω.



(a) Calculate the total resistance in the circuit. (2 marks)

(b) The current through the circuit if the Battery is 10 volts. (2 marks)

What is the total power supplied by the battery? (1 mark)

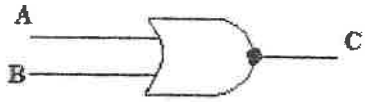
Question 6 (6 marks)

A car starts from rest and accelerated with a uniform acceleration of 5.0 ms^{-2} for 10 seconds and then moves with a constant velocity for another 10 seconds and finally decelerates uniformly to rest in 3 seconds. Sketch a velocity – time graph which represent the above information.

(6 marks)

Question 7 (6 marks)

(a) The logic gate below is a two input NOR gate. Draw the truth table for the NOR gate. (3 marks)



(b) Using the truth table in part(a), find the logic equation representing A, B and C. (In other words, what is C equal to in terms of A and B for only C=1?) (3 marks)

Question 8 (8 marks)

a) If you shoot an arrow straight up at 50 m/s, when will it run out of its speed? (2 marks)

b) What will be the arrow's speed 5 seconds after you shoot it? (2 marks)

c) What will its speed be after 7 seconds after you shoot it? (2 mark)

d) How high is the arrow after it runs out of speed? (2 marks)

Question 9 (10 marks)

a) A calorimeter with a heat capacity of 800J/^{o}C contains 100 g of water at 60^{0}C. A 25 g of ice at -10^{0}C is added to the water in the calorimeter. Assume no heat is lost to the surroundings, calculate the final temperature of the mixture of ice and water when equilibrium condition is reached. (4 mark)

b) The horizontal pipe shown in figure below has a cross- sectional area of 40.0 cm^2 at the wider portions and 10.0 cm^2 at the constriction. Water is flowing in the pipe, and flows through the narrow pipe at 6.00 x 10^{-3} m^3/s(6.00L/s). Find:

(a) the flow speeds at the wider portion;

(b) the pressure difference between these portions;

(c) the difference in height between the mercury columns in the V-shaped tube.

(6 marks)

$mc\Delta T = m_s c_s \Delta T$

$mc(T_2 - T_1) = mc(T_2 - T_1)$

$\frac{J}{1} \div \frac{J}{^{o}C}$

$1m = 100cm$

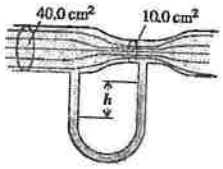
$1m^2 = 10000cm^2$

$Area = 10cm^2$

$Volume\ Flow = 6 \times 10^{-3} m^3/s$

0.006

$= 6 \times 10^{-3}$ $V = AY$



Question 10

(7 Marks)

A house hold refrigerator is rated at 550W

a) How much energy is delivered to the refrigerator in two hours and switched off 30 minutes from that 2 hours? (3 Marks)

b) At the rate of K0.075 per kWh, how much does it cost to run the refrigerator per day for 30 days? (4 Marks)

Question 11

(7 Marks)

A 100kg rugby player running with 15 ms^{-1} bumped into the opponent player whose mass is 350 kg and come to a dead stop in 0.05 s. Assume that the player did not go further but stopped by the heavy weight opponent,

a) What is the change in momentum of the Player? (3 marks)

b) What is the impulse of the Player needed to come to a complete stop? (2 Marks)

c) Calculate the average force of the Player? (2 Marks)

Question 12

(6 Marks)

A positive charge of 8.0×10^{-3} C is placed 26 cm away from another positive charge of 7×10^{-3} C. Calculate;

a) The force that exists between them. (3 Marks)

b) The electric field between the charges. (3 Marks)

Question 13 (7 Marks)

A 2 kg block of a material slides down a 30^0 and 2 m inclined plane with a constant acceleration. The block starts from rest at the top and gained its velocity of 5 ms^{-1} at the bottom.

a) Draw a free body diagram of all the forces acting on the 2 kg block. (2 marks)

b) What is the acceleration of the block? (3 Marks)

c) How much is the coefficient of the friction? (2 Marks)

THE END!

Data and Formula Sheet

1. $c_{water} = 4184 J/kg°C$
2. $L_{f(ice)} = 3.34x10^5 J/kg$
3. $L_{v(water)} = 2.26x10^6 J/kg$
4. $C_{ice} = 2100 J/Kg°C$
5. Density of water = 1000 kg/m³
6. $P = \rho gh$
8. $P = \frac{F}{A}$
8. $\rho = \frac{m}{V}$
9. $V = IR$
10. $P = I^2 R = IV = V^2/R$
11. $E = P \times t$
12. $Q = mC\Delta T$
13. $Q = C\Delta T$
14. $Q = mL_f$
15. $k = \frac{1}{4\pi \varepsilon_0} = 9x10^9$
16. $\Delta L = L_0 \alpha \Delta T$
17. Snell's law: $n_1 \sin\theta_1 = n_2 \sin\theta_2$
18. $B = \frac{\mu_0 I}{2\pi d} = \frac{kI}{d}, k = 2 \times 10^{-7}$ magnetic field in a conductor
19. **Bernoulli's equation:** $P_1 + \frac{1}{2}\rho v_1 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2 + \rho g h_2$
20. **Acceleration due to gravity (g) = 10 ms^{-2}**
21. $E = \Delta mC^2$, mass energy conversion equation.
22. $m = \frac{m_0}{2^n}$, mass remaining in a nuclear decay, where n is the number of half-lives.
23. **Velocity of sound through water,** $v = \sqrt{\frac{B}{\rho}}$, ρ = density of water, B = bulk modulus.