

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: DGE 1312
COURSE TITLE	: FUNDAMENTAL OF PHYSICS
SEMESTER/SESSION	: 2 - 2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains FIVE (5) questions. Answer ALL questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 5 PRINTED PAGES INCLUDING COVER PAGE

INSTRUCTION: ANSWER ALL THE QUESTIONS**QUESTION 1**

- a) Quantities can be categorized into scalar quantities and vector quantities.
- Define a scalar quantity. (1 Mark)
 - Define a vector quantity. (1 mark)
 - Give two (2) examples of a scalar quantity and a vector quantity. (2 Marks)
- b) A man walks 3 km to the north, then 5 km to the east, and then 3 km to the south. His total journey takes 3 hours.
- Calculate his speed and velocity in km/h. (4 Marks)
 - Then, convert your answer in speed into m/s. (2 Marks)
- c) A boat is traveling east at 10 m/s and a river is flowing south at 5 m/s. Determine the resultant velocity of the boat. (4 Marks)

QUESTION 2

- a) A car is traveling at a speed of 100 km/h. The driver applies the brakes and the car decelerates uniformly at a rate of 10 m/s^2 .
- Calculate the distance traveled by the car before it comes to a stop. (2 Marks)
 - Determine the time taken for the car to come to a stop. (2 Marks)
 - Calculate the average speed of the car during its journey. (1 Mark)
- b) A ball is dropped from a height of 20 meters.
- Calculate the ball's speed at the moment of impact with the ground. (2 Marks)
 - Calculate the time it takes for the ball to reach the ground. (2 Marks)

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- c) A ball is thrown vertically upwards with a speed of 20 m/s.
- Calculate the time taken for the ball to reach its maximum height. (2 Marks)
 - Calculate the maximum height that the ball will reach. (2 Marks)
 - Calculate the time taken for the ball to fall back to the ground. (2 Marks)
 - Describe the motion of the ball in the first 5 seconds of its flight. (2 Marks)
- d) Figure 1 shows the speed versus time graph of a car.

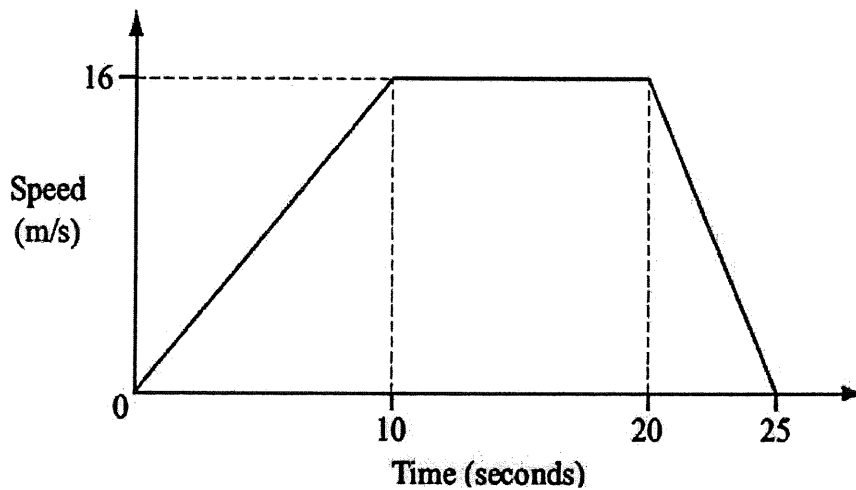


Figure 1

- Summarize the motion of the car. (3 Marks)
- Determine the average speed throughout the journey. (2 Marks)

QUESTION 3

- Define the rotational motion. (2 Marks)
- Give six (6) examples of rotational motion. (6 Marks)

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- c) An object completes 1.5 circular orbits in half a minute. Determine its approximate angular velocity. (3 Marks)
- d) A disk with a diameter of 60 cm speeds up from 20 rad/s to 40 rad/s in 5 seconds.
- Calculate the number of revolutions will the disk go through during that time period. (7 Marks)
 - Find the average linear acceleration of the disk. (3 Marks)

QUESTION 4

- a) Define Newton's First Law. (4 Marks)
- b) List the 4 types of forces. (4 Marks)
- c) Sketch a free-body diagram for each of the following situations:
- A block is sliding down an inclined plane. (2 Marks)
 - A car is accelerating on a level road. (2 Marks)
- d) State the two conditions needed to put an object in static equilibrium. (2 Marks)
- e) A block with a mass of 10 kg is sitting on a horizontal surface. The coefficient of static friction between the block and the surface is 0.5. Determine the maximum force that can be applied to the block before it starts to move. (4 Marks)
- f) A uniform rod of length 1 m and mass 2 kg is supported by two vertical ropes, one at each end. The rod is in static equilibrium and a mass of 3 kg is placed at the centre of the rod. Find the tension in each of the ropes. (4 Marks)

QUESTION 5

- a) State the difference between work and energy. (2 Marks)
- b) Define power and efficiency. (2 Marks)
- c) A roller coaster car starts at the top of a hill with a height of 100 m. The hill is followed by a loop with a radius of 20 m and a height of 10 m. The roller coaster car has a mass of 1000 kg.
- Calculate the total mechanical energy of the roller coaster car at the top of the hill. (3 Marks)
 - Calculate the speed of the roller coaster car at the bottom of the hill, assuming that there is no friction or other energy losses. (3 Marks)
 - Calculate the minimum speed of the roller coaster car at the top of the loop, in order for it to successfully complete the loop. (4 Marks)
- d) Give an example of a device with high efficiency. (3 Marks)
- e) Describe how to improve the efficiency of a device. (2 Marks)

-----END OF QUESTIONS-----

