



کراچی یونیورسٹی University of Karachi

Department of Mathematics

PHY 301(S) • Physics I (Mechanics & Properties of Matter)

Time Allowed: 3 hours • Maximum Marks: 80 • Date: Tuesday, May 31, 2011 • Paper Format: A

Student's Name _____ (in CAPITAL LETTERS using a "marker")

Questions 1-4 constitute the terminal and 5-7 midterm. Each part of Question 1 is of 4 marks. Questions 2-7 are of 10 marks each. Note down the time spent on solving each part of question and time spent on revision by making the following "Time Chart" on the answerbook front page (2 marks). Time spent on revision must be at least 10% of the total time.

Question No.	1a	1b	1c	1d	2	3	4	5	6	7	Revision
Time (minutes)											

a) DO NOT TURN PAPER AROUND unless the invigilator says: *Start now*

b) This is a closed-book examination. Deposit all BOOKS, NOTES, MOBILE PHONES (switched off), DIGITAL DIARIES and LAPTOPS in the designated area. Remove everything from your desk, except markers, pens, pencils, stapler and calculator.

c) If you want to use a calculator, **it must bear a "sticker"** displaying your NAME and your SEAT NUMBER, large enough so that it is visible from a distance of 5 meters. **Absolutely, NO sharing of calculators.**

d) Use your own material. **Nothing can be borrowed from or given to** a friend.

e) The papers may be of different formats. Therefore, work on your own **without consulting anyone** (We have a record of your seating arrangement).

f) Write your "NAME" on all pages of **your question paper** (5 marks shall be deducted for failing to comply) [NOTHING ELSE SHOULD BE WRITTEN ON THE QUESTION PAPER] and "PAPER FORMAT" on the front page of **your answerbook** (the upper-right-hand corner) and **the Yellow Sheet** using a "marker". Start your work from **Page 2** of your answerbook. The only thing that could be written on the front page is the "Time Chart" (see above) and the "Honor Statement" (see below).

g) The following statement must be copied on the front page of your answerbook and signed (2 marks): *"My signatures, below, testify that I am the person, whose name and photograph appear on the Admit Card. Upon my honor, I declare that the following work is my own, completed without giving or receiving unacknowledged help, without copying, or the use of any unfair means."* Signatures _____

h) This paper contains TWO PAGES (this page and the back page). On invigilator's signal (*Start now*) turn the paper around, check if you have the back page printed, correctly. Last line of the second

page reads: <END>. Start working on the paper, immediately.

i) Put your pens down and your papers turned (so that this page is facing you) and the FRONT PAGE of your answerbook should be facing you as soon as you hear "ALL PENS DOWN". Failure to do as directed shall result in "deduction of 5 marks" from your score.

j) If you use extra copies, it is "your responsibility" to write YOUR NAME, COPY NUMBER and all OTHER INFORMATION on each copy used. All the extra copies must be stapled with the main copy, before turning in your paper (you may wish to bring in a stapler with you for this purpose).

k) If you have a question of "Fill in the blanks" in your paper you must write the complete sentence with the filled word underlined.

l) Nobody is allowed to leave the examination hall, **for whatsoever reason**, once the examination has started. Bring your own DRINKING WATER.

m) Students are not allowed to LEAVE THEIR SEATS or STAND UP during the examination. If you have a query, "raise your hand" and someone will help you.

n) All work, including rough work, must be on the official answerbook. No extra sheet may be used.

o) Students are *not* allowed to use RED anywhere. All work (except figures) must be in pen or ballpoint.

p) The result shall be displayed on my homepage on **Wednesday, June 15, 2011** at **0900h**. DO NOT contact the Course Supervisor. Students are not permitted to see the answerbooks.

q) Anyone found cheating in the examination should be facing disciplinary action, which may result in **EXPLUSION** or **SUSPENSION** for 2 or more years as per University of Karachi rules. **Absolutely, no conversation among students. DON'T TURN THE PAPER, YET. Wait for "signal" from the invigilator.**

Student's Name _____ (in CAPITAL LETTERS using a "marker")

TERMINAL

- 1-a) Differentiate between inertial frame and non-inertial frame. In which frame, Newton's second law can be applied?
- 1-b) Define sagittal plane, frontal plane, transverse plane, anteroposterior axes, transverse axis and longitudinal axis as used in biomechanics.
- 1-c) Complete the following table regarding forces of nature:

	Range	Exchange Particle	Responsible for	Relative Strength	Comprehensive Theory
Strong		gluon			
Electromagnetic	∞	g	Chemistry Electronics	$\frac{1}{137}$	QED
Weak	10^{-10}				
Gravitational		Graviton			Einstein's Theory of Gravitation

- 1-d) Which conservation law is, mainly, responsible for:
- A bicycle not falling when paddled by the rider.
 - No success in constructing a perpetual-motion machine.
 - Motion of Ghauri missile
 - Einstein's photoelectric equation
- 2) Show that the $U(n)$ group has n^2 generators? In the $SU(2) \times U(1)$ theory, $U(1)$ corresponds to which force? Name the mediating particle, which the generator of $U(1)$ represents?
- 3) Define inertial mass and gravitational mass? Which one has a greater numerical value? Of the two machines, beam balance and bathroom scale, which measures weight and which measures mass? Which physical principle/law is used in each of them?
- 4) A light mass ' m ' and an infinitely heavy mass ' M ' are separated by a distance ' r_0 ' at time $t = 0$. They are allowed to move towards each other under the influence of gravity. Find the velocity of ' m ' as a function of ' r ', where ' r ' is the separation between the two masses at time ' t '?

MIDTERM

- 5) Prove that the track of outgoing electron in the Compton effect must lie in the plane containing the incident and the scattered photons.
- 6) A car starts from rest and its velocity increases linearly to 25 m/s during the first 15 s. It travels at constant velocity for the next 7 s. It, then, uniformly accelerates to 40 m/s during the next 10 s. Afterwards, it uniformly decelerates to rest during the last 20 s. Draw a velocity-time graph and compute (a) average acceleration during the first 15 s, (b) distance traveled during the last 20 s.
- 7) Derive the following equation using geometrical argument and method of integration. What should be conditions on direction of motion and magnitude of acceleration for this equation to be valid (under ordinary circumstances average is never taken by summing up the lowest and highest value and dividing by 2)?

$$S = \frac{v_i + v_f}{2} t$$

Web address of this document: http://www.ngds-ku.org/PHY301-2/Exams301-2/301-11_Paper.pdf
(to be uploaded 12 hours from the conduct of exam)

Exam solution: First class of PHY302