

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING IN ELECTRICAL
CERTIFICATE IV IN ELECTRICAL ENGINEERING – STAGE 1
EEE325 MATERIAL SCIENCE
FINAL EXAMINATION – TRIMESTER 1, 2015

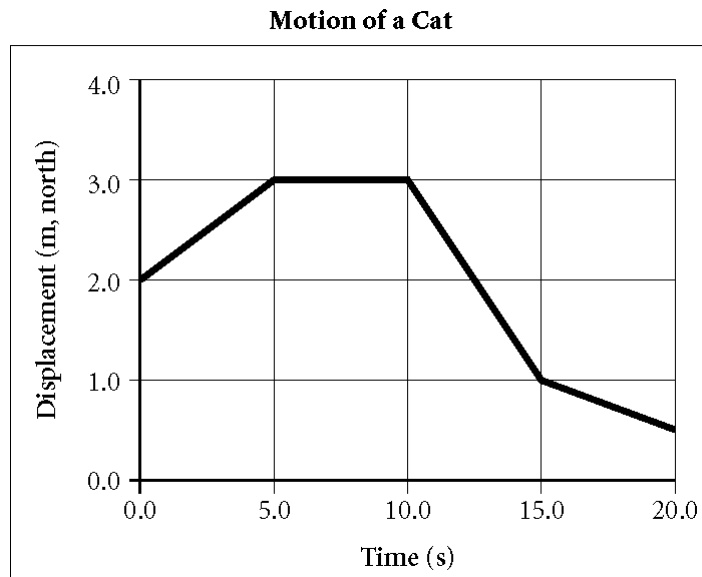
INSTRUCTIONS TO STUDENTS

1. You are allowed 10 minutes Extra reading time during which you are NOT to write
2. Two hours only is the time allocated for candidates to do this examination paper
3. Begin each answer on a fresh page and use both sides of the sheet.
4. Write your candidate-number at the top of each attached sheet.
5. Insert all written foolscaps, graph paper, drawing, etc. in their correct sequence and secure with string.
6. For all sheets of paper on which rough/draft work has been done, cross it through and you **MUST ATTACH** to your answer scripts.
7. Write clearly the number(s) of the question(s) attempted on top of each sheet.
8. **ANSWER ALL QUESTIONS.**
9. Show all workings where necessary.
10. Do not use programmable calculators, especially the ones that do the conversion of number systems.
11. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM.**

MULTIPLE CHOICE QUESTIONS (50 MARKS)

Identify the choice that best completes the statement or answers the question, (Q1 to Q40 = 1 mark each & Q41 to Q45 = 2 marks each).

Use displacement vs time graph to answer questions 1 through to 3 below.



Question 1

Acceleration is defined as

- | | |
|--|------------------------------------|
| a. a rate of displacement. | c. the change in velocity. |
| b. the rate of change of displacement. | d. the rate of change of velocity. |

Question 2

When a car's velocity is positive and its acceleration is negative, what is happening to the car's motion?

- | | |
|------------------------|---------------------------------------|
| a. The car slows down. | c. The car travels at constant speed. |
| b. The car speeds up. | d. The car remains at rest. |

Question 3

When a car's velocity is negative and its acceleration is negative, what is happening to the car's motion?

- | | |
|------------------------|---------------------------------------|
| a. The car slows down. | c. The car travels at constant speed. |
| b. The car speeds up. | d. The car remains at rest. |

Question 4

In machine tools where different components are made of different components, the assembly may jam, or become too loose and vibrate, when the temperature changes. Their design must account and compensate for the materials used their,

- (a) ductility, (b) density, (c) fatigue,
 (d) elasticity, (e) thermal expansion

Question 5

Which one of the following materials has the highest hardness:

- (a) aluminum, (b) diamond, (c) steel,
 (d) titanium, or (e) tungsten?

Question 6

Steel is a good material for the wrecking ball used to demolish old buildings because of its

- (a) high density (b) low elasticity (c) high coefficient of linear thermal expansion
 (d) low fatigue (e) poor ductility

Question 7

Which of the following pure metals is the best conductor of electricity:

- (a) aluminum, (b) copper, (c) gold, or (d) silver?

Question 8

Which of the following statements represent ohm's law?

- (a) Current / potential difference = constant
 (b) Potential difference / current = constant
 (c) Potential difference = current / resistance
 (d) Current = resistance x potential difference

Question 9

The unit of current is

- (a) Ampere (b) watt (c) Volt (d) coulomb

Question 10

The potential difference required to pass a current 0.2 A in a wire of resistance 20W is

- (a) 100 V (b) 4 V (c) 0.1 V (d) 40 V

Question 11

The resistance of an electric bulb drawing 1.2A ~~Type equation here~~.current at 6.0 V is

- (a) 0.5 Ω (b) 5 Ω (c) 0.2 Ω (d) 2 Ω

Question 12

The unit of resistivity is

- (a) Ohm (b) ohm / m (c) Ohm-m (d) ohm

Question 13

Two resistances of 100 W and zero ohm are connected in parallel. The overall resistance will be

- (a) 100 Ω (b) 50 Ω (c) 25 Ω (d) zero ohm

Question 14

Three resistors 2 Ω , 3 Ω and 4 Ω are connected so that the equivalent resistance is 9 Ω . The resistors are connected

- (a) all in series
 (b) all in parallel
 (c) 2 Ω and 3 Ω in parallel and the combination in series with 4 Ω
 (d) 2 Ω and 3 Ω in series and the combination in parallel to 4 Ω on in parallel to 4 Ω

Question 15

In the figure 8.1,

- (a) $6\ \Omega$, $3\ \Omega$ and $9\ \Omega$ are in series
- (b) $9\ \Omega$ and $6\ \Omega$ are in parallel and the combination is in series with $3\ \Omega$
- (c) $3\ \Omega$, $6\ \Omega$ and $9\ \Omega$ are in parallel
- (d) $3\ \Omega$, $6\ \Omega$ are in parallel and $9\ \Omega$ is in series

Question 16

The resistance across AB (fig. 8.2) is

- (a) $4.0\ \Omega$,
- (b) $1.0\ \Omega$,
- (c) $2.0\ \Omega$,
- (d) $0.5\ \Omega$

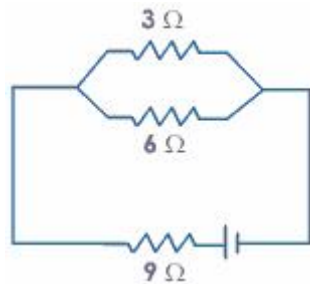


Fig. 8.1

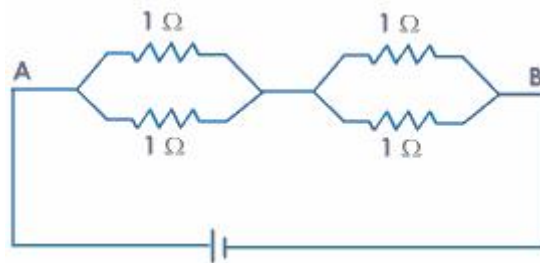


Fig. 8.2

Question 17

When a current 'I' flows through a resistance 'R' for time 't' the electrical energy spent is given by

- (a) IRt , (b) IRt ,
(c) IR^2t , (d) I^2Rt

Question 18

Kilowatt - hour is the unit of

- (a) Potential difference (b) Electric power (c) Electrical energy (d) Charge

Question 19

The hardness of steel increases if it contains

- (a) Pearlite (b) ferrite (c) Cementite (d) martensite

Question 20

An alloy steel which is work hardenable and which is used to make the blades of bulldozers, bucket wheel excavators and other earth moving equipment contain iron, carbon and

- (a) chromium (b) silicon (c) manganese (d) magnesium

Question 21

Which of the following has a fine gold color and is used for imitation jewellery?

- (a) Silicon bronze (b) Aluminum bronze (c) Gun metal (d) Babbitt metal

Question 22

Cast iron is a

- (a) Ductile material (b) malleable material (c) Brittle material (d) tough material

Question 23

The hardness is the property of a material due to which it

- (a) can be drawn into wires (c) breaks with little permanent distortion exactly in the middle.
(b) cut another metal (d) can be rolled or hammered into thin sheets.

Question 24

According to the kinetic-molecular theory, particles of matter

- (a) are in constant motion. (c) have different colors.
(b) have different shapes. (d) are always fluid.

Question 25

Which process can be explained by the kinetic-molecular theory?

- (a) combustion (c) condensation
(b) oxidation (d) displacement reactions

Question 26

According to the kinetic-molecular theory, which substances are made of particles?

- (a) gases only (c) all matter
(b) liquids only (d) all

Question 27

According to the kinetic-molecular theory, particles of matter are in motion in

- (a) gases only.
- (b) gases and liquids only.
- (c) solids, liquids, and gases.
- (d) solids only.

Question 28

An ideal gas is a hypothetical gas

- a. not made of particles.
- b. that conforms to all of the assumptions of the kinetic theory.
- c. whose particles have zero mass.
- d. made of motionless particles.

Question 29

A real gas

- (a) does not obey all the assumptions of the kinetic-molecular theory.
- (b) consists of particles that do not occupy space.
- (c) cannot be condensed.
- (d) cannot be produced in scientific laboratories.

Question 30

According to the kinetic-molecular theory, particles of an ideal gas

- (a) attract each other but do not collide.
- (b) repel each other and collide.
- (e) neither attract nor repel each other but collide.
- (f) neither attract nor repel each other and do not collide.

Question 31

- (a) Which is an example of gas diffusion?
- (b) inflating a flat tire
- (c) the odor of perfume spreading throughout a room
- (d) a cylinder of oxygen stored under high pressure
- (e) All of the above

Question 32

By which process do gases take the shape of their container?

- (a) evaporation
- (b) expansion
- (c) adhesion
- (d) diffusion

Question 33

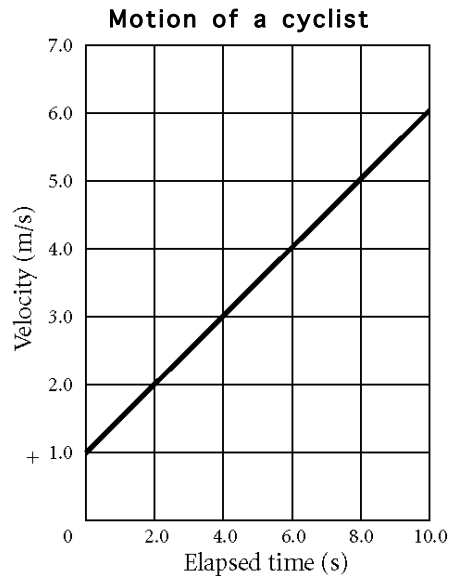
According to the kinetic-molecular theory, how does a gas expand?

- (a) Its particles become larger.
- (b) Collisions between particles become elastic.
- (c) Its temperature rises.
- (d) Its particles move greater distances.

Question 34

Which is an example of effusion?

- (a) air slowly escaping from a pinhole in a tire
- (b) the aroma of a cooling pie spreading across a room
- (c) helium dispersing into a room after a balloon pops
- (d) oxygen and gasoline fumes mixing in an automobile carburetor

**Question 35**

The graph above describes the motion of a cyclist. The graph illustrates that the acceleration of the cyclist

- a. is constant.
- b. decreases.
- c. increases.
- d. is zero.

Question 36

The graph above describes the motion of a cyclist. During the interval shown, the cyclist is

- a. slowing down.
- b. speeding up.
- c. traveling at the same speed.
- d. at rest.

Question 37

Suppose you take a trip that covers 180 km and takes 3 hours to make. Your average speed is

- (a) 30 km/h
- (b) 60 km/h
- (c) 180/h
- (d) 360 km/h
- (e) 540 km/h

Question 38

Suppose a car is moving in a straight line and steadily increases its speed. It moves from 35 km/h to 40 km/h the first second and from 40 km/h to 45 km/h the next second. What is the car's acceleration?

- (a) 5 km/h.s
- (b) 10 km/h.s
- (c) 35 km/h.s
- (d) 40 km/h.s
- (e) 45 km/h.s

Question 39

The alloying element which increases residual magnetism and coercive magnetic force in steel for magnets is

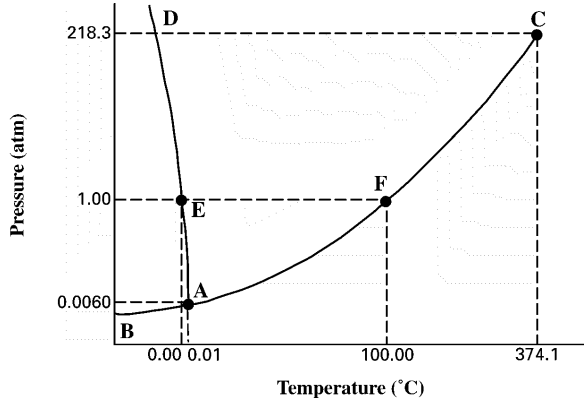
- (a) chromium (b) nickel (c) vanadium (d) cobalt

Question 40

A car accelerates at 2 m/s^2 . Assuming the car starts from rest, how much time does it need to accelerate to a speed of 20 m/s ?

- (a) 2 seconds (c) 20 seconds
 (b) 10 seconds (d) 40 seconds
 (e) none of the above.

Use the phase diagram for water to answer questions 41 through to 45.

**BRIEF ANSWERS (32 MARKS)****Question 41** (2 marks)

What does point C represent in the figure above?

Question 42 (2 marks)

What state exists above the curve AB and to the left of the curve AD?

Question 43 (2 marks)

What does point A represent in the figure above?

Question 44 (2 marks)

What state exists below the curve BC?

Question 45 (2 marks)

What state exists between the AC and AD curves?

Question 46 (3 marks)

How can you determine the instantaneous velocity at a given point on a position versus time graph?

Question 47 (2 marks)

The ratio of the change in an object's velocity to the time required for the change to occur describes what quantity?

Question 48 (3 marks)

What is free fall?

Question 49 (2 marks)

What is the magnitude of the acceleration of an object in free fall near Earth's surface?

Question 50 (3 marks)

A man on a bicycle travels at a constant speed in the positive direction for a short time. He then stops for a short rest before returning back to his starting point at the same constant speed that he originally moved. Sketch a distance-time graph and a velocity-time graph to represent this motion.

Questions 51 (3 marks)

An automobile accelerates from rest up to a speed of 15 m/s. It then maintains this speed while driving for a while. Sketch a distance-time graph and a velocity-time graph to represent this motion.

Question 52 (6 marks)

Write a short paragraph explaining the difference between velocity and acceleration, and give examples of both.

PROBLEMS (28 MARKS)
Question 53

In words, explain what each of the following equations represents. Be VERY CLEAR to distinguish between symbols that represent *averages* vs. *instantaneous* values

(a) $s = d/t$ (2 marks)

(b) $d = vt + \frac{1}{2} at^2$ (2 marks)

(c) $v = v_i + at$ (2 marks)

(d) $d = \frac{1}{2} at^2$ (2 marks)

(e) $v = at$ (2 marks)

Utilize the equations above and the template provided to solve the problems on the following pages.

EXAMPLE: A biker travels at an average speed of 11.1 m/s along a 8900 m straight segment of a bike path. How much time does the biker take to travel this segment?

What information do I know to start?	What quantity am I trying to find?	What equation relates what I know to what I am looking for	Substitute the known numbers into the equation	Answer
$s = 11.1 \text{ m/s}$ $d = 8900 \text{ m}$ (1 marks)	$t = ?$ (1 mark)	$s = d/t$ (1 marks)	$11.1 = 8900/t$ or $t = 8900/11.1$ (1 marks)	$t = 802 \text{ s}$ (2 marks)

Question 54 (6 marks)

A model airplane flies a distance of 1200 m in a time of 15 s. What is the average speed of the model airplane?

What information do I know to start?	What quantity am I trying to find?	What equation relates what I know to what I am looking for	Substitute the known numbers into the equation	Answer

Question 55 (6 marks)

A skateboarder starting from rest accelerates down a ramp at 2 m/s^2 for 2.4 s. What is the speed of the skateboarder at the bottom of the ramp?

What information do I know to start?	What quantity am I trying to find?	What equation relates what I know to what I am looking for	Substitute the known numbers into the equation	Answer

Question 56 (6 marks)

An apple falls from a tree and 0.5 second later hits the ground. How fast is the apple falling as it hits the ground?

What information do I know to start?	What quantity am I trying to find?	What equation relates what I know to what I am looking for	Substitute the known numbers into the equation	Answer

END