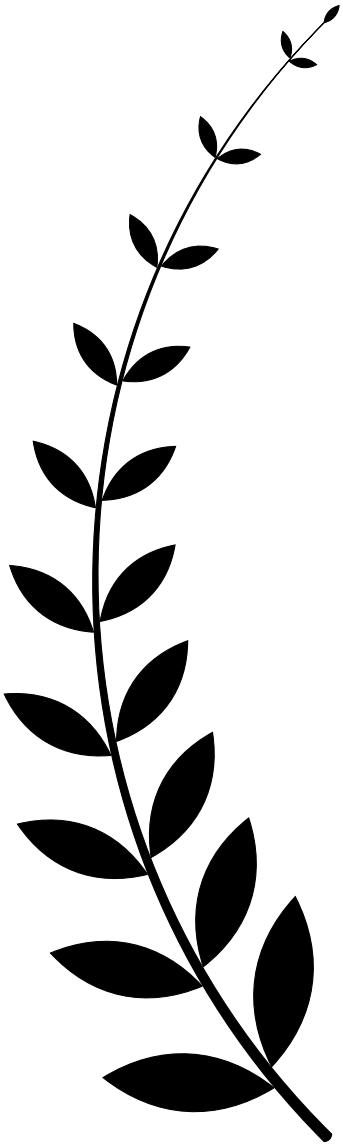
Title Head
Subject or Class Name

Examination Title
Examination Subtitle №1



The possession or use of *any* communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be given.

Use of a non-QWERTY calculator, a ruler of any scale, any writing utensil, and a protractor are permitted. The use of any external reference material is strictly prohibited. You will be provided with scrap paper by the proctor, you may request more at any time.

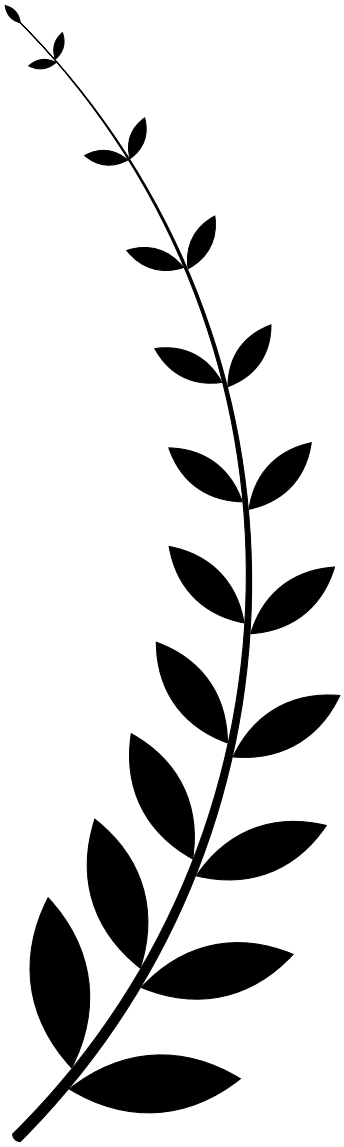
For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the provided reference tables. Record your answers on the provided response sheet located on the last page of this booklet.

Questions using the sign ♣ may have zero, one or several correct answers. All other questions have one correct answer.

You may write in this booklet as only your response sheet will be collected. You may *only* use either an HB or №2 graphite pencil, or a black ink pen on the response sheet. Make no stray marks on the response sheet!

All questions are weighted evenly for grading purposes. Each correct response is worth +4 points, and each incorrect response is worth −1 point. Questions using the sign ♣ are worth +4 or 0, and nothing in-between. Points awarded will be the geometric mean of the points earned and points available.

This booklet has printed material on the recto and verso side of each page. *Good Luck!*



JPH

Q1 A ball of mass $m = 0.100\,\text{kg}$ is launched straight upward so that it rises to a maximum height of 12.0 m above the launch point. Ignore air resistance. Approximately how much time does it take the ball to reach the maximum height from its launch?

[a] 1.55 s [c] 2.40 s [e] 1.20 s
[b] 0.65 s [d] 1.00 s

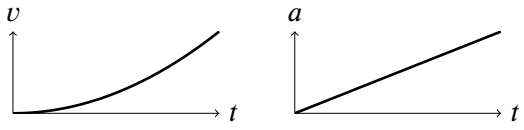
Q2 A ball is thrown straight downward with a speed of 0.50 m/s from a height of 4.0 m. What is the speed of the ball 0.70 s after it is released? [Neglect friction.]

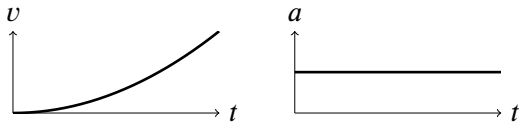
[a] 0.50 m/s [c] 9.8 m/s
[b] 10 m/s [d] 7.4 m/s

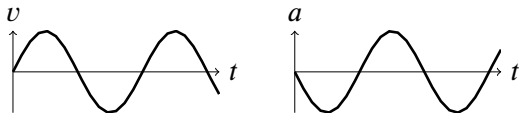
Q3 Is it possible for an object's velocity to increase while its acceleration decreases?

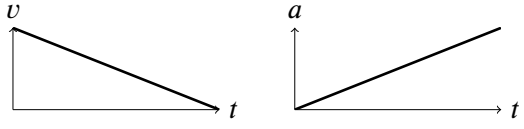
[a] No, this is impossible because of the way in which acceleration is defined.
[b] Yes, an example would be a falling object in the presence of air resistance
[c] No, because if acceleration is decreasing the object will be slowing down.
[d] Yes, an example would be a falling object near the surface of the moon.
[e] No, because velocity and acceleration must always be in the same direction.

Q4 Which pair of velocity (v) and acceleration (a) graphs below describe the same motion?

[a] 

[b] 

[c] 

[d] 

Q5 Suppose two cars are racing on a circular track 1 km in circumference. The first car can circle the track in 15 s at top speed while the second car can circle the track in 12 s at top speed. How much lead does the first car need starting the last lap of the race not to lose?

[a] at least 67 m [d] at least 104 m
[b] at least 250 m [e] at least 200 m
[c] at least 83 m

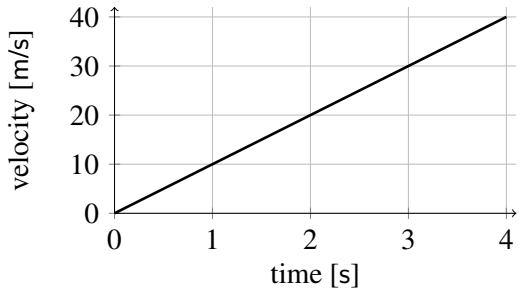
Q6 A car travels at 20.0 mile/h. Which one of the following choices best represents the speed of the car in SI units of meter per second (m/s)?

[a] 20.0 m/s [c] 533 m/s [e] 8.9 m/s
[b] 45.0 m/s [d] 0.75 m/s

Q7 What is the approximate diameter of a dinner plate?

[a] 2.5 m [c] 0.25 m
[b] 0.025 m [d] 0.0025 m

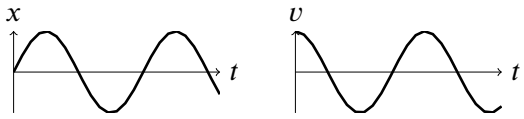
Q8 The graph below shows the velocity of a race car moving along a straight line as a function of time.

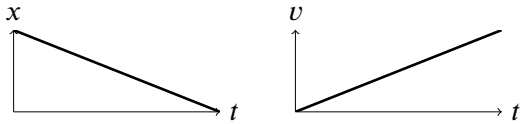


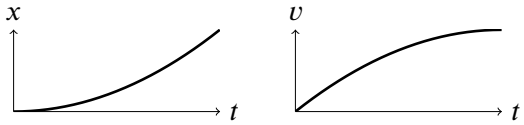
What is the magnitude of the displacement of the car from $t = 2.0\,\text{s}$ to $t = 4.0\,\text{s}$?

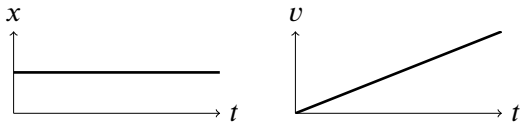
[a] 60 m [c] 80 m
[b] 40 m [d] 20 m

Q9 Which pair of displacement (x) and velocity (v) graphs below describe the same motion?

a 

b 

c 

d 

Q10 An astronaut standing on a platform on the Moon drops a hammer. If the hammer falls 6.0 m vertically in 2.7 s, what is the acceleration?

a $1.6\ \text{m/s}^2$ c $4.4\ \text{m/s}^2$

b $9.8\ \text{m/s}^2$ d $2.2\ \text{m/s}^2$

Q11 Two objects both move uniformly accelerate to the right. At time $t = 0$ s, the objects are at the same initial position but

- Object 1 has initial speed twice that of Object 2
- Object 1 has one-half the acceleration of Object 2

After some time T, the velocity of the two objects is the same. What is the ratio of the distance traveled in this time T by Object 2 to that traveled by Object 1?

a 1 : 2 c 5 : 6 e 2 : 3

b 4 : 5 d 3 : 4

Q12 Starting from rest, a car uniformly accelerates to a speed of 7.60 m/s in a time of 3.00 s. Through what distance does the cart move in this time?

a 22.8 m c 5.7 m e 16.1 m

b 11.4 m d 8.1 m

Q13 The height of a typical high school physics student is closest to:

a 1.7×10^1 m c 1.7×10^3 m

b 1.7×10^0 m d 1.7×10^2 m

Q14 A 1000 kg car traveling with a velocity of +20 m/s decelerates at $-5.0\ \text{m/s}^2$ until it comes to rest. What is the total distance the car travels as it decelerates to rest?

a 20 m c 40 m

b 80 m d 10 m

Q15 The length of a dollar bill is approximately:

a 1.5 m c 1.5×10^{-1} m

b 1.5×10^1 m d 1.5×10^{-3} m

Q16 A cart is initially moving at 0.5 m/s along a track. The cart comes to rest after traveling 1 m. The experiment is repeated on the same track, but now the cart is initially moving at 1 m/s. How far does the cart travel before coming to rest?

a 1 m c 3 m e 2 m

b 4 m d 5 m

Q17 A toy car moves 0.80 m in 1.0 s at the constant velocity. If it continues, how far will it travel in 3.0 s?

a 4.8 m c 14.4 m e 7.2 m

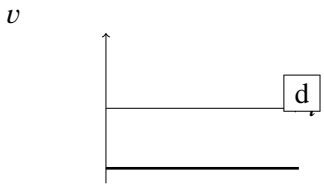
b 2.4 m d 3.6 m

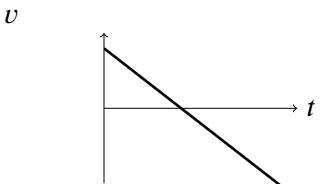
Q18 A rock falls freely from rest near the surface of a planet where the acceleration due to gravity is $4.0\ \text{m/s}^2$. What is the speed of this rock after it falls 32 m?

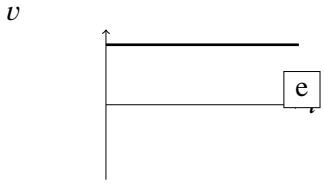
a 25 m/s c 16 m/s

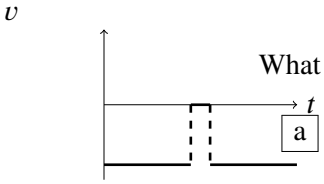
b 8.0 m/s d 32 m/s

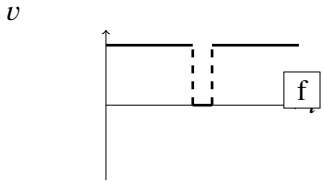
Q19 A ball rolls up a ramp, then back down under the influence of gravity. Which velocity-time graph best represents the balls motion? Motion up the ramp is defined to be positive.

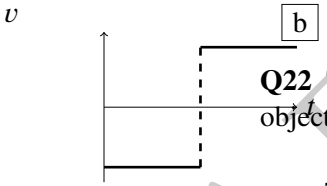
a 

d 

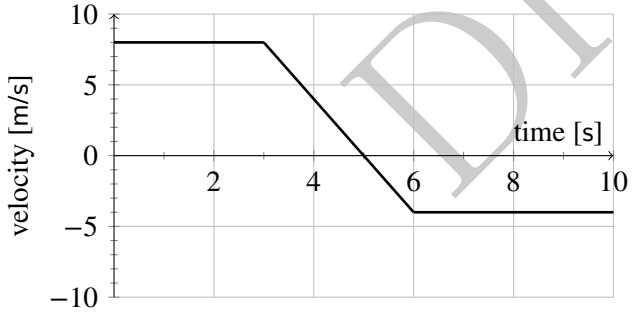
b 

e 

c 

f 

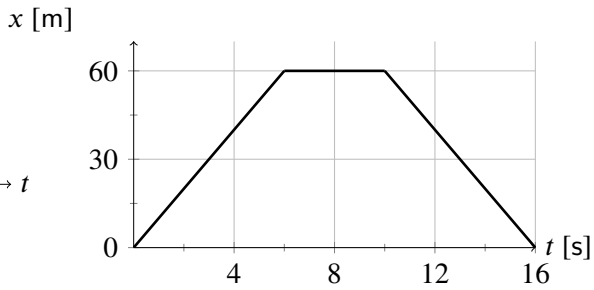
Q20 The velocity vs. time graph for the motion of a car on a straight track is shown in the diagram. The thick line represents the velocity. Assume that the car starts at the origin $x = 0$.



What is the average speed of the car for the 10 s interval?

a 1.20 m/s
c 3.30 m/s
e 1.40 m/s
b 5.00 m/s
d 5.40 m/s

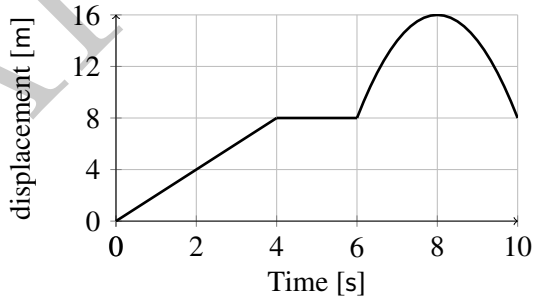
Q21 Consider the motion of an object whose displacement-time graph is provided below.



What is the instantaneous velocity of the object at $t = 8$ s?

a 60 m/s
c $\frac{75}{2}$ m/s
e 2 m/s
b 0 m/s
d $\frac{15}{2}$ m/s
f 300 m/s

Q22 The graph below represents the displacement of an object moving in a straight line as a function of time.



What was the total distance traveled by the object during the 10 s time interval?

a 24 m
c 16 m
b 8 m
d 0 m

Q23 What is the approximate thickness of this piece of paper?

a 10^{-2} m
c 10^{1} m
b 10^{-4} m
d 10^{0} m

Q24 A snail is moving along a straight line. Its initial position is $x_0 = -5$ m and it is moving away from the origin and slowing down. In this coordinate system, the signs of the initial position x_0, initial velocity v_0 and acceleration a, respectively, are

a $x_0 = +, v_0 = +, a = +$

b $x_0 = -, v_0 = -, a = -$

c $x_0 = -, v_0 = +, a = +$

d $x_0 = -, v_0 = +, a = -$

e $x_0 = -, v_0 = -, a = +$

Q25 Car A, moving in a straight line at a constant speed of 20.0 m/s, is initially 200 m behind car B, moving in the same straight line at a constant speed of 15 m/s. How far must car A travel from this initial position before it catches up with car B?

a 400 m

b 800 m

c 1000 m

d 200 m

Q26 A dog starts from rest and runs in a straight line with constant acceleration of 2.5 m/s^2. How much time does it take for the dog to run a distance of 10.0 m?

a 2.0 s

b 2.8 s

c 4.0 s

d 8.0 s

e 1.4 s

Q27 A cart starting from rest travels a distance of 3.6 m in 1.8 s. The average speed of the cart is:

a 0.50 m/s

b 0.20 m/s

c 5.0 m/s

d 2.0 m/s

Q28 An object with an initial speed of 4.0 m/s accelerates uniformly at 2.0 m/s^2 in the direction of its motion for a distance of 5.0 m. What is the final speed of the object?

a 36 m/s

b 14 m/s

c 6.0 m/s

d 10 m/s

Q29 The diameter of an automobile tire is closest to:

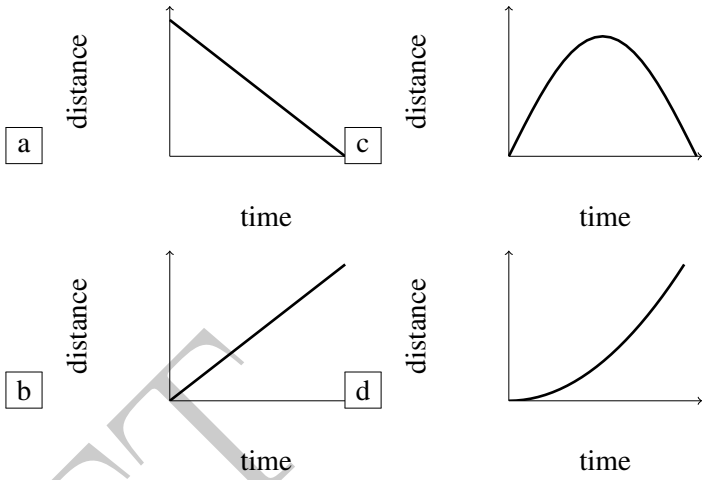
a 10^1 m

b 10^0 m

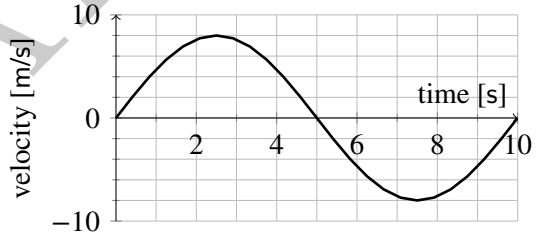
c 10^2 m

d 10^{-2} m

Q30 A cart travels with a constant nonzero acceleration along a straight line. Which graph best represents the relationship between the distance the cart travels and the time of travel?



Q31 The motion of an object moving along a straight line is given by the velocity vs. time graph shown.



Which one of the following choices best represents the instantaneous acceleration of the object at the time $t = 4.0$ s

a -4.0 m/s^2

b -2.0 m/s^2

c 0 m/s^2

d -1.6 m/s^2

e -3.2 m/s^2

Q32 A box uniformly slides 7.50 m to rest across a flat surface in a time of 12.0 s. What was the initial speed of the box when it started its slide?

a 5.00 m/s

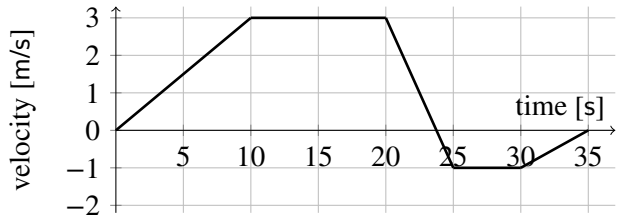
b 2.50 m/s

c 1.25 m/s

d 0.313 m/s

e 0.625 m/s

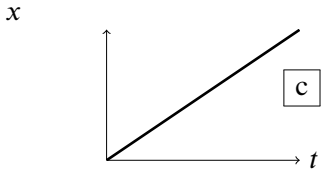
Q33 The graph shown below is a plot of the car's velocity in the x direction, v_x, versus time, t.

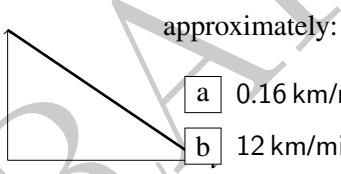


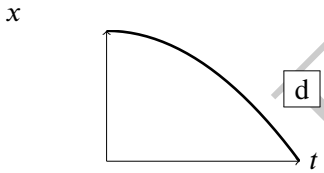
During what time interval was the car moving towards its initial position at constant velocity?

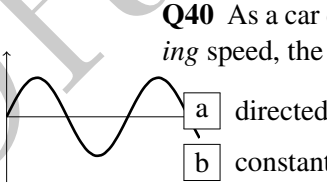
a 10 s to 20 s
b 30 s to 35 s
c 0 s to 10 s
d 25 s to 30 s
e 20 s to 25 s

Q34 Which of the following displacement-time graphs best represents a moving object with non-zero constant acceleration?

a 

c 

b 

d 

Q35 ♣ A particle moves on the x-axis. When the particle's acceleration is positive and increasing

a its velocity must be negative.
b it must be speeding up.
c its velocity must be positive.
d it must be slowing down.

Q36 A ball dropped from a bridge takes 3.0 s to reach the water below. How far is the bridge above the water?

a 15 m
b 44 m
c 88 m
d 29 m

Q37 A toy car initially moves to the right at 60.0 cm/s. Five seconds later, the car is moving at 40.0 cm/s to the left. The total displacement of the car during this time is 10.0 cm to the left of where it started. Which one of the following choices best represents the magnitude of the average velocity of the car during the five second motion?

a 4.0 cm/s
b 50.0 cm/s
c 0.40 cm/s
d 2.0 cm/s
e 10.0 cm/s

Q38 A rock falls from rest off a high cliff. How far has the rock fallen when its speed is 39.2 m/s? [Neglect friction.]

a 123 m
b 78.3 m
c 44.1 m
d 19.6 m

Q39 In a 4.0 km race, a runner completes the first kilometer in 5.9 min, the second kilometer in 6.2 min, and the third kilometer in 6.3 min, and the final kilometer in 6.0 min. The average speed of the runner for the race is approximately:

a 0.16 km/min
b 12 km/min
c 0.33 km/min
d 24 km/min

Q40 As a car driven south in a straight line with *decreasing* speed, the acceleration of the car must be:

a directed southward
b constant, but not zero
c directed northward
d zero

Q41 An object moves with constant acceleration starting with velocity $v_0 = 5.00$ m/s and ending with a velocity of $v = -1.00$ m/s in a time of 3.00 s. For this motion, what is the average speed associated with the object.

a 2.50 m/s
b 2.83 m/s
c 3.00 m/s
d 2.17 m/s
e 2.00 m/s

Q42 The definition of average velocity is:

[a] displacement divided by the time.

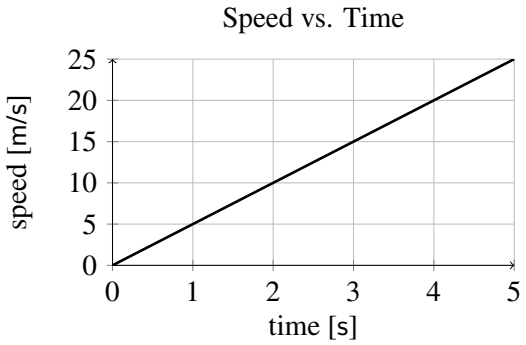
[b] $\frac{1}{2}\left(v_f + v_i\right)$

[c] radius multiplied by angular velocity.

[d] the average acceleration multiplied by the time.

[e] distance traveled divided by the time.

Q43 The graph below represents the relationship between speed and time for an object moving along a straight line.



What is the total distance traveled by the object during the first 4 s?

[a] 5 m

[b] 80 m

[c] 20 m

[d] 40 m

Q44 Which of the following relationships correctly ranks the three given speeds from least to greatest? The speeds are given as $v_1 = 1.25 \times 10^{-4}$ cm/s, $v_2 = 0.076$ Mm/week, $v_3 = 9.50$ km/day.

[a] $v_3 < v_2 < v_1$

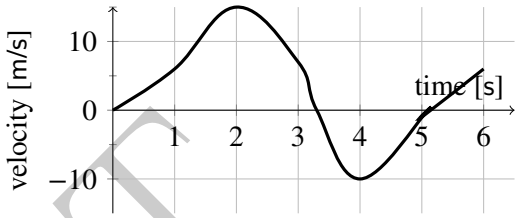
[b] $v_1 < v_3 < v_2$

[c] $v_3 < v_2 = v_1$

[d] $v_2 < v_3 < v_1$

[e] $v_1 < v_2 < v_3$

Q45 A car has the velocity versus time curve shown.



Which of the following statements regarding its motion is *incorrect*?

[a] The car is speeding up from $t = 0$ s to $t = 2.0$ s.

[b] The car is moving fastest at 2.0 s.

[c] The car has negative acceleration at $t = 4.5$ s.

[d] The car is at rest at approximately 5.2 s.

[e] The car has no acceleration at the instant $t = 2.0$ s.

When you finish this exam, you should go back and reexamine your work, both on the earlier part of this exam and in your life up until the day of this exam, for any errors that you may have made.

+1/9/52+

Student Number

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

Examination Title: Examination Subtitle №1

Last and First Name: Today's Date:

Print your last and first name in the box provided above. Enter your course student ID number by filling in the appropriate boxes to the left. Enter your chosen selection for each question on this form by filling in completely your selected oval(s) for each question. *Good Luck!!*

Q01: a b c d e
Q02: a b c d
Q03: a b c d e
Q04: a b c d
Q05: a b c d e
Q06: a b c d e
Q07: a b c d
Q08: a b c d
Q09: a b c d
Q10: a b c d
Q11: a b c d e
Q12: a b c d e
Q13: a b c d
Q14: a b c d
Q15: a b c d
Q16: a b c d e
Q17: a b c d e
Q18: a b c d
Q19: a b c d e f
Q20: a b c d e
Q21: a b c d e f
Q22: a b c d
Q23: a b c d
Q24: a b c d e
Q25: a b c d
Q26: a b c d e
Q27: a b c d
Q28: a b c d
Q29: a b c d
Q30: a b c d
Q31: a b c d e
Q32: a b c d e
Q33: a b c d e
Q34: a b c d
Q35: a b c d
Q36: a b c d
Q37: a b c d e
Q38: a b c d
Q39: a b c d
Q40: a b c d
Q41: a b c d e
Q42: a b c d e
Q43: a b c d
Q44: a b c d e
Q45: a b c d e

International System of Units (SI)

length	meter	m	
mass	kilogram	kg	
time	second	s	
electric current	ampere	A	
thermodynamic temperature	kelvin	K	
amount of substance	mole	mol	
luminous intensity	candela	cd	
plane angle	radian	rad	m/m
solid angle	steradian	sr	m^2/m^2
frequency	hertz	Hz	1/s
force	newton	N	$kg\,m/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, heat	joule	J	N m
power, radiant flux	watt	W	J/s
electric charge	coulomb	C	A s
electric potential difference	volt	V	W/A
capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
electric conductance	siemens	S	A/V
magnetic flux	weber	Wb	V s
magnetic flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
Celsius temperature	degree	℃	K
luminous flux	lumen	lm	cd sr
illuminance	lux	lx	lm/m^2
activity (of radionuclide)	becquerel	Bq	1/s
absorbed dose	gray	Gy	J/kg
dose equivalent	sievert	Sv	J/kg
catalytic activity	katal	kat	mol/s

l, x, r, etc…	L
m	M
t	T
I, i	I
T	Φ
n	N
I_v	J

SI Prefixes

10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	
10^{-3}	milli	m
10^{-2}	centi	c
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P

Physical Constants

Rest mass of the electron	m_e	=	9.11×10^{-31} kg
Rest mass of the proton	m_p	=	1.67×10^{-27} kg
Magnitude of the electron charge	e	=	1.60×10^{-19} C
Avogadro's number	N_A	=	6.02×10^{23}/mol
Universal gas constant	R	=	8.31 J/(mol K)
Boltzman's constant	k	=	1.38×10^{-23} J/K
Speed of light	c	=	3.00×10^{8} m/s
Planck's constant	h	=	6.63×10^{-34} J s
		=	4.14×10^{-15} eV s
	$\hbar$	=	$h/(2\pi)$
	hc	=	1.24×10^{3} eV nm
Vacuum permittivity	ϵ_0	=	8.85×10^{-12} $C^2/(N\,m^2)$
Vacuum permeability	μ_0	=	4×10^{-7} T m/A
Universal gravitational constant	G	=	6.67×10^{-11} $m^3/(kg\,s^2)$
Standard acceleration of gravity	g	=	9.81 m/s^2
1 Ångström	1	=	1×10^{-10} m

Rotational Inertia

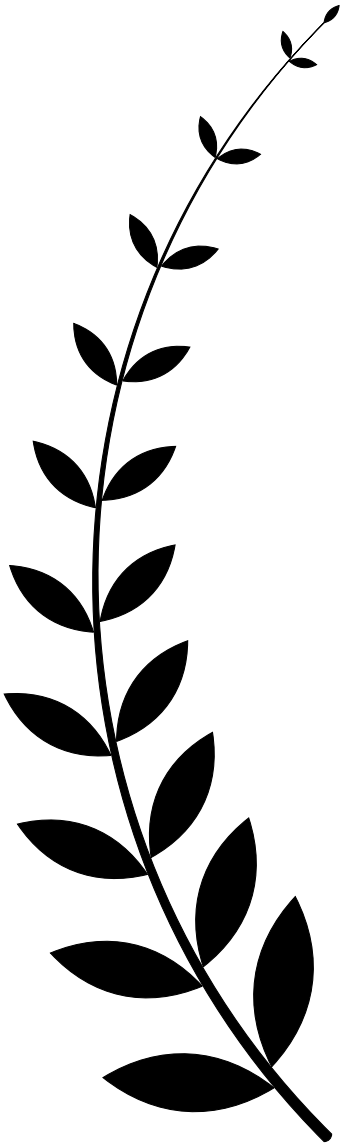
Rod	$\frac{1}{12}ML^2$
Disc	$\frac{1}{2}MR^2$
Sphere	$\frac{2}{5}MR^2$

Unit Conversions

inch	=	2.54 cm
foot	=	12 in
yard	=	3 ft
mile	=	5280 ft
lb-mass	=	0.454 kg
lb-force	=	4.448 N
gallon	=	3.785 L
liter	=	10^{-3} m^3

Title Head
Subject or Class Name

Examination Title
Examination Subtitle №2



The possession or use of *any* communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be given.

Use of a non-QWERTY calculator, a ruler of any scale, any writing utensil, and a protractor are permitted. The use of any external reference material is strictly prohibited. You will be provided with scrap paper by the proctor, you may request more at any time.

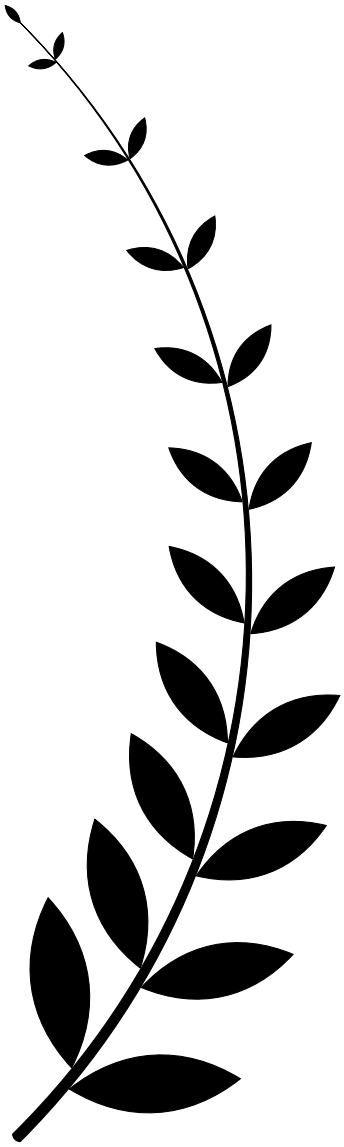
For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the provided reference tables. Record your answers on the provided response sheet located on the last page of this booklet.

Questions using the sign ♣ may have zero, one or several correct answers. All other questions have one correct answer.

You may write in this booklet as only your response sheet will be collected. You may *only* use either an HB or №2 graphite pencil, or a black ink pen on the response sheet. Make no stray marks on the response sheet!

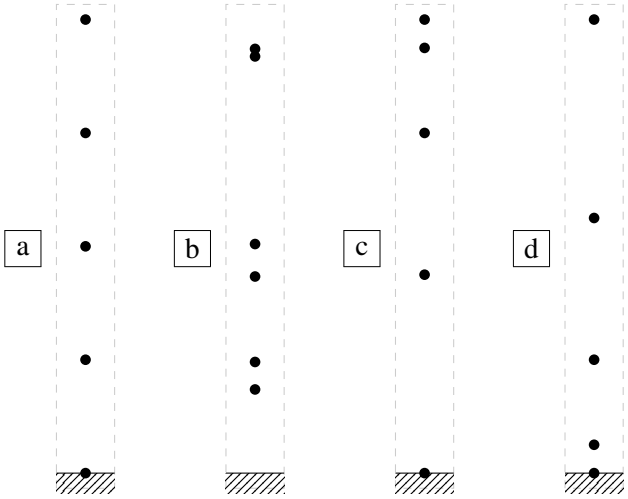
All questions are weighted evenly for grading purposes. Each correct response is worth +4 points, and each incorrect response is worth −1 point. Questions using the sign ♣ are worth +4 or 0, and nothing in-between. Points awarded will be the geometric mean of the points earned and points available.

This booklet has printed material on the recto and verso side of each page. *Good Luck!*



JPH

Q1 Which diagram best represents the position of a ball, at equal time intervals, as it falls freely from rest near Earth's surface?



Q2 An object moving along a line completes a 20.0 s trip with an average speed of 10.0 m/s in two stages. During stage 1, the object moves with a constant velocity of 6.0 m/s to the right for 12.0 s. What constant magnitude acceleration directed to the left must the object have during the 8.0 s of stage 2?

a $2.5\ \text{m/s}^2$
b $5.3\ \text{m/s}^2$
c $2.7\ \text{m/s}^2$
d $6.3\ \text{m/s}^2$
e $4.0\ \text{m/s}^2$

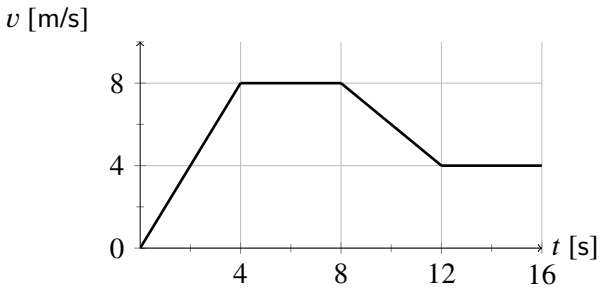
Q3 A baseball dropped from the roof of a tall building takes 3.1 s to hit the ground. How tall is the building? [Neglect friction.]

a 30 m
b 47 m
c 15 m
d 94 m

Q4 What is the approximate diameter of a dinner plate?

a 2.5 m
b 0.0025 m
c 0.025 m
d 0.25 m

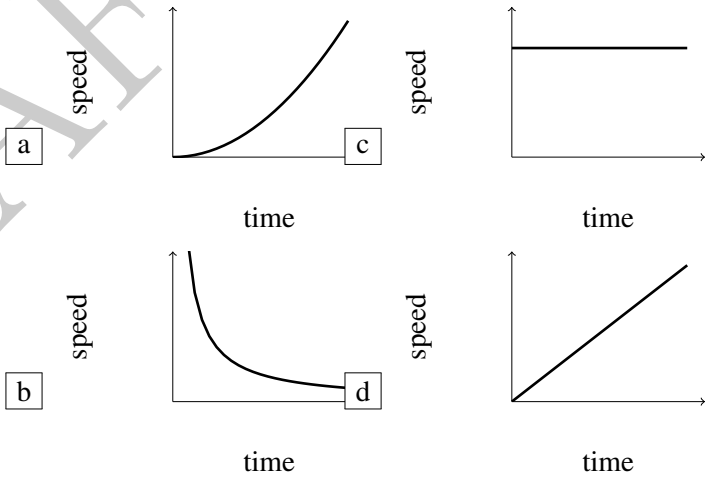
Q5 Consider the motion of an object whose velocity-time graph is provided below.



What is the acceleration of the object at $t = 2\,\text{s}$?

a $8\ \text{m/s}^2$
b $4\ \text{m/s}^2$
c $-1\ \text{m/s}^2$
d $0\ \text{m/s}^2$
e $10\ \text{m/s}^2$
f $2\ \text{m/s}^2$

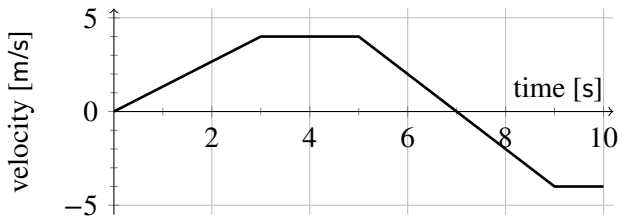
Q6 Which graph best represents the motion of a freely falling body near the Earth's surface?



Q7 A basketball player jumped straight up to grab a rebound. If she was in the air for 0.8 s, how high did she jump?

a 1.3 m
b 0.50 m
c 0.78 m
d 1.2 m

Q8 An object starts at the origin and its velocity along a line vs. time is graphed.



Which one of the following choices best gives the proper interval(s) of time for which the object is moving away from the origin?

a Only for times $3\,\text{s} < t < 5\,\text{s}$

b Only for times $0\,\text{s} < t < 7\,\text{s}$

c Only for times $0\,\text{s} < t < 5\,\text{s}$

d For times $0\,\text{s} < t < 3\,\text{s}$ and $5\,\text{s} < t < 9\,\text{s}$

e Only for times $0\,\text{s} < t < 3\,\text{s}$

Q9 Two automobiles are 150 km apart and traveling toward each other. One automobile is moving at 60 km/h and the other is moving 40 km/h. In how many hours will they meet?

a 1.75 h

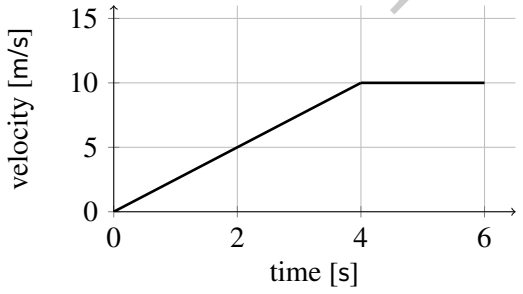
b 2.0 h

c 3.0 h

d 2.5 h

e 1.5 h

Q10 The diagram below represents the motion of a car during a 6.0 s time interval.



What is the total distance traveled by the car during this 6.0 s interval?

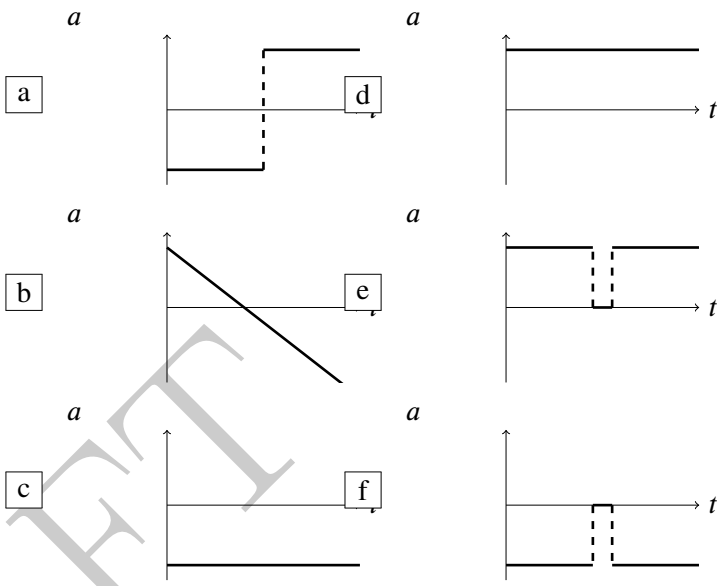
a 10.0 m

b 20.0 m

c 40.0 m

d 60.0 m

Q11 A ball rolls up a ramp, then back down under the influence of gravity. Which acceleration-time graph best represents the balls motion? Motion up the ramp is defined to be positive.



Q12 A child riding a bicycle at 15 m/s accelerates at $-3.0\,\text{m/s}^2$ for 4.0 s. What is the child's speed at the end of this 4.0 s interval?

a 12 m/s

b 27 m/s

c 3.0 m/s

d 7.0 m/s

Q13 Which measurement of an average classroom door is closest to 1 m?

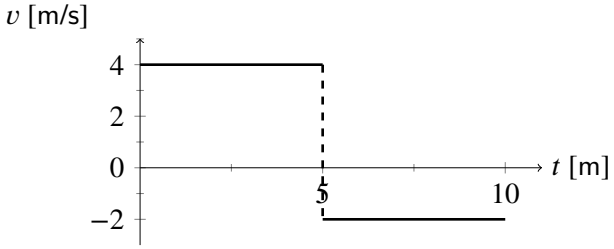
a height

b thickness

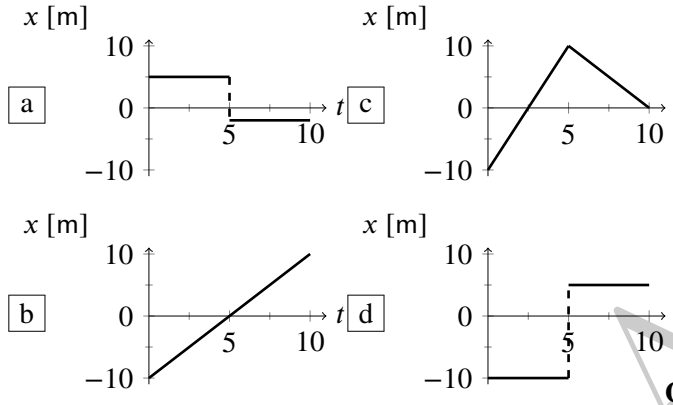
c width

d surface area

Q14 Which displacement-time graph best describes the motion shown in the velocity-time graph below?



The particle's position at $t_i = 0\,\text{s}$ is $x_i = -10\,\text{m}$.



Q15 Car *A*, moving in a straight line at a constant speed of 20.0 m/s, is initially 200 m behind car *B*, moving in the same straight line at a constant speed of 15 m/s. How far must car *A* travel from this initial position before it catches up with car *B*?

a 800 m
c 1000 m
b 200 m
d 400 m

Q16 Two cars are moving to the right on a horizontal track, each with constant acceleration. At an instant of time, the information about the cars is shown:

Car #1: position = 125.0 m; velocity = 13.0 m/s; constant acceleration = 1.5 m/s^2

Car #2: position = 80.0 m; velocity = 9.30 m/s; constant acceleration = 5.5 m/s^2

During the next 1.0 s of motion, which one of the following choices best represents what happens to the distance between the cars?

a It initially increases and then decreases resulting in a smaller distance between the cars after 1.0 s.
b It initially increases and then decreases resulting in a greater distance between the cars after 1.0 s.
c It decreases during the entire 1.0 s of motion.
d It increases during the entire 1.0 s of motion.
e It initially increases and then decreases resulting in the same distance between the cars after 1.0 s.

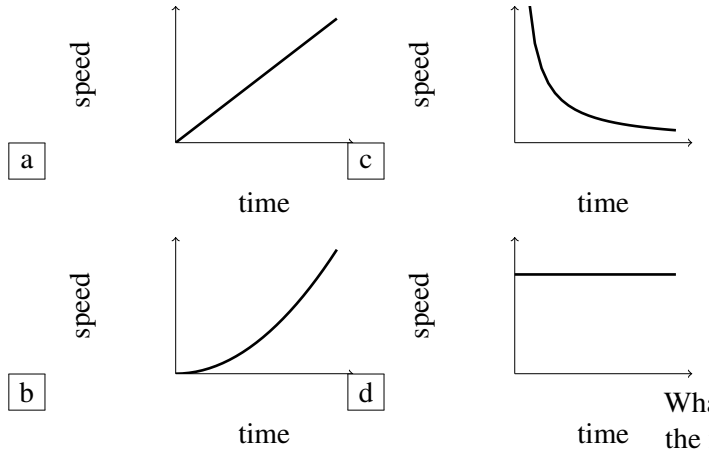
Q17 An object falls freely from rest near the surface of Earth. What is the speed of the object after having fallen a distance at 4.9 m?

a 96.1 m/s
c 4.90 m/s
b 9.80 m/s
d 24.0 m/s

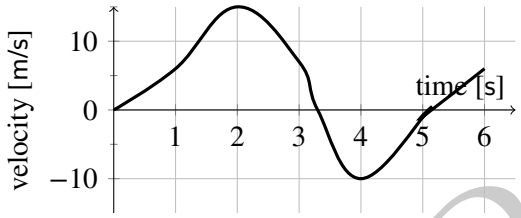
Q18 Starting from rest, object 1 falls freely for 4.0 s, and object 2 falls freely for 8.0 s. Compared to object 1, object 2 falls:

a four times as far.
b half as far.
c three times as far.
d twice as far.
e sixteen times as far.

Q19 Which graph represents the relationship between the speed of a freely falling object and the time of fall of the object near Earth's surface?



Q20 A car has the velocity versus time curve shown.



Which of the following statements regarding its motion is *incorrect*?

a The car has no acceleration at the instant $t = 2.0\,\text{s}$.

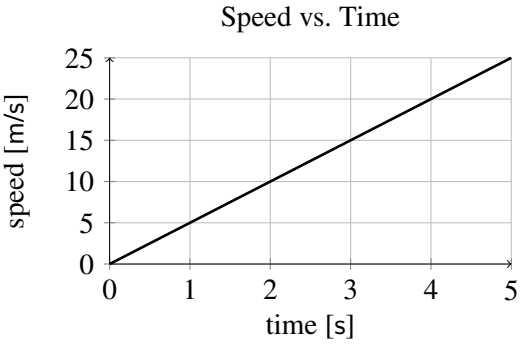
b The car is speeding up from $t = 0\,\text{s}$ to $t = 2.0\,\text{s}$.

c The car is at rest at approximately 5.2 s.

d The car is moving fastest at 2.0 s.

e The car has negative acceleration at $t = 4.5\,\text{s}$.

Q21 The graph below represents the relationship between speed and time for an object moving along a straight line.



What is the total distance traveled by the object during the first 4 s?

a 20 m

c 40 m

b 5 m

d 80 m

Q22 Which object weighs approximately 1 N?

a physics student

c golf ball

b dime

d paper clip

Q23 The surface area of a typical student desk is closest to:

a $3 \times 10^{-1}\,\text{m}^2$

c $3 \times 10^{2}\,\text{m}^2$

b $3 \times 10^{0}\,\text{m}^2$

d $3 \times 10^{3}\,\text{m}^2$

Q24 A bicyclist accelerates from rest to a speed of 5.0 m/s in 10 s. During the same 10 s, a car accelerates from a speed of 22 m/s to a speed of 27 m/s. Compared to the acceleration of the bicycle, the acceleration of the car is:

a the same

b less

c greater

Q25 Two cars travel to the right, each starting from rest, along a straight road. Car A has twice the acceleration of car B. After traveling a distance d, Car A has speed v. When Car B has traveled the same distance d, what is its speed in terms of v?

a $\frac{\sqrt{2}}{2}v$

b $\frac{\sqrt{3}}{2}v$

d $\frac{1}{2}v$

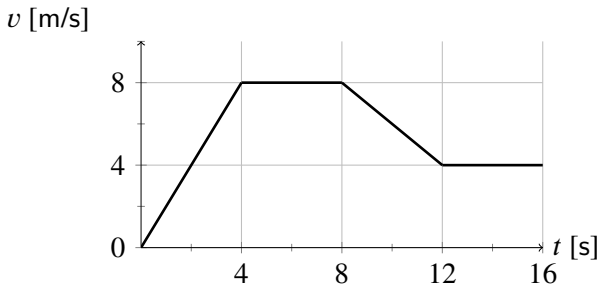
c $\frac{1}{4}v$

e v

Q26 A ball which is dropped from the top of a building strikes the ground with a speed of 30 m/s. Assume air resistance can be ignored. The height of the building is approximately:

[a] 30 m [c] 90 m [e] 45 m
[b] 75 m [d] 15 m

Q27 Consider the motion of an object whose velocity-time graph is provided below.



What is the acceleration of the object at $t = 6\,\text{s}$?

[a] $2\,\text{m/s}^2$ [c] $4\,\text{m/s}^2$ [e] $8\,\text{m/s}^2$
[b] $-1\,\text{m/s}^2$ [d] $10\,\text{m/s}^2$ [f] $0\,\text{m/s}^2$

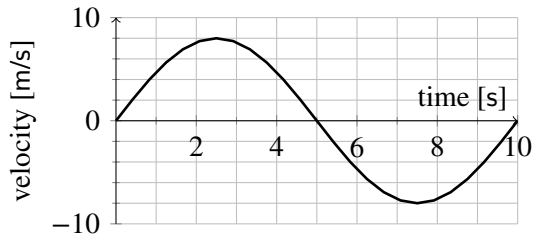
Q28 An object of mass 5.00 kg moves only to the right along the $+x$-axis. During some time interval, the object's speed increased from 4.00 m/s to 8.00 m/s with a constant acceleration of $2.00\,\text{m/s}^2$. Through what distance does the object move during the time interval of the acceleration?

[a] 12.0 m [c] 24.0 m [e] 4.00 m
[b] 2.00 m [d] 8.00 m

Q29 A car starts from rest and accelerates at $0.80\,\text{m/s}^2$ for 10 s. It then continues at constant velocity. Twenty seconds (20 s) after it began to move, the car has:

[a] velocity 8.0 m/s and has traveled 40 m.
[b] velocity 8.0 m/s and has traveled 80 m.
[c] velocity 16.0 m/s and has traveled 320 m.
[d] velocity 16.0 m/s and has traveled 160 m.
[e] velocity 8.0 m/s and has traveled 120 m.

Q30 The motion of an object moving along a straight line is given by the velocity vs. time graph shown.



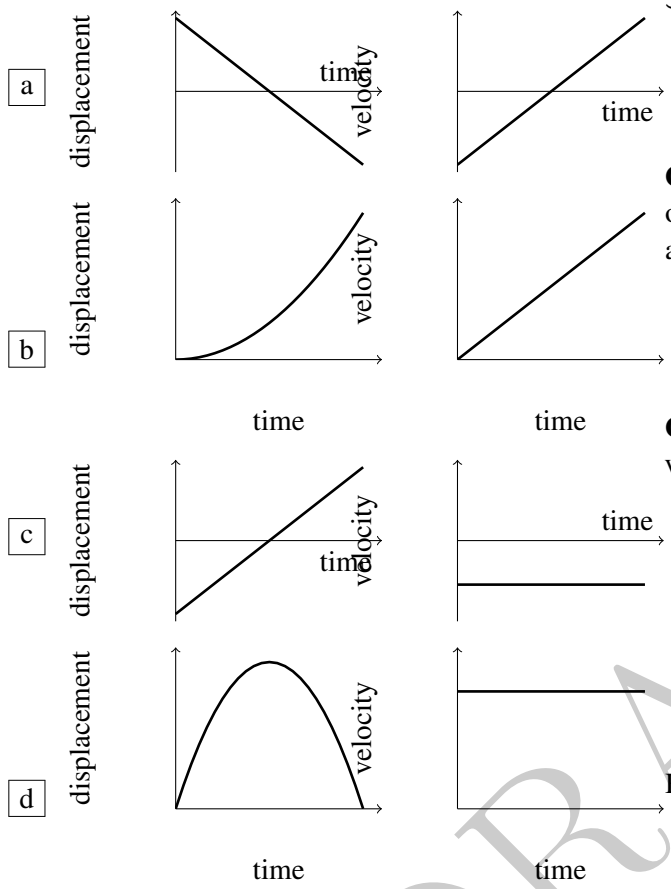
Which one of the following choices best represents the instantaneous acceleration of the object at the time $t = 4.0\,\text{s}$

[a] $-3.2\,\text{m/s}^2$ [d] $-2.0\,\text{m/s}^2$
[b] $-1.6\,\text{m/s}^2$ [e] $-4.0\,\text{m/s}^2$
[c] $0\,\text{m/s}^2$

Q31 By computing the area under the acceleration vs time graph for a fixed time interval of an object's motion, what quantity has been determined for that object?

[a] The average speed during the time interval.
[b] The average velocity during the time interval.
[c] The change in velocity during the time interval.
[d] The velocity at the time midway through the time interval.
[e] The velocity at the end of the time interval.

Q32 Which pair of graphs represents the same motion of an object?



Q33 An object moves along a horizontal line with increasing speed. Which one of the following choices could represent the signs of the velocity and of the acceleration for the object to achieve this motion?

№	Velocity	Acceleration
a	Zero	Zero
b	Negative	Negative
c	Positive	Negative
d	Negative	Positive
e	Positive	Zero

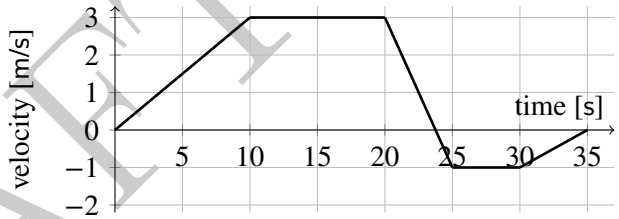
Q34 A car initially traveling at a speed of 16 m/s accelerates uniformly to a speed of 20 m/s over a distance of 36 m. What is the magnitude of the car's acceleration?

a $9.0\ \text{m/s}^2$ c $2.0\ \text{m/s}^2$
b $0.11\ \text{m/s}^2$ d $0.22\ \text{m/s}^2$

Q35 If a car accelerates uniformly from rest to 15 m/s over a distance of 100 m, the magnitude of a car's acceleration is:

a $1.1\ \text{m/s}^2$ c $0.15\ \text{m/s}^2$
b $2.3\ \text{m/s}^2$ d $6.7\ \text{m/s}^2$

Q36 The graph shown below is a plot of the car's velocity in the x direction, v_x, versus time, t.



How far did the car travel during the first 15 s?

a 45 m c 30 m e 0.0 m
b 15 m d 3.0 m

Q37 A cart is initially moving at 0.5 m/s along a track. The cart comes to rest after traveling 1 m. The experiment is repeated on the same track, but now the cart is initially moving at 1 m/s. How far does the cart travel before coming to rest?

a 2 m c 5 m e 3 m
b 1 m d 4 m

Q38 ♣ A particle moves on the x-axis. When the particle's acceleration is positive and increasing

a it must be slowing down.
b its velocity must be negative.
c its velocity must be positive.
d it must be speeding up.

Q39 A car is moving with a constant speed of 20 m/s. What total distance does the car travel in 2.0 min?

[a] 2400 m
[b] 1200 m
[c] 40 m
[d] 10 m

Q40 A car moves to the right along a one-dimensional track for a total time T in two parts.

Part One: The car maintains constant non-zero speed V for the first $\frac{3}{4}$ of the total time.

Part Two: The car accelerates uniformly to rest during the last $\frac{1}{4}$ of the total time.

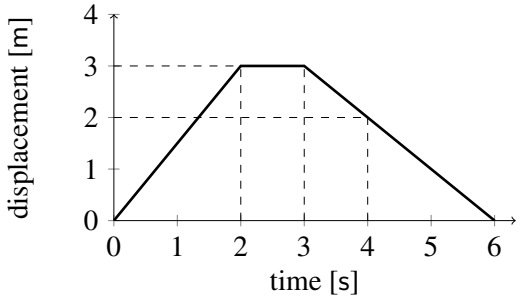
What is the ratio of the distance traveled during Part One of the trip to the distance traveled during Part Two of the trip?

[a] 3 : 2
[b] 4 : 3
[c] The values of V and T are required to answer the question.
[d] 8 : 3
[e] 6 : 1

Q41 A freely falling object is found to be moving downward at 18 m/s. If it continues to fall, two seconds later the object would be moving with a speed of:

[a] 38 m/s
[b] 10 m/s
[c] 18 m/s
[d] 180 m/s
[e] 8.0 m/s

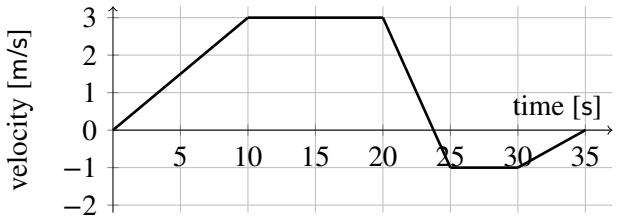
Q42 The graph below represents the displacement of an object as a function of time.



How far is the object from the starting point at the end of 3 s?

[a] 9.0 m
[b] 2.0 m
[c] 0 m
[d] 3.0 m

Q43 The graph shown below is a plot of the car's velocity in the x direction, v_x, versus time, t.



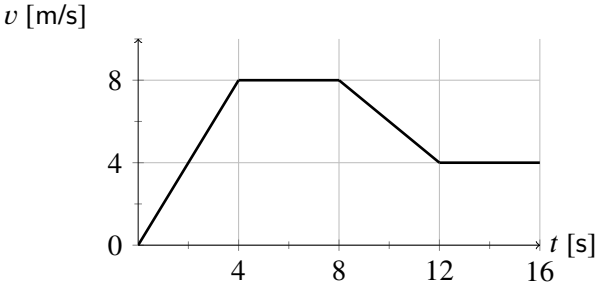
During what time interval was the car moving towards its initial position at constant velocity?

[a] 0 s to 10 s
[b] 10 s to 20 s
[c] 30 s to 35 s
[d] 20 s to 25 s
[e] 25 s to 30 s

Q44 The change of distance per unit time without reference to a particular direction is called

[a] inertia
[b] speed
[c] acceleration
[d] position
[e] velocity

Q45 Consider the motion of an object whose velocity-time graph is provided below.



What is the average velocity between $t = 0$ s and $t = 14$ s?

[a] $\frac{40}{7}$ m/s
[b] $\frac{11}{2}$ m/s
[c] $\frac{36}{7}$ m/s
[d] 2 m/s
[e] 4 m/s
[f] 0 m/s

When you finish this exam, you should go back and reexamine your work, both on the earlier part of this exam and in your life up until the day of this exam, for any errors that you may have made.

+2/11/40+

Student Number

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

Examination Title: Examination Subtitle №2

Last and First Name: Today's Date:

Print your last and first name in the box provided above. Enter your course student ID number by filling in the appropriate boxes to the left. Enter your chosen selection for each question on this form by filling in completely your selected oval(s) for each question. *Good Luck!!*

Q01: a b c d

Q02: a b c d e

Q03: a b c d

Q04: a b c d

Q05: a b c d e f

Q06: a b c d

Q07: a b c d

Q08: a b c d e

Q09: a b c d e

Q10: a b c d

Q11: a b c d e f

Q12: a b c d

Q13: a b c d

Q14: a b c d

Q15: a b c d

Q16: a b c d e

Q17: a b c d

Q18: a b c d e

Q19: a b c d

Q20: a b c d e

Q21: a b c d

Q22: a b c d

Q23: a b c d

Q24: a b c

Q25: a b c d e

Q26: a b c d e

Q27: a b c d e f

Q28: a b c d e

Q29: a b c d e

Q30: a b c d e

Q31: a b c d e

Q32: a b c d

Q33: a b c d e

Q34: a b c d

Q35: a b c d

Q36: a b c d e

Q37: a b c d e

Q38: a b c d

Q39: a b c d

Q40: a b c d e

Q41: a b c d e

Q42: a b c d

Q43: a b c d e

Q44: a b c d e

Q45: a b c d e f

International System of Units (SI)

length	meter	m	
mass	kilogram	kg	
time	second	s	
electric current	ampere	A	
thermodynamic temperature	kelvin	K	
amount of substance	mole	mol	
luminous intensity	candela	cd	
plane angle	radian	rad	m/m
solid angle	steradian	sr	m^2/m^2
frequency	hertz	Hz	1/s
force	newton	N	$kg\,m/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, heat	joule	J	N m
power, radiant flux	watt	W	J/s
electric charge	coulomb	C	A s
electric potential difference	volt	V	W/A
capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
electric conductance	siemens	S	A/V
magnetic flux	weber	Wb	V s
magnetic flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
Celsius temperature	degree	℃	K
luminous flux	lumen	lm	cd sr
illuminance	lux	lx	lm/m^2
activity (of radionuclide)	becquerel	Bq	1/s
absorbed dose	gray	Gy	J/kg
dose equivalent	sievert	Sv	J/kg
catalytic activity	katal	kat	mol/s

l, x, r, etc…	L
m	M
t	T
I, i	I
T	Φ
n	N
I_v	J

SI Prefixes

10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	
10^{-3}	milli	m
10^{-2}	centi	c
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P

Physical Constants

Rest mass of the electron	m_e	=	9.11×10^{-31} kg
Rest mass of the proton	m_p	=	1.67×10^{-27} kg
Magnitude of the electron charge	e	=	1.60×10^{-19} C
Avogadro's number	N_A	=	6.02×10^{23}/mol
Universal gas constant	R	=	8.31 J/(mol K)
Boltzman's constant	k	=	1.38×10^{-23} J/K
Speed of light	c	=	3.00×10^{8} m/s
Planck's constant	h	=	6.63×10^{-34} J s
		=	4.14×10^{-15} eV s
	$\hbar$	=	$h/(2\pi)$
	hc	=	1.24×10^{3} eV nm
Vacuum permittivity	ϵ_0	=	8.85×10^{-12} $C^2/(N\,m^2)$
Vacuum permeability	μ_0	=	4×10^{-7} T m/A
Universal gravitational constant	G	=	6.67×10^{-11} $m^3/(kg\,s^2)$
Standard acceleration of gravity	g	=	9.81 m/s^2
1 Ångström	1	=	1×10^{-10} m

Rotational Inertia

Rod	$\frac{1}{12}ML^2$
Disc	$\frac{1}{2}MR^2$
Sphere	$\frac{2}{5}MR^2$

Unit Conversions

inch	=	2.54 cm
foot	=	12 in
yard	=	3 ft
mile	=	5280 ft
lb-mass	=	0.454 kg
lb-force	=	4.448 N
gallon	=	3.785 L
liter	=	10^{-3} m^3