1993 Practice Test

Name Key

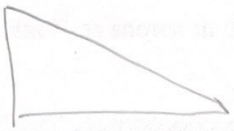
PART A: MULTIPLE-CHOICE QUESTIONS

Omit #26

Value: 60 (2 marks per question) Suggested Time: 60 minutes

INSTRUCTIONS: For each question, select the BEST answer and record your choice on the answer sheet provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

1. A 2.6 kg block slides down an incline of 19° to the horizontal at a constant speed. What is the net force on the block?

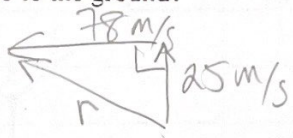


A. 0.0 N ✓
B. 8.3 N
C. 24 N
D. 25 N

$a = 0$

$F_{net} = ma = 0$

2. An airplane heads due west with an airspeed of 78 m/s. The wind is blowing due north at 25 m/s. What is the speed of the airplane relative to the ground?

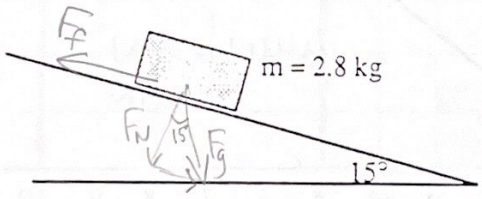


A. 53 m/s
B. 78 m/s
C. 82 m/s ✓
D. 103 m/s

$\sqrt{78^2 + 25^2} = r$

$r = 81.9$

3. In the following diagram, the coefficient of friction between the 2.8 kg block and the 15° inclined plane is 0.268.



$F_f = \mu F_N$

$= 0.268(F_g \cos 15°)$

$= 0.268(2.85)(9.81)\cos 15°$

$= 7.11\,N$

If the block does not move, what frictional force exists between the block and the surface?

A. 2.5 N
B. 7.1 N ✓
C. 9.3 N
D. 9.6 N

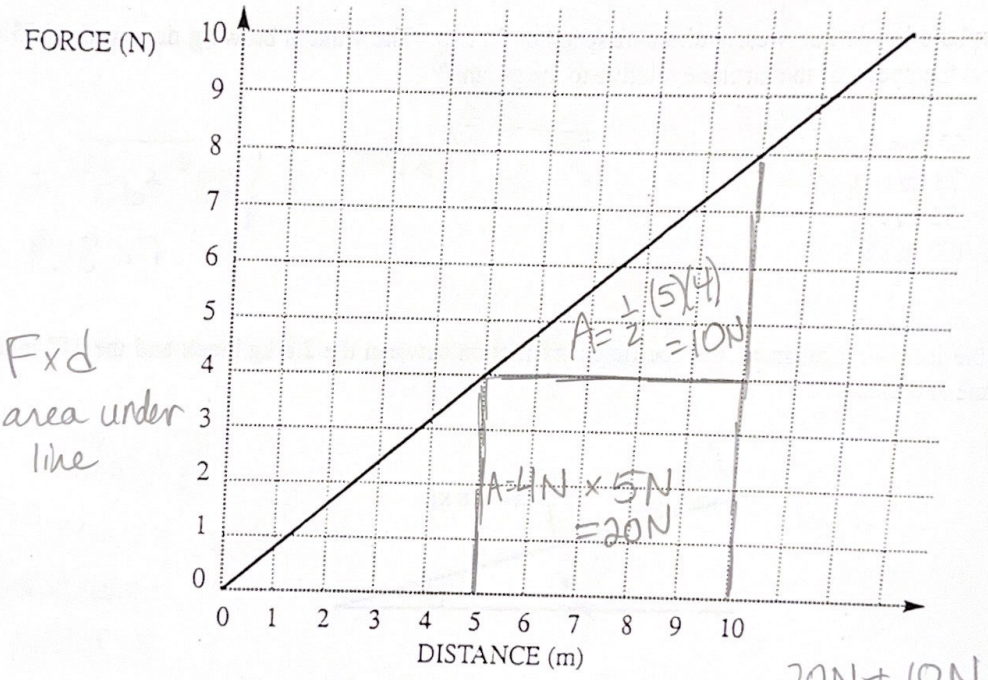
OVER

4. Which one of the following **BEST** describes an **inelastic** collision between two objects?

always conserved ≠ always conserved

	TOTAL ENERGY	TOTAL MOMENTUM	KINETIC ENERGY
A.	conserved	conserved	conserved
B.	conserved	conserved	not conserved
C.	conserved	not conserved	not conserved
D.	not conserved	not conserved	not conserved

5. The graph below shows the distance an object moved when pulled by a varying force.



W = F x d
= area under line

20N + 10N = 30N

How much work was done by this force in moving the object from 5.0 m to 10.0 m?

A. 10 J
B. 20 J
C. 30 J ✓
D. 40 J

A 5.0 kg object is dropped from a height of 28 m. The object strikes the ground with a speed of 15 m/s. How much heat energy was produced while falling?

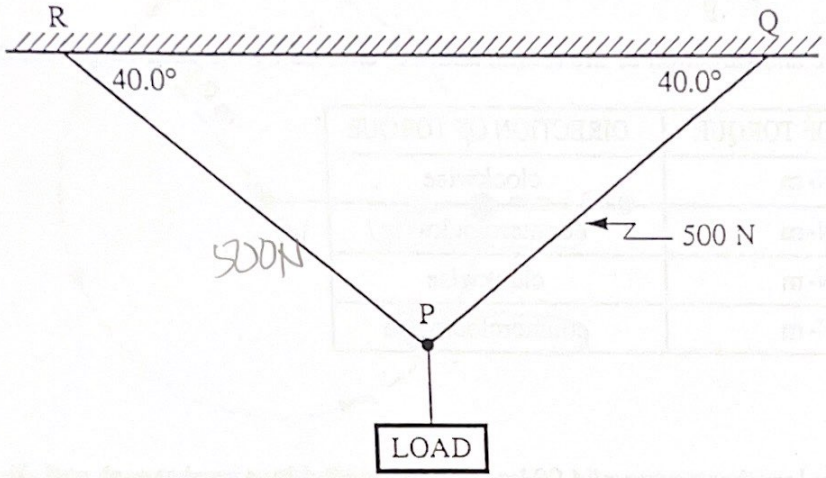
A. 5.6×10^2 J
B. 8.1×10^2 J ✓
C. 1.4×10^3 J
D. 1.9×10^3 J

$E_p - E_k = E_H$

$mgh - \frac{1}{2}mv^2 =$

$5(9.81)(28) - \frac{1}{2}(5)(15)^2 = 8.1 \times 10^2$

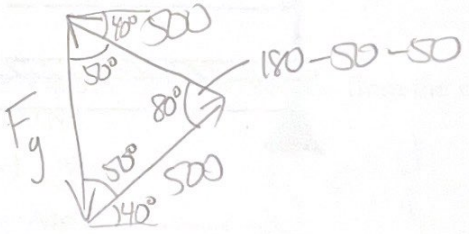
A load is suspended from point P, as shown in the diagram.



same angles, same tensions

If the tension in the cord PQ is 500 N, what is the magnitude of the force of gravity on the load?

A. 250 N
B. 321 N
C. 643 N ✓
D. 1000 N

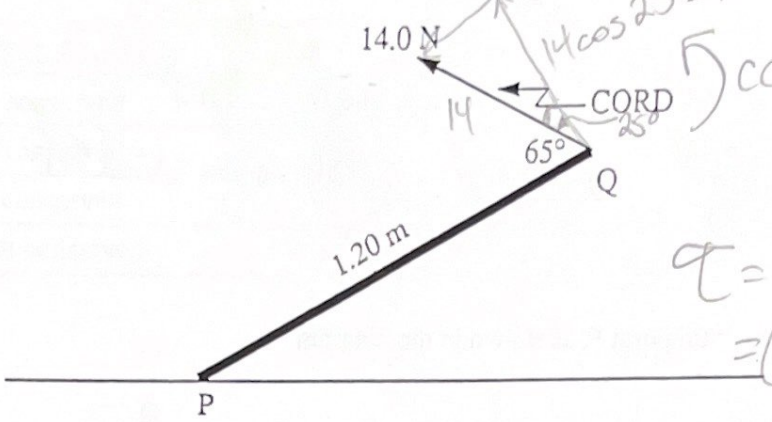


$\frac{F_g}{\sin 80°} = \frac{500}{\sin 50°}$

$F_g = 643\ N$

OVER

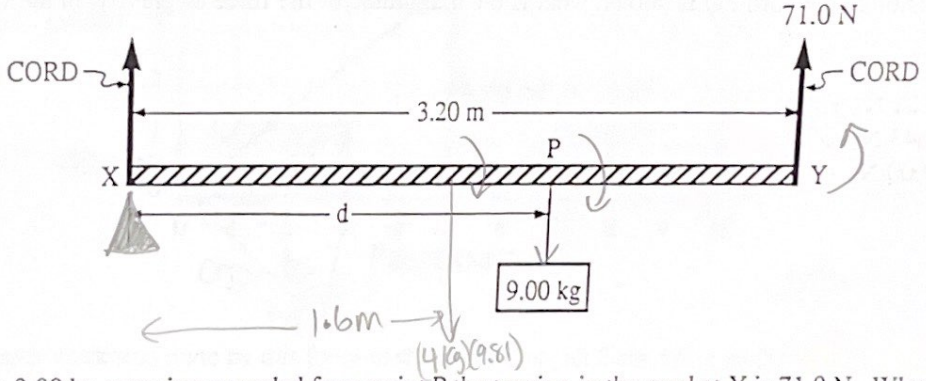
8. A uniform beam 1.20 m in length is supported by a cord at Q, as shown. The tension in the cc attached to the beam is 14.0 N.



What are the magnitude and direction of the torque about P, exerted by the cord on the beam?

	MAGNITUDE OF TORQUE	DIRECTION OF TORQUE
A.	15.2 N·m	clockwise
B.	15.2 N·m	counterclockwise
C.	16.8 N·m	clockwise
D.	16.8 N·m	counterclockwise

9. A uniform beam 3.20 m long has a mass of 4.00 kg. It is suspended by a cord at each end, X and Y, as shown.



When a 9.00 kg mass is suspended from point P the tension in the cord at Y is 71.0 N. What is the distance d? (not drawn to scale)

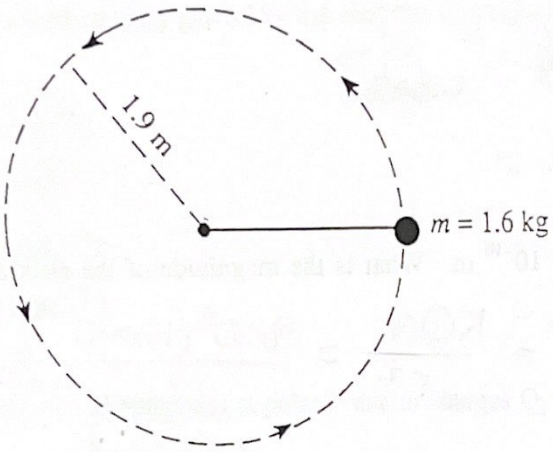
A. 1.78 m
B. 1.86 m
C. 2.21 m
D. 2.58 m

Which one of the following best describes an object in uniform circular motion?

	MAGNITUDE OF ACCELERATION	MAGNITUDE OF VELOCITY
A.	constant	constant
B.	constant	changing
C.	changing	constant
D.	changing	changing

always to centre

The diagram below shows a 1.6 kg air puck on the end of a string. The puck is moving in a horizontal circular path of radius 1.9 m.



$F_c = \frac{m4\pi^2 r}{T^2}$

$T = \sqrt{\frac{m4\pi^2 r}{F_c}}$

$= \sqrt{\frac{(1.6)(4)\pi^2(1.9m)}{150N}}$

$= 0.89s$

If the tension in the string is 150 N, what is the period of revolution of the puck?

$T = F_c$

A. 0.71 s
B. 0.89 s ✓
C. 1.1 s
D. 1.4 s

12. The force of gravity on an object at the Moon's surface is 400 N. At what distance from the centre of the Moon will the force of gravity on this object be 100 N?

$F_{g_1} = 400N$ @ r_1

$F_g \propto \frac{1}{r^2}$

$r_1 = r_{moon} = 1.74 \times 10^6 m$

A. 1.74×10^6 m
B. 2.46×10^6 m
C. 3.48×10^6 m ✓
D. 6.96×10^6 m

$\frac{F_{g_1}}{F_{g_2}} = \frac{r_2^2}{r_1^2}$

$\sqrt{\frac{r_1^2 F_{g1}}{F_{g2}}} = r_2 = \sqrt{\frac{(1.74\times10^6)^2(400)}{100}} = 3.48\times10^6$

OVER

13. A 75 000 kg spacecraft is situated at the surface of a planet. The planet has a mass of 4.20×10^{23} and a radius of 7.20×10^{6} m. What is this spacecraft's escape velocity from this planet?

A. 2.01×10^{2} m/s
B. 2.84×10^{2} m/s
C. 1.97×10^{3} m/s
(D) 2.79×10^{3} m/s ✓

$E_k = E_p$

$\frac{1}{2}mv^2 = \frac{GMm}{r}$

$v = \sqrt{\frac{2GM}{r}} = \sqrt{\frac{2(6.67\times10^{-11})(4.2\times10^{23})}{7.2\times10^{6}}} = 2.7^{c}$

14. Which one of the following is a correct unit for electric field?

A. N/A
B. J/C
C. N/A·m
(D) N/C ✓

$\vec{E} = \frac{F}{Q_t}$

15. Two electrons are separated by 1.0×10^{-10} m. What is the magnitude of the electrostatic force acting on each electron?

A. 1.2×10^{-8} N
(B) 2.3×10^{-8} N ✓
C. 1.4×10^{1} N
D. 1.4×10^{11} N

$F_e = \frac{KQQ}{r^2} = \frac{9\times10^{9}(1.6\times10^{-19})(1.6\times10^{-19})}{(1\times10^{-10})^2}$

$= 2.3\times10^{-8}\,N$

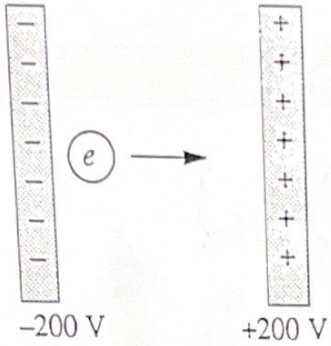
16. Two parallel metal plates are 4.0×10^{-3} m apart. The potential difference between them is 200 V. What is the magnitude of the uniform electric field between the plates?

A. 0.0 V/m
B. 0.80 V/m
(C) 5.0×10^{4} V/m ✓
D. 1.0×10^{5} V/m

$\vec{E} = \frac{\Delta V}{d_{btwn}} = \frac{200V}{4\times10^{-3}m}$

$= 5\times10^{4}\frac{V}{m}$

An electron moves from a –200 V plate to a +200 V plate as shown in the diagram. The distance between the plates is 0.080 m.



What is the kinetic energy gained by the electron as it moves from the negative to the positive plate?

$E_{K\,gained} = E_{p\,it\,had}$

$= \Delta V Q$

$= (400V)(1.6 \times 10^{-19} C)$

$= 6.4 \times 10^{-17} J$

A. 2.0×10^{-18} J

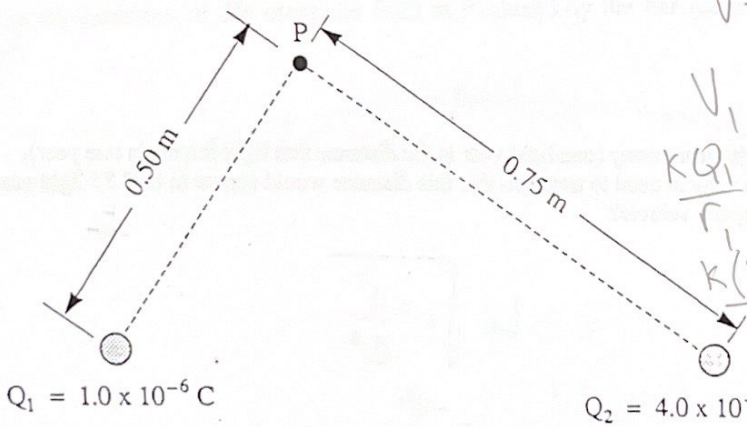
B. 6.4×10^{-17} J ✓

C. 4.0×10^{-16} J

D. 8.0×10^{-16} J

18. What is the electric potential at point P due to charges Q_1 and Q_2 arranged as shown in the diagram below?

scalar



$V = \frac{kQ}{R}$

$V_1 + V_2$

$\frac{kQ_1}{r_1} + \frac{kQ_2}{r_2}$

$\frac{k(1 \times 10^{-6})}{0.5} + \frac{k(4 \times 10^{-6})}{0.75}$

$= 6.6 \times 10^4 V$

A. 3.0×10^4 V

B. 5.1×10^4 V

C. 6.6×10^4 V ✓

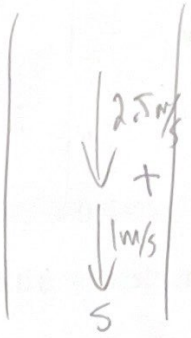
D 1.0×10^5 V

OVER

19.

A boat with a speed of 2.5 m/s on still water is now in a river with a velocity of 1.0 m/s south. Wl is the velocity of the boat relative to the shore when the boat is headed south?

(A) 3.5 m/s [S] ✓
B. 1.5 m/s [N]
C. 2.7 m/s [22° S of W]
D. 2.5 m/s



20.

An astronaut is travelling at a constant speed of 2.40×10^8 m/s relative to Earth through space. According to timing devices aboard the space vehicle, the trip took 1.25 years. How long did the trip last if measured relative to Earth?

$t = \frac{t_0}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{1.25}{\sqrt{1-\left(\frac{2.4\times10^8}{3\times10^8}\right)^2}}$

$= 2.08$ years.

A. 0.750 years
B. 1.25 years
(C) 2.08 years ✓
D. not enough information

21.

A 3.0×10^4 kg truck is moving east at 8.0 m/s when it collides with a 5.0×10^4 kg truck moving south at a velocity of 5.0 m/s. If these two vehicles lock together upon collision, what is the initial velocity of the vehicles immediately after colliding. (momentum question)

$= 2.4\times10^5$

$(3\times10^4)(8\text{ m/s})$

$\tan\theta = \frac{2.5\times10^5}{2.4\times10^5}$

$\theta = 46°$ S of E

θ

$(5\times10^4)(5) = 2.5\times10^5$

$P = m_T v_T$

$P_i = P_f$

$P_{i1}^2 + P_{i2}^2 = P_f^2$

$(2.4\times10^5)^2 + (2.5\times10^5)^2 = P_f$

$3.5\times10^5 = P_f = mv$

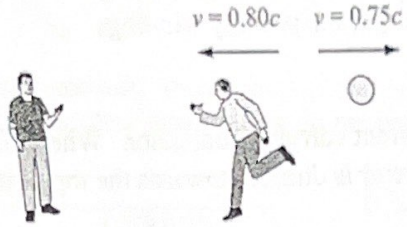
$\frac{346554}{(8\times10^4)} = v$

$v = 4.3$ m/s

b) $v = 4.3$ m/s [46° S of E]

2.

A student travelling at 0.80c toward a stationary observer throws an object backward at a velocity of 0.75c (relative to the student). What is the velocity of the object with respect to the stationary observer?



$v = 0.8$

$u' = -0.75$

+ = left

− = right

A. 0.97c [right]
B. 0.13c [right]
C. 0.97c [left]
(D.) 0.13c [left]

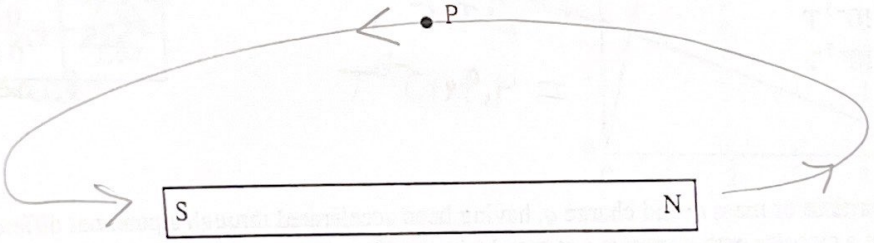
$$u = \frac{v + u'}{1 + \frac{vu'}{c^2}}$$

$$= \frac{0.8c - 0.75c}{1 + \frac{(0.8)(-0.75)c^2}{c^2}} = \frac{0.05c}{0.4}$$

$$= 0.125c$$

+ = left

23. What is the direction of the magnetic field at P caused by the bar magnet as shown in the diagram below?



(A.) towards the left ✓
B. towards the right
C. into the page
D. out of the page

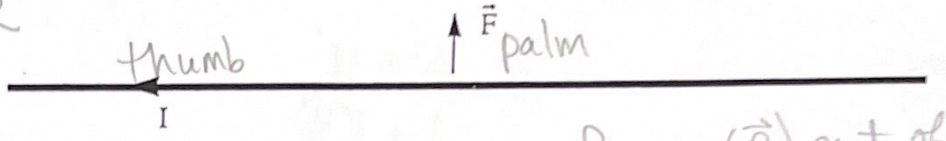
OVER

24. Which one of the following would induce a potential difference in the secondary windings of transformer?

A. the electric field of the secondary windings
B. the magnetic field of the primary windings
C. the changing electric field of the secondary windings
D. the changing magnetic field of the primary windings ✓

25. The diagram below shows a current carrying conductor. When placed in a uniform magnetic field, the magnetic force on the conductor is directed towards the top of the page as shown.

RHR



fingers ($\vec{B}$) out of page

What is the direction of the magnetic field?

A. out of the page ✓
B. into the page
C. towards the left
D. towards the right

26. What is the magnitude of the magnetic field 0.17 m from a long straight conductor carrying a 4.2 A current?

A. 4.9×10^{-6} T ✓
B. 2.9×10^{-5} T
C. 3.1×10^{-5} T
D. 3.9 T

$B = \frac{\mu_0 I}{2\pi r}$

$= 4.9 \times 10^{-6}$ T

haven't done this in our class

27. A charged particle of mass m and charge q, having been accelerated through a potential difference V, travels along a circular path of radius r at speed v in a uniform magnetic field B. What is the correct expression for the radius of this path?

A. $r = \frac{mv}{qB}$ ✓
B. $r = \frac{qB}{mv}$
C. $r = \frac{qmB}{2V}$
D. $r = \frac{2V}{qmB}$

$F_c = F_e$

$\frac{mv^2}{r} = qvB$

$\frac{mv}{qB} = r$

Find the magnetic flux through a coil of wire of area 4.5×10^{-2} m^2 whose plane is perpendicular to a magnetic field of magnitude 2.0×10^{-3} T.

A. 0.0 Wb
B. 9.0×10^{-5} Wb ✓
C. 4.4×10^{-2} Wb
D. 23 Wb

$\Phi = BA$
$= (2 \times 10^{-3}\,T)(4.5 \times 10^{-2}\,m^2)$
$= 9.0 \times 10^{-5}$ Wb

A DC motor is connected to a constant voltage power supply. The mechanical load on the motor increases, causing the armature to slow down. How do the back emf and current through the motor change?

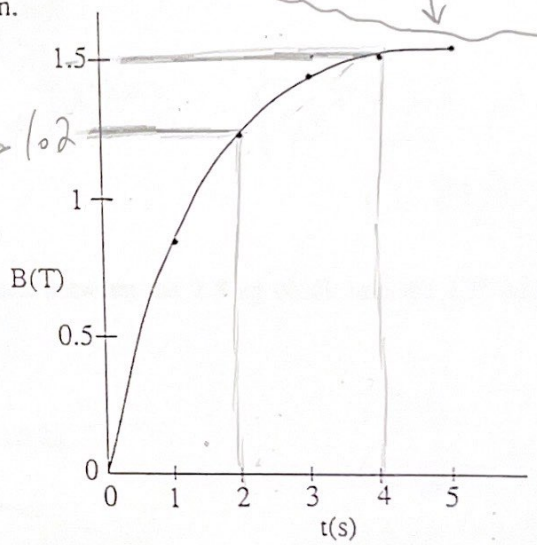
	BACK emf	CURRENT
A.	Increases	Decreases
B.	Increases	Increases
C.	Decreases	Increases
D.	Decreases	Decreases

✓

load increases
→ rotation slows
→ decreases V_{back}
→ increases I
since $V_{back} = \mathcal{E} - Ir$

30. The following data is plotted on the graph, as shown.

t(s)	B(T)
0.0	0.0
1.0	0.80
2.0	1.20
3.0	1.40
4.0	1.50
5.0	1.55



The data was obtained using a coil of 85 turns, having a cross-sectional area of 4.0×10^{-2} m^2. The plane of the coil is perpendicular to the changing magnetic field (B). What is the magnitude of the average emf induced in the coil between t = 2.0 s and t = 4.0 s?

A. 0.34 V
B. 0.51 V ✓
C. 1.6 V
D. 2.4 V

$\mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}$
$= -N\frac{\Delta(BA)}{\Delta t} = \frac{85(1.5-1.2)(4\times10^{-2})}{(4s-2s)} = 0.51\,V$

This is the end of the multiple-choice section.
Answer the remaining questions directly in this examination booklet.

OVER