MERIDIAN JUNIOR COLLEGE
JC2 Preliminary Examinations
Higher 1

H1 Physics 8866/01

Paper 1 Multiple Choice **22 September 2016**

1 hour

Additional Materials: Multiple Choice Answer Sheet

	Class	Reg No
Candidate Name: _____		

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

In the Index Number section, shade your index number using the first two spaces (e.g. index number 5 should be entered as "05"). Ignore the remaining numbers and letters.

There are **thirty** questions in this section. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the Answer Sheet.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
The use of an approved scientific calculator is expected, where appropriate.

DATA AND FORMULAE

Data

speed of light in free space	c	=	3.00×10^8 m s^{-1}
elementary charge	e	=	1.60×10^{-19} C
the Planck constant	h	=	6.63×10^{-34} J s
unified atomic mass constant	u	=	1.66×10^{-27} kg
rest mass of electron	m_e	=	9.11×10^{-31} kg
rest mass of proton	m_p	=	1.67×10^{-27} kg
acceleration of free fall	g	=	9.81 m s^{-2}

Formulae

uniformly accelerated motion	s	=	$ut + \frac{1}{2}at^2$
	v^2	=	$u^2 + 2as$
work done on/by a gas	W	=	$p\Delta V$
hydrostatic pressure	p	=	ρgh
resistors in series	R	=	$R_1 + R_2 + \ldots$
resistors in parallel	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$

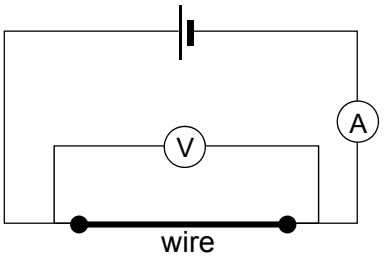
1 The SI unit for magnetic flux density is the tesla (T). How should the tesla be expressed in terms of SI base units?

A $kg\ s^{-1}\ A^{-2}$ **B** $kg\ s^{-2}\ A^{-1}$ **C** $kg\ s^{-1}\ C^{-1}$ **D** $kg\ s^{-2}\ C^{2}$

2 Which pair includes a vector and scalar quantity?

A	displacement	acceleration
B	magnetic flux density	kinetic energy
C	power	electromotive force
D	electric current	potential energy

3 A wire is connected in a simple circuit as shown below.



The voltmeter reads (2.0 ± 0.5) V while the ammeter reads (0.30 ± 0.01) A.

What is the uncertainty in the resistance of the wire?

A 0.2 Ω **B** 0.3 Ω **C** 1 Ω **D** 2 Ω

4 A stone falls freely from rest to the ground. The effect of air resistance on the stone is negligible. The stone travels $\frac{3}{4}$ of the total distance to the ground in the last two seconds of its fall. What is the total time of its fall?

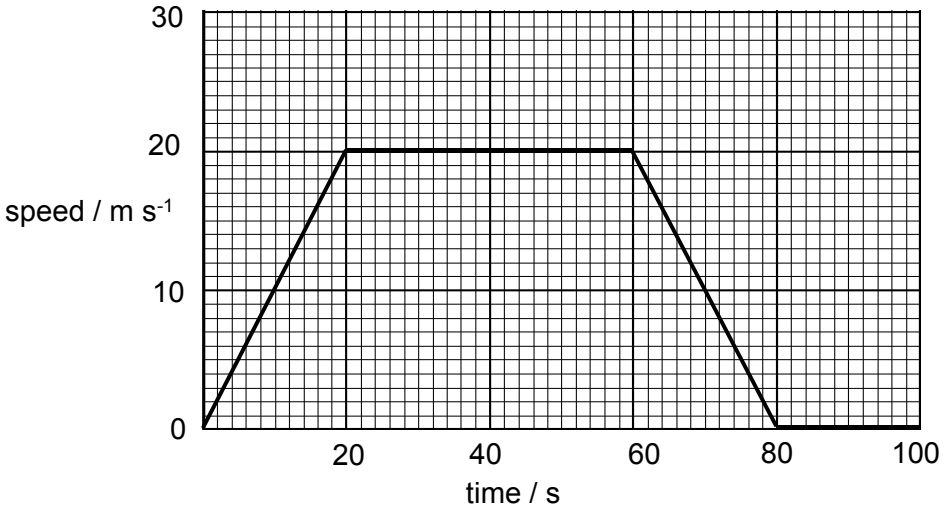
A 1.3 s **B** 2.7 s **C** 4.0 s **D** 14.9 s

5 A man throws a stone upwards off the edge of a cliff with an initial velocity *u*. The stone reaches the highest point at 2.0 s and then reaches the bottom of the cliff at 7.0 s. Air resistance is negligible.

Which of the following shows the correct signs for displacement *s*, velocity *v* and acceleration *a* of the stone at the respective times *t*?

	t / s	*s*	*v*	*a*
A	1.0	+	+	+
B	3.0	+	+	−
C	3.5	−	−	−
D	6.5	−	−	−

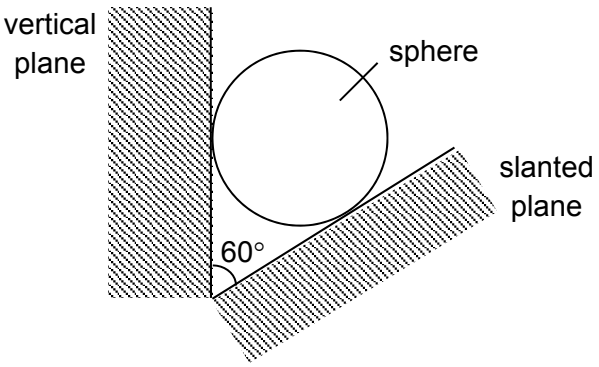
6 The graph below shows how the speed of a vehicle varies over a period of time of 100 s.



What is the average speed of the vehicle over the 100 s?

A 8.0 m s^{-1} **B** 12 m s^{-1} **C** 15 m s^{-1} **D** 20 m s^{-1}

7 A uniform sphere of weight 15 N is placed in between two smooth planes as shown.



What is the magnitude of the force exerted by the vertical plane on the sphere?

A zero **B** 7.5 N **C** 8.7 N **D** 13.0 N

8 A mass is suspended using a spring balance from the ceiling of a lift.

When the lift is moving up at a constant speed, the reading on the spring balance is *F*. Under which of the following situations is the reading on the spring balance more than *F*?

A The lift is stationary

B The lift is moving down at constant speed

C The lift is moving down at increasing speed

D The lift is moving down at decreasing speed

9 Two carts of different masses m_1 and m_2 move towards each other at different speeds u_1 and u_2 respectively and collide, producing a loud sound. Subsequently, the two carts move in opposite directions. Which of the following must be correct?

A The collision was elastic since the carts move in opposite directions.

B Each cart experienced a change in momentum, and thus the total momentum of the system must have changed.

C The sum of kinetic energies of the carts after the collision is less than that before the collision.

D The relative speed of approach and the relative speed of separation of the carts must be the same.

10 A particle X moving with kinetic energy E and momentum p makes a head-on inelastic collision with an identical particle Y which is initially at rest.

Which of the following options shows possible values for the kinetic energy of the particle X and the system as a whole, and the magnitude of the momentum of X and the system as a whole, after this collision?

	kinetic energy of		momentum of	
	X	system	X	system
A	0	E	0	p
B	$\frac{E}{2}$	E	$\frac{p}{2}$	p
C	$\frac{E}{4}$	$\frac{E}{2}$	$\frac{p}{4}$	$\frac{p}{2}$
D	$\frac{E}{4}$	$\frac{E}{2}$	$\frac{p}{2}$	p

11 Two ice boats, of masses m and $2m$, are made to compete in a race on a frictionless frozen lake. The boats have identical sails so that the wind pushes them forward with the same force. The two boats start from rest and travel the same distance.

Which of the following statements is correct?

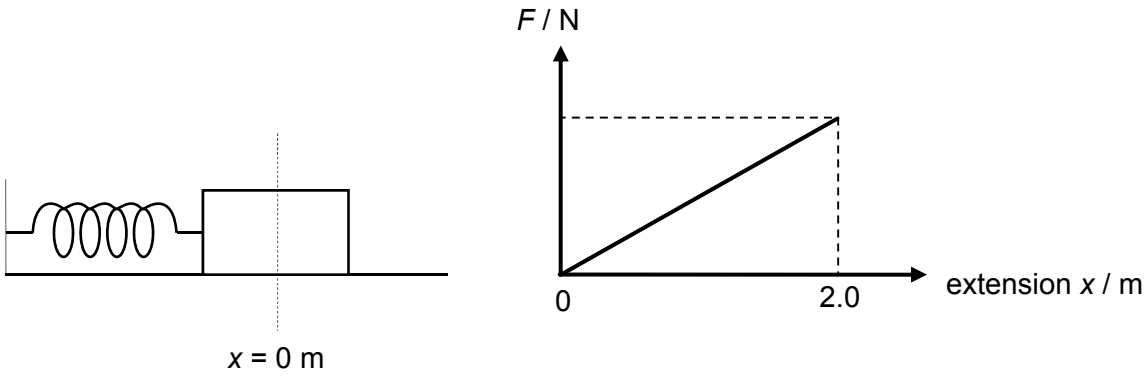
A The boat of mass m will win the race but the two boats will have the same final speed.

B The boat of mass m will win the race but it will have a lower final kinetic energy.

C The boat of mass m will win the race and it will have a higher final kinetic energy.

D The boat of mass m will win the race but the two boats will have the same final kinetic energy.

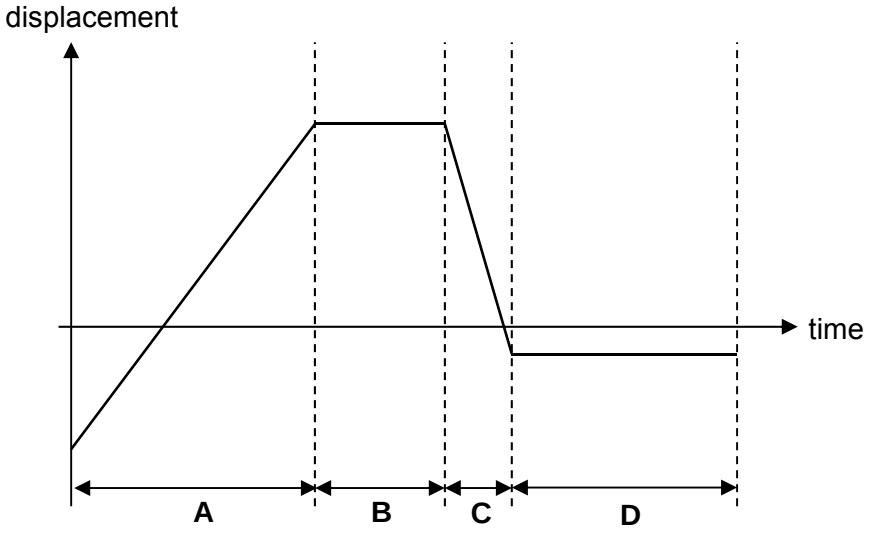
12 A 5.0 kg mass is placed on a frictionless surface, at the end of a spring. The mass is initially at x = 0 m and the spring at its natural length. The graph shows how the elastic force in the spring F varies with its extension x.



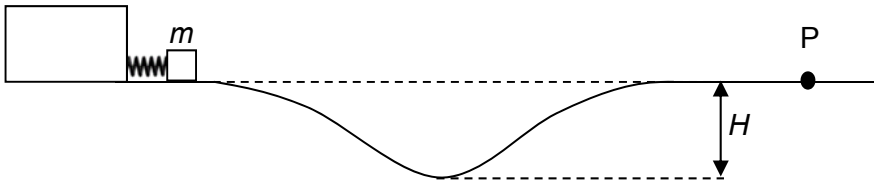
At x = 0 m, the mass is given an initial speed of 4.0 m s^{-1}. The mass comes to a stop at x = 2.0 m. What is the speed of the mass when the mass is at x = 1.0 m?

A 2.0 m s^{-1} **B** 2.8 m s^{-1} **C** 3.0 m s^{-1} **D** 3.5 m s^{-1}

13 The following shows a displacement-time graph of a mass being moved on a table. It experiences a constant force of friction. Which time interval has the greatest work done per unit time against friction?



14 A small mass *m* is launched by a spring and travels along a rough track to a point P. The spring constant is *k* and the initial compression of the spring was *x*. As it travels to P it goes through a dip of depth *H*. The mass experiences a constant force of friction *f* for the entire distance of *d*.



What is the kinetic energy of the mass at point P?

A $\frac{1}{2}kx^2 - fd$

B $\frac{1}{2}kx^2 + fd + mgH$

C $\frac{1}{2}kx^2 + fd$

D $\frac{1}{2}kx^2 - fd - mgH$

15 Which one of the following cannot be polarised?

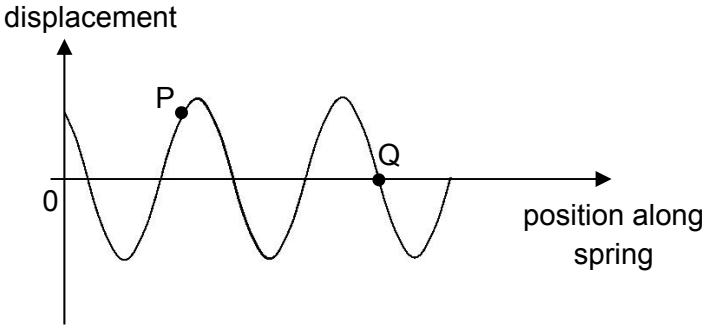
A Sound waves

B Radio waves

C Microwaves

D X-rays

16 A longitudinal wave travels to the right along a long horizontal spring. The graph below shows the displacement of different points of the spring at a given instant of time.



Which of the following statements is true?

A P is moving vertically downwards.

B Q is stationary.

C P and Q are moving in opposite directions.

D P has higher speed than Q.

17 Two speakers S_1 and S_2 emit coherent sound waves. The sound waves reach a point P by two paths which differ in length by 0.70 m. When the frequency of the sound is gradually increased, the resultant intensity at P goes through a series of maxima and minima.

A maximum occurs when the frequency is 2400 Hz and the next maximum occurs at 2800 Hz.

What is the speed of the sound waves?

A 200 m s^{-1} **B** 280 m s^{-1} **C** 340 m s^{-1} **D** 400 m s^{-1}

18 Which of the following statements about two-source interference is always true?

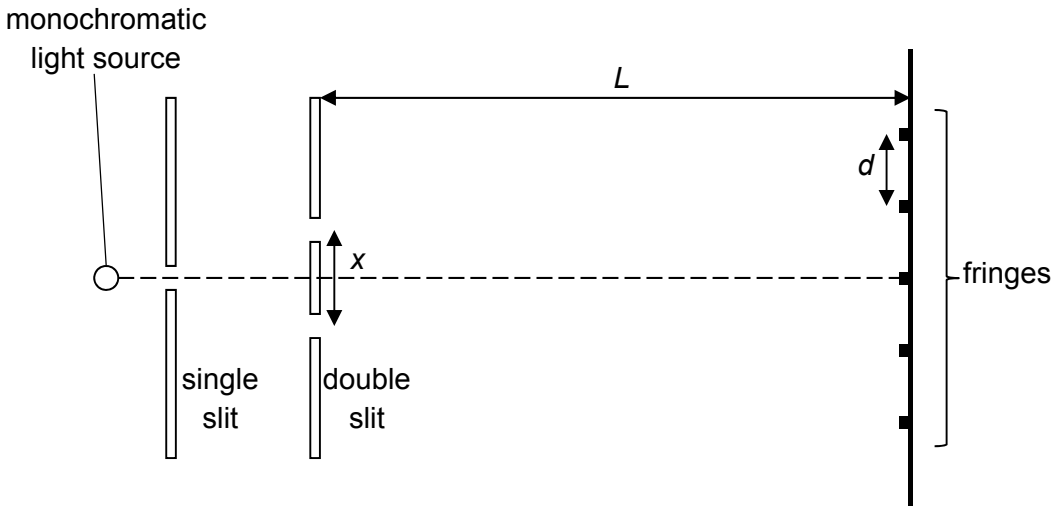
A Destructive interference occurs when the two sources are 180° out of phase.

B Constructive interference occurs when two waves meet in phase.

C Interference occurs only when two waves meet in phase or 180° out of phase.

D Constructive interference occurs when the path difference of the two waves is an integer multiple of wavelength.

19 A double slit experiment is shown in the figure below. The light source has wavelength λ, and the slit separation is x. The fringe separation is d and the distance between the slits and the screen is L.



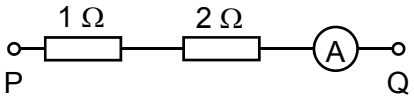
The wavelength is increased to 2λ, the slit separation is increased to $4x$ and the distance between the slits and the screen is decreased to $\frac{1}{2}L$. What is the resulting fringe separation?

A 0.25 d **B** 0.50 d **C** 2.0 d **D** 4.0 d

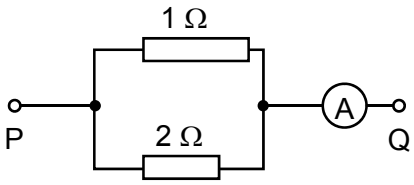
20 An ammeter with a resistance of 2 Ω is placed in different resistor configurations.

The same potential difference is applied across P and Q. In which configuration does the ammeter give the smallest reading?

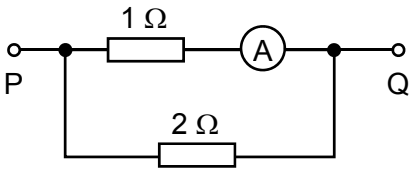
A



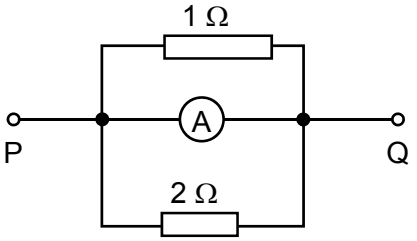
B



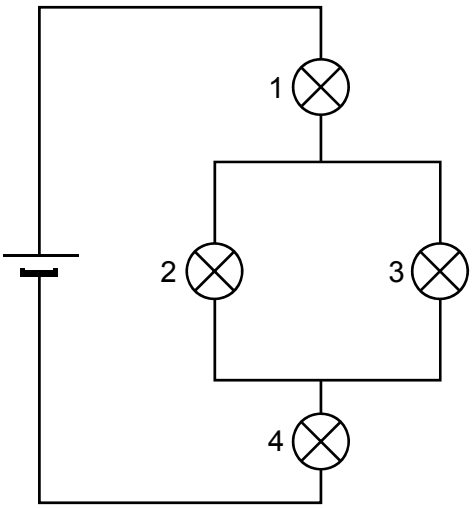
C



D



21 An ideal cell and four identical bulbs are connected as shown.



Bulb 3 is removed. Which of the following describes the changes in the brightness of bulbs 1, 2 and 4?

	Bulb 1	Bulb 2	Bulb 4
A	dimmer	brighter	brighter
B	dimmer	brighter	dimmer
C	brighter	dimmer	brighter
D	brighter	dimmer	dimmer

22 A cell of e.m.f. E and internal resistance r is connected to a variable resistor R as shown in Fig. (a).

Fig. (b) shows the variation with ammeter reading I of the voltmeter reading V as R is varied.

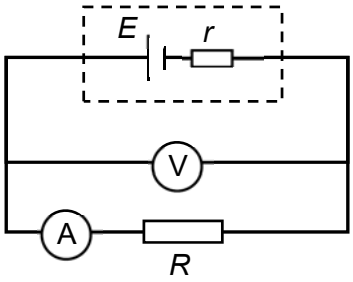


Fig. (a)

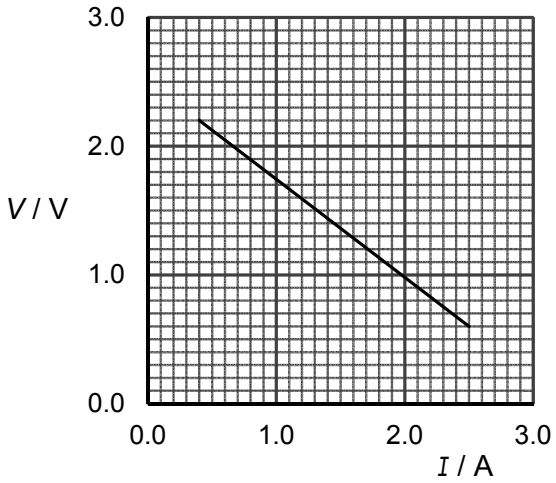
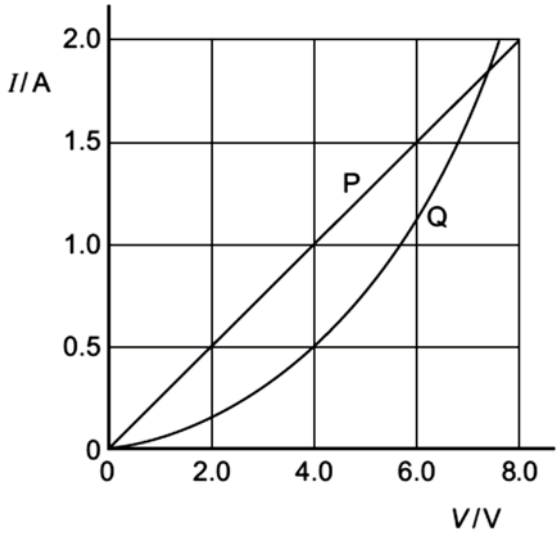


Fig. (b)

What is the e.m.f. and internal resistance of the battery?

	E / V	r / Ω
A	2.2	1.3
B	2.5	1.3
C	2.2	0.76
D	2.5	0.76

23 The I-V characteristics of two electrical components P and Q are shown below.



Which of the following statements is false?

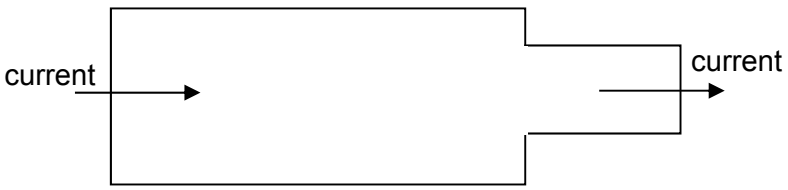
A Q could be a thermistor.

B The resistance of Q decreases as current increases.

C When the current is 1.9 A, the resistance of Q is approximately half that of P.

D When the current is 0.5 A, the power dissipated in Q is double that in P.

24 The figure shows the top view of a conducting copper strip of uniform thickness. The width of the narrow section is half the width of the wider section. An electrical current flows through the strip.



Which one of the following deductions is valid?

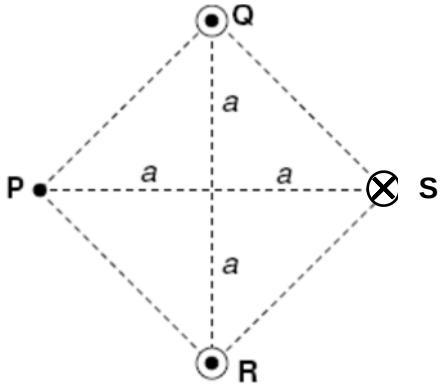
A The resistivity of the narrow section is greater than that of the wide section.

B The current in the narrow section is less than that in the wide section.

C The resistance of the narrow section is more than that of the wide section.

D The resistance per unit length of the narrow section is twice that of the wide section.

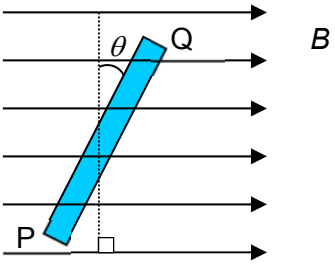
25 Three long, parallel conductors, Q, R and S carry currents of equal magnitude. The figure below shows the plan view of the conductors, whereby the current in S is opposite in direction to those in Q and R. The distance between P and S is 2*a*.



Which of the following shows the direction of the magnetic field at point P?

A zero field **B** ↑ **C** ↓ **D** →

26 A straight conductor PQ of length 0.50 m is placed in a magnetic flux density *B* of 150 mT as shown in the diagram.



What is the magnetic force on the conductor PQ if it carries a current of 5.0 A and θ is 15°?

A 0.097 N **B** 0.36 N **C** 97 N **D** 360 N

27 Fig. (a) shows a square coil CDEF of sides 0.25 m, lying in a vertical plane and carrying a current I of 2.0 A. The magnetic flux density B of 0.010 T is parallel to DE.

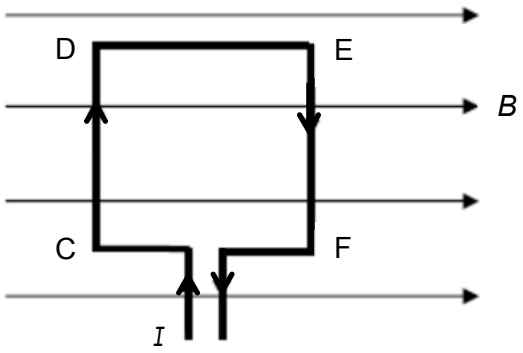


Fig. (a) side view

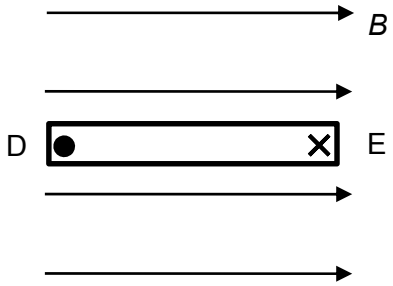


Fig. (b) top view

What is the magnitude of the torque and its direction when viewed from the top, as shown in Fig. (b)?

A 1.3×10^{-3} Nm, clockwise

B 1.3×10^{-3} Nm, anticlockwise

C 2.5×10^{-3} Nm, clockwise

D 2.5×10^{-3} Nm, anticlockwise

28 Which of the following observations from the photoelectric experiment does not provide evidence for the particulate nature of light?

A The existence of threshold frequency

B The emission of photoelectrons is instantaneous

C The photocurrent obtained is proportional to the intensity of light.

D Photoelectrons emitted from a metal have a range of velocities from zero up to a maximum v_{max}.

29 The equation $hf = \phi + \frac{1}{2}mv_{max}^2$ is used when studying the photoelectric effect. What is the meaning of each term in this equation?

	hf	ϕ	$\frac{1}{2}mv_{max}^2$
A	the energy of an incoming photon	the least energy required to release an electron	the maximum kinetic energy of a photoelectron
B	the energy of an incoming photoelectron	the work done by the incoming photoelectron	the maximum kinetic energy of the outgoing photoelectron
C	the energy of an incoming photoelectron	the least energy required to release an photon	the maximum kinetic energy of a photon
D	the energy of an incoming photon	the work done by the incoming photon	the maximum kinetic energy of the outgoing photon

30 What is a reasonable estimate, to one significant figure, of the energy of a photon of red light?

A 2 eV **B** 3 eV **C** 4 eV **D** 5 eV