



# RIVER VALLEY HIGH SCHOOL

## YEAR 6 PRELIMINARY EXAMINATION II

### H1 PHYSICS 8866

## PAPER 1

28 SEP 2015

1 HOUR

CANDIDATE  
NAME

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CENTRE  
NUMBER

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INDEX  
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CLASS

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#### INSTRUCTIONS TO CANDIDATES

**DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.**

**Read these notes carefully.**

Write your name, centre number, index number and class in the spaces at the top of this page.

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 shade your choice in **soft pencil** on the separate **Optical Answer Sheet**.

Hand in **only** the Optical Answer Sheet.

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This Question Paper consists of **14** printed pages.

## Data

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

## 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,	$p = \rho gh$
resistors in series,	$R = R_1 + R_2 + \dots$
resistors in parallel,	$1/R = 1/R_1 + 1/R_2 + \dots$

For each question, there are four possible answers, A, B, C and D. Choose the one you consider to be correct.

- 1 A cylindrical tube rolling down a slope of inclination  $\theta$  moves a distance  $L$  in time  $T$ . The equation relating these quantities is

$$L \left( 3 + \frac{a^2}{P} \right) = QT^2 \sin \theta$$

where  $a$  is the internal radius of the tube and  $P$  and  $Q$  are constants.

Which of the following gives the correct units for  $P$  and  $Q$ ?

	$P$	$Q$
A	m	$\text{m s}^{-2}$
B	$\text{m}^2$	$\text{m s}^{-2}$
C	$\text{m}^2$	$\text{m}^3 \text{s}^{-2}$
D	$\text{m}^2$	$\text{m}^2 \text{s}^{-2}$

- 2 For which quantity is the magnitude a reasonable estimate?

- A density of a metal  $500 \text{ g m}^{-3}$
- B frequency of a radio wave  $500 \text{ pHz}$
- C mass of an atom  $500 \text{ }\mu\text{g}$
- D wavelength of green light  $500 \text{ nm}$

- 3 A student determined the density of a spherical steel ball by measuring its mass and diameter. The mass and diameter were measured to an accuracy of 1% and 2% respectively. The student's error in the calculated density of the steel ball is at most

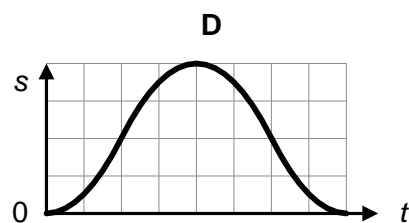
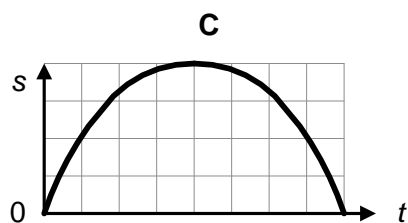
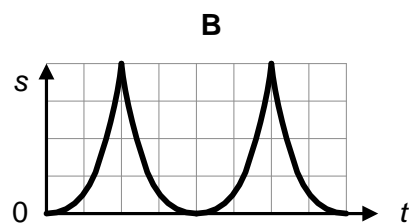
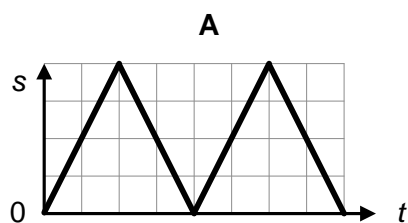
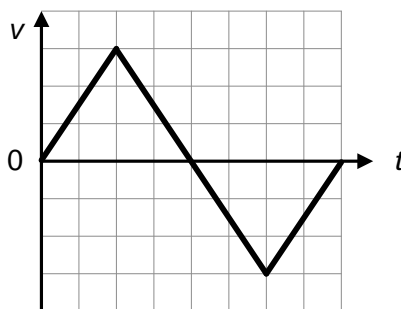
- A 3%
- B 4%
- C 5%
- D 7%

- 4 An artillery gun sited at the top of a cliff fires a shell horizontally to hit a target 2.0 km away from the bottom of the cliff.

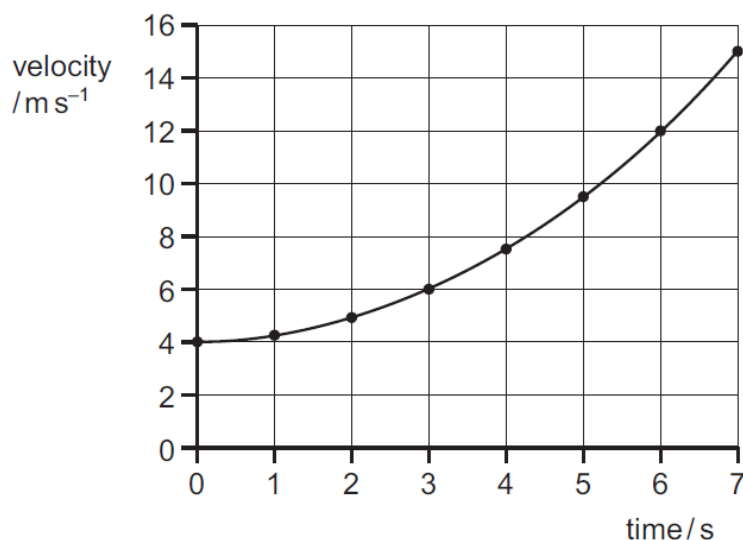
If the cliff is 180 m high, the initial velocity of the shell is

- A  $54 \text{ m s}^{-1}$
- B  $99 \text{ m s}^{-1}$
- C  $110 \text{ m s}^{-1}$
- D  $330 \text{ m s}^{-1}$

- 5 The figure below shows the variation of velocity  $v$  of a particle with time  $t$ . Which of the following graphs best represents the corresponding variation of its displacement  $s$  with time  $t$ ?



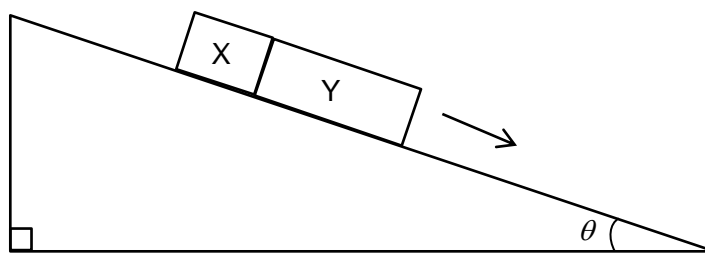
- 6 The diagram shows a velocity-time graph for a vehicle.



The vehicle, moving at  $4.0 \text{ m s}^{-1}$ , begins to accelerate at time = 0.  
What is the vehicle's acceleration at time = 6.0 s?

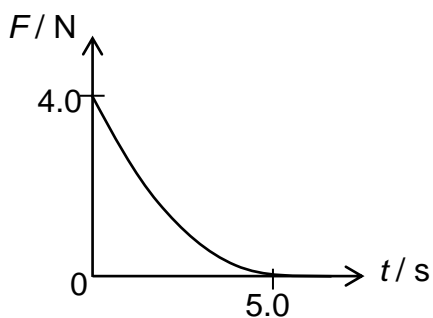
- A**  $0.50 \text{ m s}^{-2}$       **B**  $1.3 \text{ m s}^{-2}$       **C**  $2.0 \text{ m s}^{-2}$       **D**  $2.8 \text{ m s}^{-2}$

- 7 Two blocks X and Y of mass ratio 1:3 slide on a frictionless slope as shown below.



Given the mass of X is  $m$ , what is the magnitude of the force that Y exerts on X during the sliding?

- A 0
  - B  $0.33 \, mg \sin \theta$
  - C  $mg \sin \theta$
  - D  $3.0 \, mg \sin \theta$
- 8 The figure below shows the variation of the resultant force  $F$  acting on an object with time  $t$ .

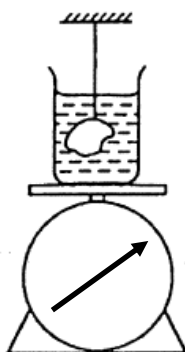


The object of mass 2.0 kg is initially at rest and its subsequent motion is along a straight line.

Which of the following statements is correct?

- A The final speed of the object is zero.
- B The object slows down during the first 5 seconds.
- C The maximum speed of the object is less than  $5 \, \text{m s}^{-1}$ .
- D The rate of change of momentum is largest at  $t = 5.0 \, \text{s}$ .

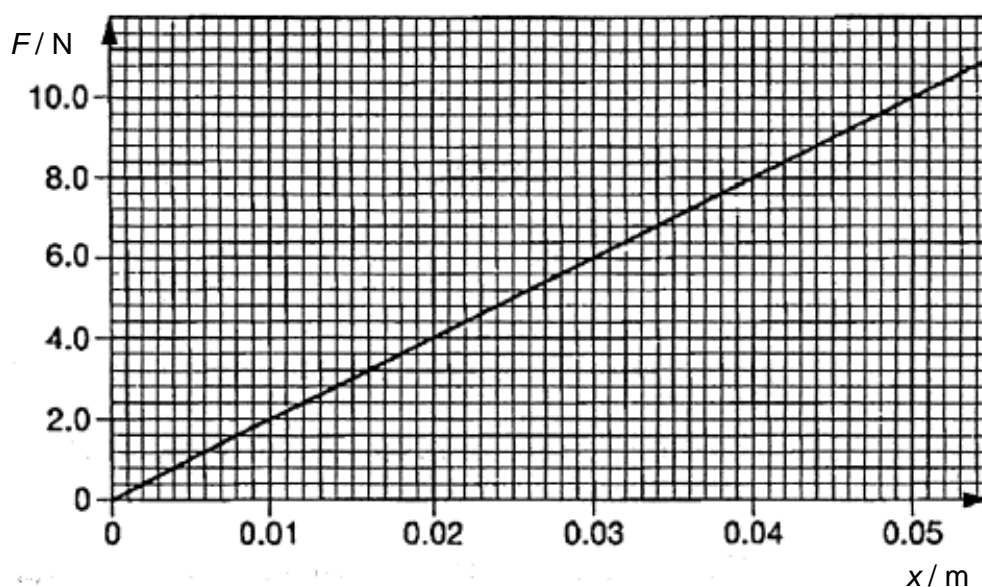
- 9 In perfectly elastic collisions between two atoms, it is always true to say that
- A the initial speed of one atom will be the same as the final speed of the other atom.
  - B whatever their initial states of motion, neither atom can be stationary after the collision.
  - C the total momentum must be conserved, but a small amount of the total kinetic energy may be lost in the collision.
  - D the relative speed of approach between the two atoms equals their relative speed of separation.
- 10 When a beaker of water is placed on a balance, the weight indicated is  $K$ . A solid object of weight  $L$  in air is placed into the beaker of water, displacing water amounting to a weight of  $M$ .



What will be the reading on the balance when the object is suspended and totally immersed into the beaker of water?

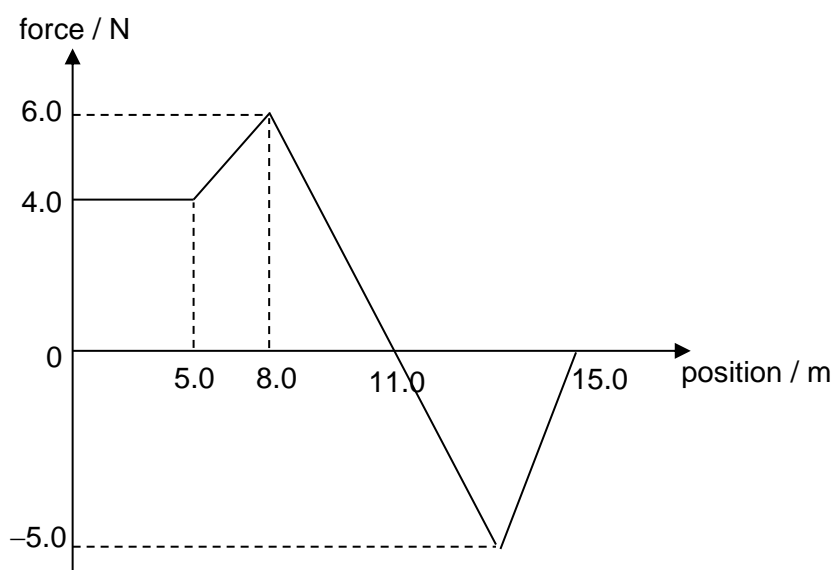
- A  $K + L$
  - B  $K + M$
  - C  $K + L - M$
  - D  $K + M - L$
- 11 Forces of 5 N, 12 N and 13 N act at one point on an object. The angles at which the forces act can vary.
- What is the value of the **minimum** resultant force of these forces?
- A 0
  - B between 1 and 4 N
  - C 4 N
  - D 6 N

- 12 The relationship between the load  $F$  and the extension  $x$  of a spring is given in the graph below. A mass of 600 g is placed on the spring.



What additional elastic potential energy is stored in the spring if it is extended for an additional 0.005 m?

- A 0.0025 J  
 B 0.015 J  
 C 0.032 J  
 D 0.119 J
- 13 An object is subjected to a varying force. The horizontal axis of the graph refers to the position of the object.



What is the net work done on the object by the varying force from position = 0 to 15.0 m?

- A 24 J                      B 34 J                      C 44 J                      D 54 J

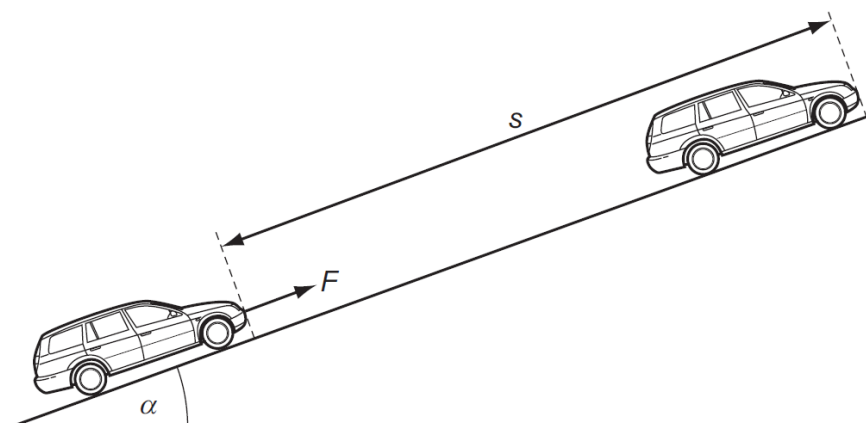


- 16 An ion is accelerated by a series of electrodes in a vacuum. A graph of the power supplied to the ion is plotted against time.

What is represented by the area under the graph between two times?

- A the average force on the ion
- B the change in velocity of the ion
- C the change in momentum of the ion
- D the change in kinetic energy of the ion

- 17 A constant force  $F$ , acting on a car of mass  $m$ , moves the car up the slope through a distance  $s$  at constant velocity  $v$ . The angle of the slope to the horizontal is  $\alpha$ .



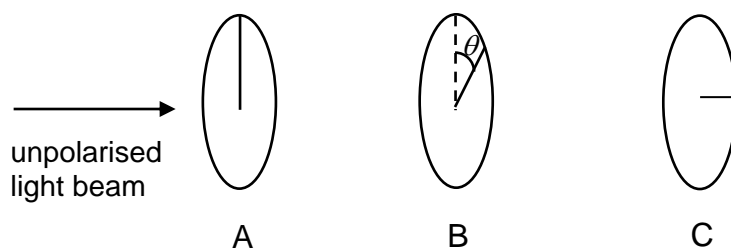
Which expression gives the efficiency of the process?

- A  $\frac{mv^2}{2Fs}$
  - B  $\frac{mv}{Fs}$
  - C  $\frac{mgsin\alpha}{F}$
  - D  $\frac{mgssin\alpha}{Fv}$
- 18  $S_1$  and  $S_2$  are two waves with equal wavelengths and amplitudes and they are travelling in the same direction.  $S_1$  is ahead of  $S_2$  and it has twice the speed of  $S_2$ . The two waves initially have a phase difference of  $2\pi$ .

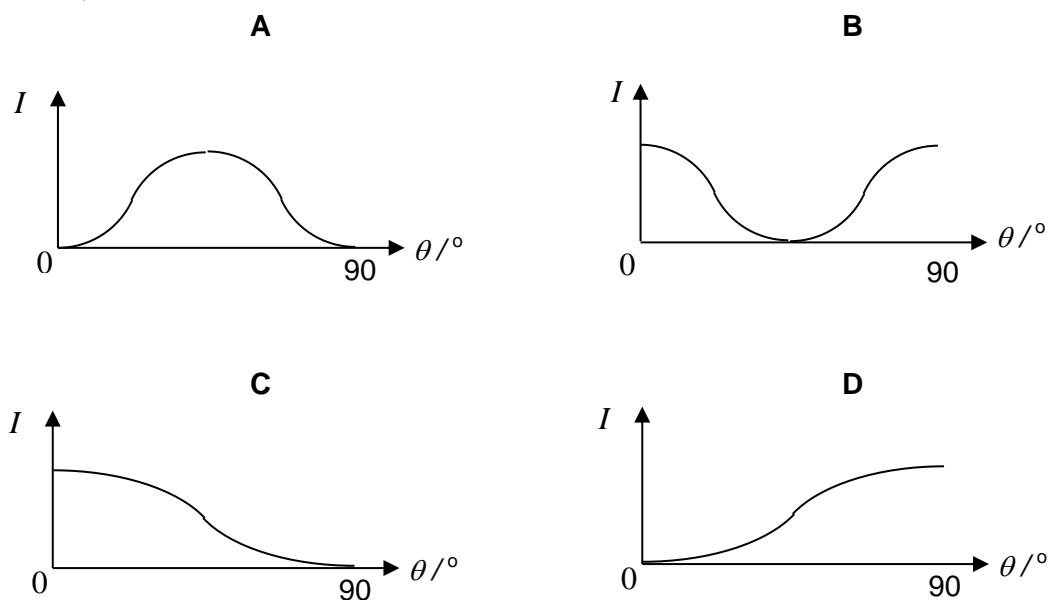
What will be their new phase difference after  $S_1$  has travelled a distance of half a wavelength?

- A  $\frac{\pi}{4}$
- B  $\frac{\pi}{2}$
- C  $\pi$
- D  $2\pi$

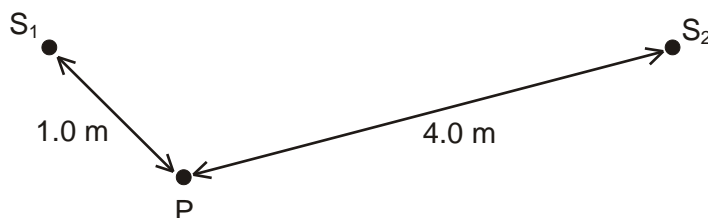
- 19 Three polarisers are placed close to one another as shown below. The direction of polarisation of polariser A is vertical, of B is at an angle of  $\theta$  from the vertical, and of C is horizontal. A light beam is shone at A, as shown.



Which of the following graphs shows how the intensity  $I$  of the emergent light beyond C will vary with  $\theta$ ?



- 20 Water waves of wavelength 2.0 m are produced by two coherent sources  $S_1$  and  $S_2$ . The sources vibrate in anti-phase.

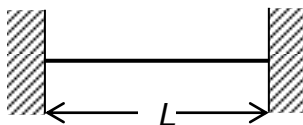


Point P is 1.0 m from  $S_1$  and 4.0 m from  $S_2$ .  $S_1$  and  $S_2$  each produces a wave of amplitude  $a$  and  $2a$  at P respectively.

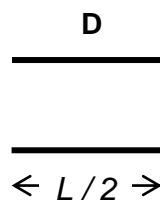
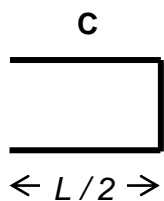
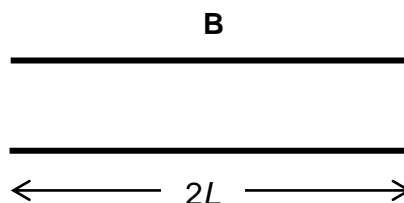
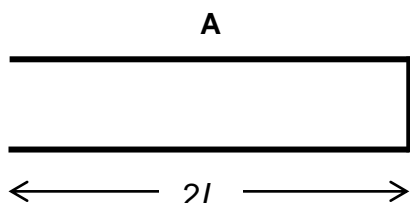
What is the amplitude of the resultant wave at point P due to  $S_1$  and  $S_2$ ?

- A zero                      B  $a$                       C  $3a$                       D  $9a$

- 21 The figure below shows a stretched string of length  $L$ . The tension in the string is adjusted until the speed of waves travelling in the string equals the speed of sound. The fundamental mode of oscillation is then set up on the string.



Which of the pipes, when placed near the string, would produce the fundamental note?

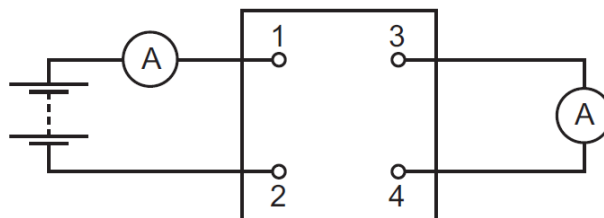


- 22 The terminal voltage of a battery is observed to fall when the battery supplies a current to an external resistor.

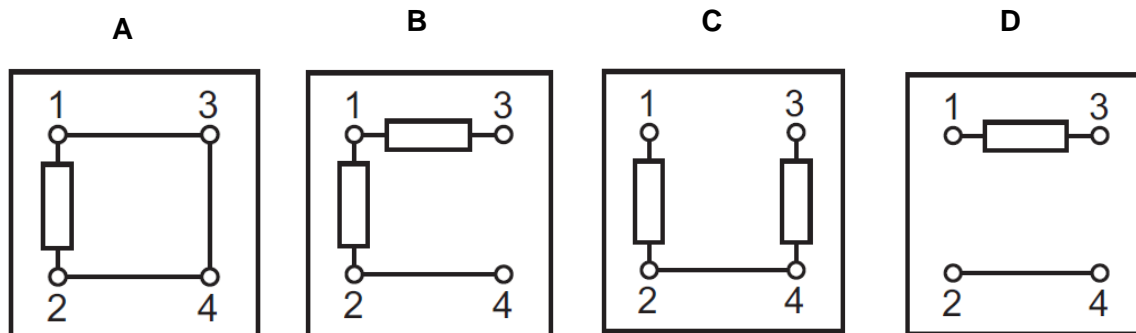
What quantities are needed to calculate the *fall* in voltage?

- A** the battery's e.m.f. and the current
  - B** the current and the external resistance
  - C** the battery's e.m.f. and its internal resistance
  - D** the current and the battery's internal resistance
- 23 A household electric lamp is rated as 240 V, 60 W.
- What is the power dissipated in the lamp when it is connected to a 12 V battery?
- A** 0.15 W
  - B** 3.0 W
  - C** 60 W
  - D** No power is dissipated as 12 V is negligible compared to 240 V.

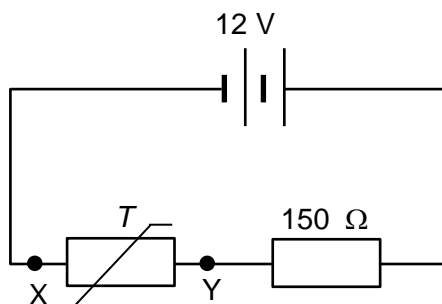
- 24 The diagram shows a four-terminal box connected to a battery and two ammeters.



The currents in the two meters are identical.  
Which circuit, within the box, will give this result?



- 25 In a fire alarm system, a thermistor  $T$  is connected in series with a  $150\ \Omega$  resistor as shown in the circuit below. The alarm is triggered when the potential difference between X and Y reaches  $7.5\text{ V}$ .



What is the resistance of the thermistor when the alarm is triggered?

- A**  $90\ \Omega$       **B**  $150\ \Omega$       **C**  $250\ \Omega$       **D**  $1300\ \Omega$

- 26 Fig. 29.1 and Fig. 29.2 show a fixed resistor  $R$  and a light-dependent resistor (LDR) connected in series and in parallel respectively to a constant voltage supply  $E$ .

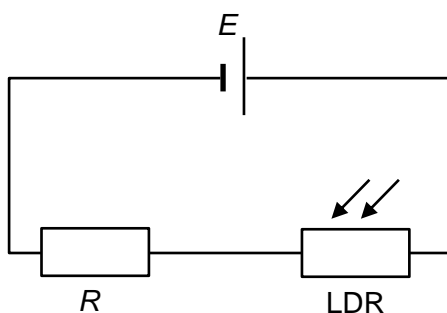


Fig. 29.1

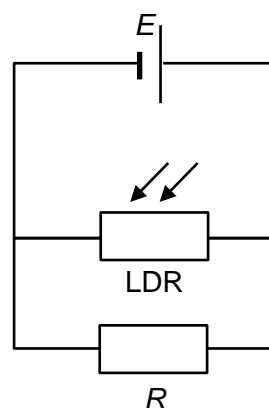
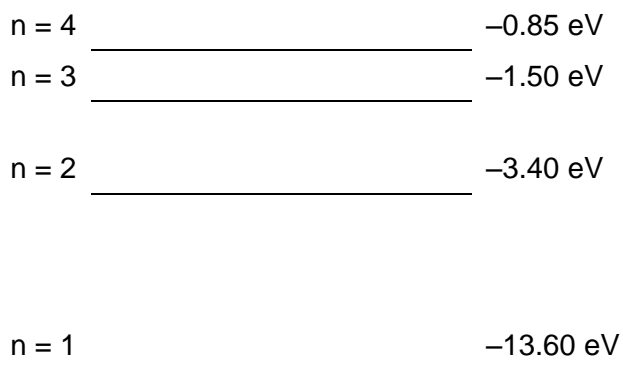


Fig. 29.2

What happens to the potential difference across  $R$  when the LDR is illuminated with bright light in both circuits?

- |   | Fig. 29.1 | Fig. 29.2 |
|---|-----------|-----------|
| A | decrease  | no change |
| B | increase  | decrease  |
| C | no change | decrease  |
| D | increase  | no change |
- 27 An electron is moving at the speed of  $10 \text{ km s}^{-1}$  along the axis of a solenoid carrying a current. The magnetic flux density along the axis of the solenoid is  $2.0 \text{ mT}$ . What is the magnetic force acting on the electron?
- A  $3.2 \times 10^{-21} \text{ N}$   
B  $3.2 \times 10^{-18} \text{ N}$   
C  $3.2 \times 10^{-15} \text{ N}$   
D None of the above.
- 28 Two parallel conductors carry equal sinusoidal alternating currents differing in phase by  $\pi$  rad. Which one of the following statements is correct?
- A There is a constant repulsive force between the two conductors.  
B There is a constant attractive force between the two conductors.  
C There is a repulsive force between the two conductors which varies in strength as the currents changes direction.  
D The force between the two conductors alternates between an attractive and repulsive force as the currents changes direction.

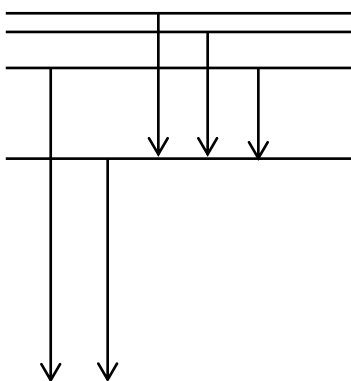
- 29 The figure below (not to scale) shows part of an energy level diagram for a hydrogen atom.



The  $n = 1$  level is the ground state of the atom.

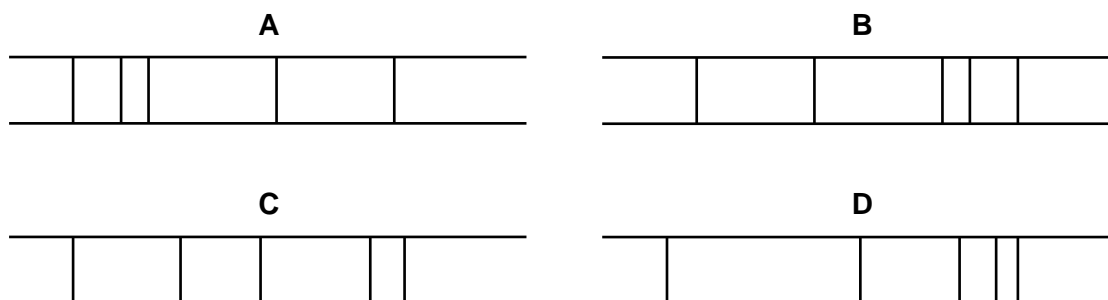
Based on this energy level diagram, what is the shortest wavelength of line spectra which could be emitted from the atom?

- A** 91.4 nm                      **B** 97.5 nm                      **C** 1.46  $\mu\text{m}$                       **D** 1.91  $\mu\text{m}$
- 30 The figure below represents some of the allowed energy levels within the hydrogen atom. Five transitions between the levels are shown.



In the spectra below, the frequency scale is linear and increases to the right.

Which spectrum best corresponds to the five transitions between the levels shown above?



**END OF PAPER**