A Methodist Institution
(Founded 1886)

Anglo-Chinese Junior College

Physics Preliminary Examination
Higher 1

CANDIDATE NAME		CLASS	
CENTRE NUMBER		INDEX NUMBER	

PHYSICS **8866/01**

Paper 1 Multiple Choice 2 Sep 2009

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your Name and Index number in the answer sheet provided.

There are **30** 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 circle your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer sheet very carefully.

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 Question Paper.

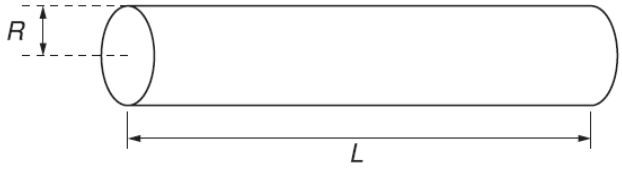
Data

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	=	$\rho g h$
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$

1 A cylinder of length L has a circular cross-section of radius R.



The volume V of the cylinder is given by the expression $V=\pi R^2 L$
The volume and length of the cylinder are measured as
$V = (15.0 \pm 0.5)\ cm^3$ and $L = (20.0 \pm 0.1)$ cm respectively.

The absolute uncertainty associated with the radius, R is

A ±0.007 cm **B** ±0.009 cm **C** ±0.014 cm **D** ±0.019 cm

2 Which one of the following experimental techniques reduces the systematic error of the quantity being investigated?

A Measuring several inter-nodal distances on a standing wave to find the mean inter-nodal distance.
B Measuring the diameter of a wire repeatedly and calculating the average.
C Adjusting an ammeter to remove its zero error before measuring a current.
D Plotting a series of voltage and current readings for an ohmic device on a graph and using its gradient to find resistance.

3 A body, X is acted on by two forces, P and Q. The direction of the forces P and Q acting on X are as shown in the vector diagram in Fig 3.

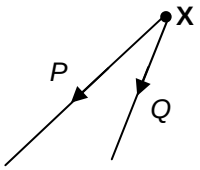
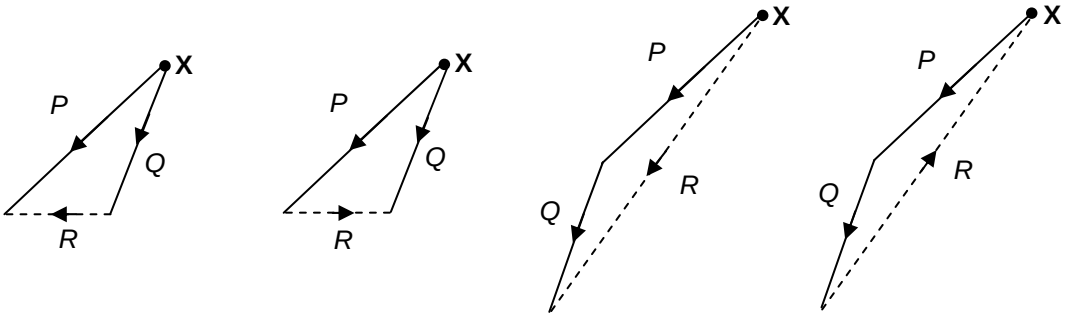


Fig 3

Resultant force R is the sum of force P and force Q. Which of the following vector diagram shows the correct diagram for resultant force R?



A **B** **C** **D**

4 Fig 4 shows the variation of the velocity, v of a body with respect to time, t.

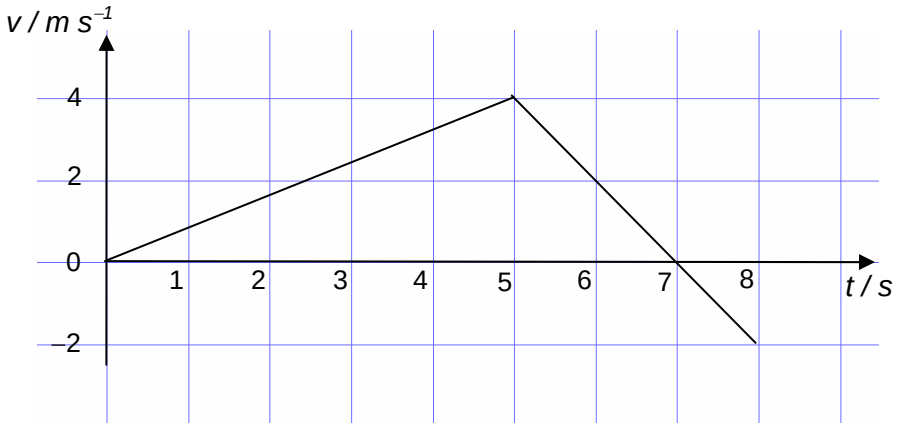


Fig 4

The displacement of the body from t = 0 s to t = 8 s is

A 13.0 m **B** 14.0 m **C** 15.0 m **D** 19.0 m

5 Fig 5 is a graph of variation of velocity, v of a body with respect to time, t.

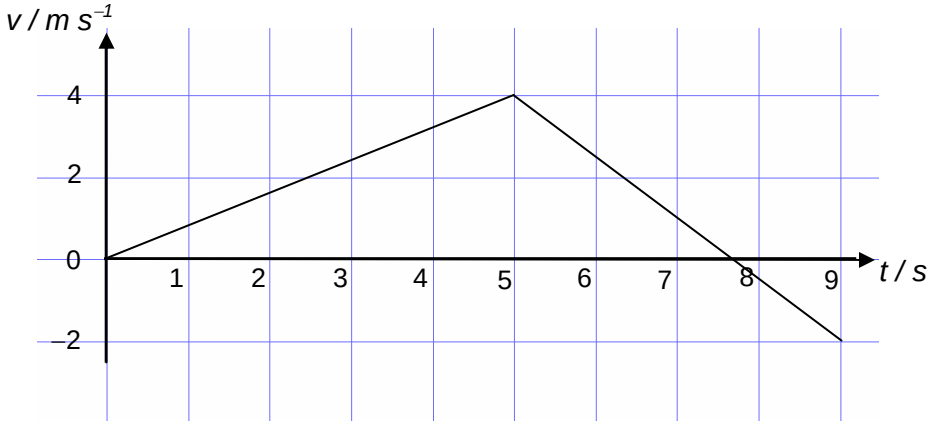


Fig 5

The acceleration of the body from t = 5 s to t = 9 s is

A –1.5 m s^{-2} **B** –0.7 m s^{-2} **C** 0.7 m s^{-2} **D** 1.5 m s^{-2}

6 A motor-cycle taking off horizontally from a platform 1.25 m above the ground and landing 10 m away as shown in Fig 6.

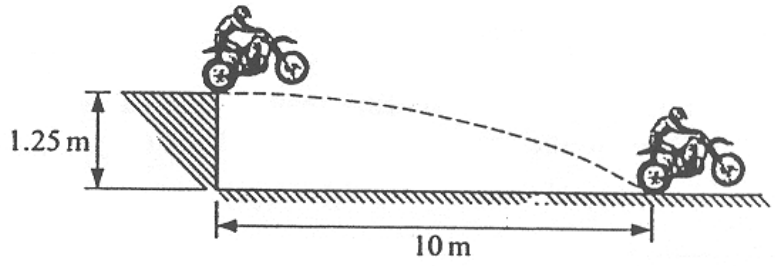


Fig 6

The take-off speed is

A 5 m s^{-1} **B** 10 m s^{-1} **C** 15 m s^{-1} **D** 20 m s^{-1}

7 Which of the following situation causes the small steel ball to achieve constant velocity in the shortest time?

A Steel ball is released from rest in a water column that is 1 m high.
B Steel ball is released from rest at a height of a few centimeters above the water column that is 1 m in height.
C Steel ball is released from rest in an oil column that is 1 m high.
D Steel ball is released from rest at a height of a few centimeters above the oil column that is 1 m in height.

8 A driver whose reaction time is 0.9 s is driving a car at a speed of 22 m s^{-1}. If the maximum deceleration which the brakes can apply to the car is 5.0 m s^{-2}, the distance that the car has moved from the point when the driver sees a danger to the point the car stops is

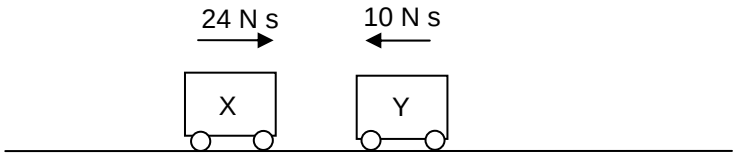
A 68.2 m **B** 48.4 m **C** 28.6 m **D** 17.8 m

9 When a mass of 4 kg is acted upon by a force of 8 N over a time of 4 s, its rate of change of momentum is

A 2 kg m s^{-2} **B** 4 kg m s^{-2} **C** 8 kg m s^{-2} **D** 16 kg m s^{-2}

10 Fig 10 shows that momentum of two trolleys, X and Y, just before they collide. The collision reverses the direction of motion of both trolleys. Just after the collision, the momentum of X is 4 N s.

Fig 10



The magnitude of the corresponding momentum of Y is

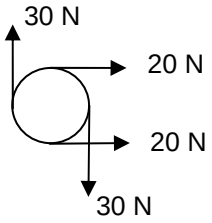
A 10 N s **B** 18 N s **C** 30 N s **D** 38 N s

11 What is the power required to give a body of mass m a forward acceleration a when it is moving with velocity v up a frictionless track inclined at an angle θ to the horizontal.

A $mavg \sin\theta$
B $(mav \sin\theta) + mgv$
C $mav + (mgv \sin\theta)$
D $(mav + mgv) \sin\theta$

12 Four forces are applied to a circular object, as shown in Fig 12.

Fig 12

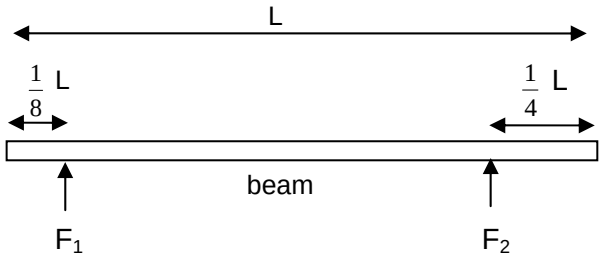


Which line in the table correctly describes the resultant force and resultant torque on the object?

	Resultant force	Resultant torque
A	zero	zero
B	non-zero	non-zero
C	non-zero	zero
D	zero	non-zero

13 Fig 13 shows a uniform beam of length L supported by two forces F_1 and F_2 at points of distance $\frac{1}{8}$ L and $\frac{1}{4}$ L from its ends.

Fig 13



The ratio F_1 **:** F_2 is

A 2 **:** 3 **B** 2 **:** 5 **C** 3 **:** 2 **D** 3 **:** 5

14 A boat moving at constant speed v through still water experiences a total frictional drag F. What is the power developed by the boat?

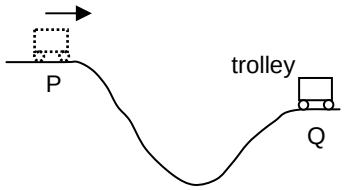
A $\frac{1}{2}Fv$ **B** Fv **C** $\frac{1}{2}Fv^2$ **D** Fv^2

15 A 10 kW motor is used to drive a pump to raise 4.0 kg of water through a height of 15 m in 0.7 s. The efficiency of the system is

A 5.9 % **B** 8.4 % **C** 41 % **D** 18 %

16 A trolley moved along a track from P to Q, as shown in Fig 16. The trolley has a kinetic energy of 5 kJ at P. Its potential energy at Q is 40 kJ less than at P. The work it does against friction from P to Q is 10 kJ.

Fig 16

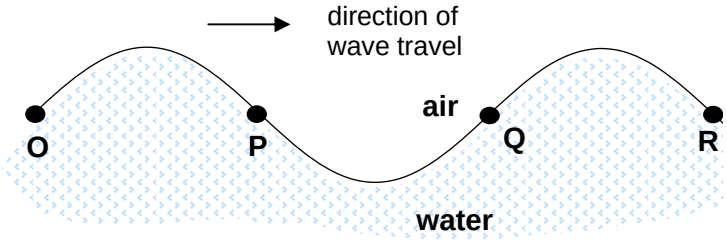


The kinetic energy of the trolley at Q is

A 25 kJ **B** 35 kJ **C** 45 kJ **D** 55 kJ

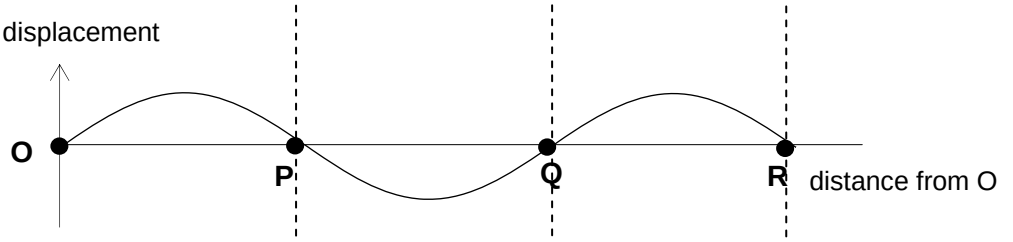
17 The wave profile of a surface wave on water at a particular instant is shown in Fig 17.

Fig 17

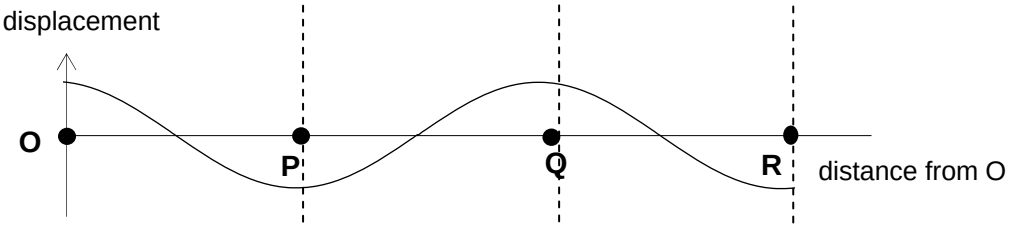


Which one of the graphs below best represents the displacement of the water molecules a quarter period later, taking upward displacement as positive?

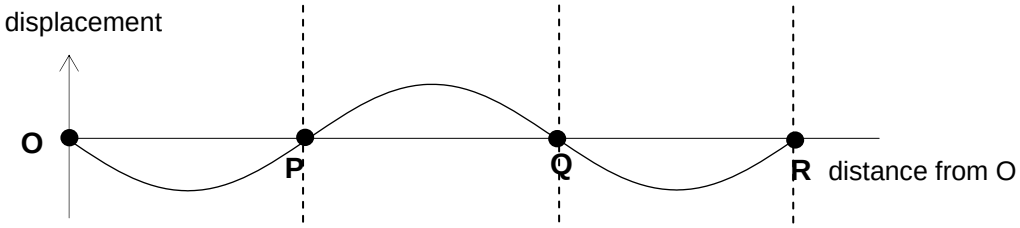
A



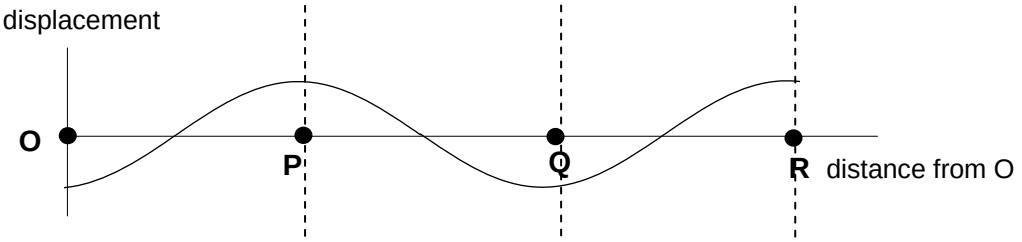
B



C



D



18 A point source of intensity I_1 has wave amplitude *A* at a distance *r* from the source. Another point source of intensity I_2 has wave amplitude *A* at a distance 2*r* from the source.

What is the ratio of $\frac{I_1}{I_2}$?

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

19 In Fig 19 below, P, Q, R, S, T, U, V are the respective mean positions of the air molecules at various distances from the source O. The graph shows the displacements of those air molecules at P, Q, R, S, T, U, V from their respective mean positions in a longitudinal progressive wave at a particular instant of time. The wave is moving towards the right and the displacement to the right is taken to be positive.

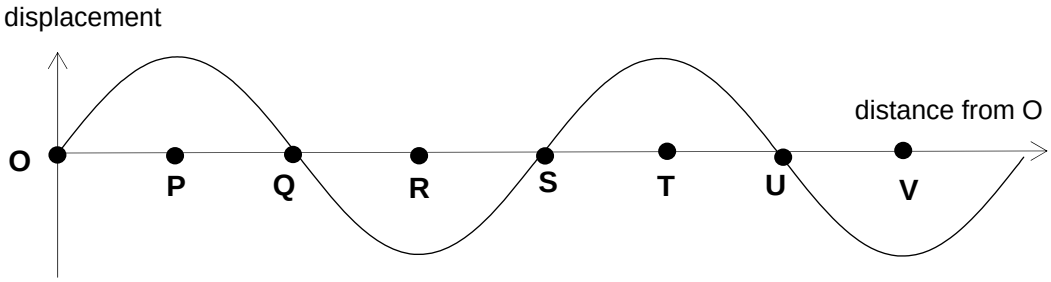


Fig 19

Which one of the following statements is correct?

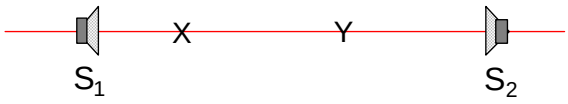
At the instant shown above,

A points marked **P**, **R**, **T** and **V** are rarefactions.
B points marked **Q**, **S** and **U** are compressions.
C points marked **Q** and **U** are rarefactions and the point **S** is a compression.
D points marked **Q** and **U** are compressions and the point **S** is a rarefaction.

20 Visible light has wavelengths between 400 nm and 700 nm, and its speed in a vacuum is 3.0×10^8 m s^{-1}. What is the maximum frequency of visible light?

A 1.2×10^{11} Hz **B** 4.3×10^{11} Hz **C** 4.3×10^{14} Hz **D** 7.5×10^{14} Hz

21 Two sources S_1 and S_2 generate microwaves of similar frequency and amplitude.



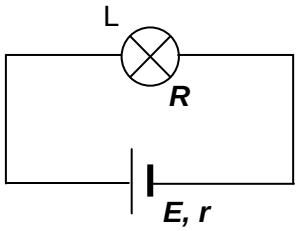
The waves travel from opposite directions towards each other and at location X, a maximum intensity is detected. However, at Y, a distance of 31.5 cm from X, a minimum intensity is observed. Between X and Y, ten maxima and ten minima are detected.
The frequency of the waves is

A 2.4×10^8 Hz **B** 4.8×10^9 Hz **C** 5.0×10^9 Hz **D** 9.5×10^9 Hz

22 When the light from two lamps falls on a screen, no interference pattern can be obtained. Why is this?

A The lamps are not point sources.
B The lamps emit light of different amplitudes.
C The light from the lamps is not coherent.
D The light from the lamps is white.

23 The filament lamp L is connected to a battery of e.m.f. *E* and internal resistance *r*. The lamp has a resistance *R* when working. What fraction of the power supplied by the battery goes to the lamp?



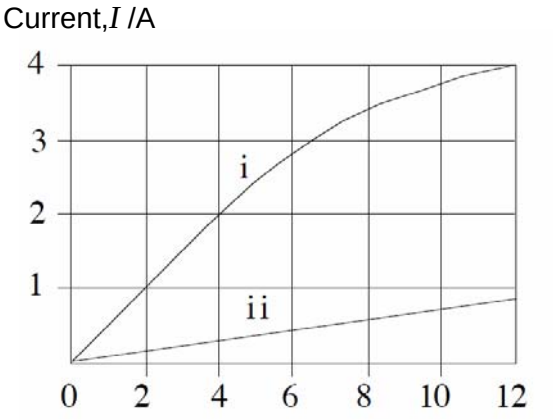
A $\frac{R}{r}$ **B** $\frac{R+r}{r}$ **C** $\frac{R}{R+r}$ **D** $\frac{R^2}{(R+r)^2}$

24 A 10.0 cm long cylinder with a cross-sectional area of 2.00×10^{-4} m^2 has a resistance of is 1.41×10^{-5} Ω.
The most likely resistivity and material of the cylinder is

	Resistivity / 10^{-8} Ω m	Material
A	1.59	Silver
B	1.70	Copper
C	2.44	Gold
D	2.82	Aluminium

25 Fig 25 shows how the current, I varies with applied potential difference, V across
(i) a 12 V, 36 W filament lamp, and
(ii) a metre length of nichrome wire of cross section 0.08 mm^2 .

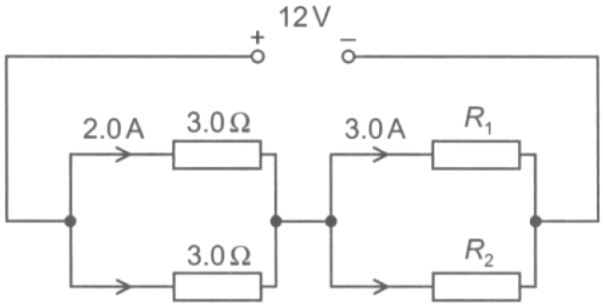
Fig 25



Which of the following best shows the ratio of the values of the electrical resistance of the filament lamp to that of the nichrome wire when the potential difference across them is 12 V?

A 0.2 **B** 0.5 **C** 2.0 **D** 5.0

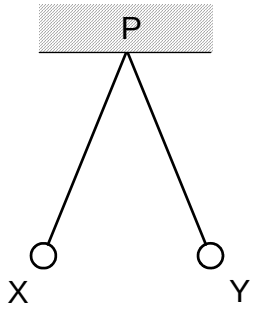
26 A circuit containing four resistors is connected across a 12 V supply as shown.



What are the resistances R_1 and R_2?

	R_1 / Ω	R_2 / Ω
A	1.5	4.5
B	2.0	2.0
C	2.0	6.0
D	4.5	4.5

27 Two light and straight conductors, X and Y, of equal mass and length, are held parallel to each other by threads suspending from a rigid support P in a uniform magnetic field. With currents of equal magnitude flowing through the conductors, Fig 27 shows the end view of the two horizontal conductors in equilibrium.



If the current through X is directed out of this page, which one of the following pairs gives the correct information of the magnetic field and the current through Y?

	Magnetic field is	***Current in Y is***
A	in opposite direction to the conductors' weight.	in opposite direction to that in X.
B	in the same direction as the conductors' weight.	in the same direction as that in X.
C	right angle to the current and conductors' weight	directed into this page.
D	parallel to the thread PY.	directed out of this page.

28 A metal surface in an evacuated tube is illuminated with monochromatic light causing the emission of photoelectrons which are collected at an adjacent electrode.

If the experiment were to be repeated with light of double the intensity but the same wavelength, how would the photocurrent I and stopping potential V be affected?

A I doubled, V halved
B I halved, V unchanged
C I doubled, V unchanged
D I doubled, V doubled

29 Arrange the following in the order of increasing wavelengths:

1. An electron moving through a potential difference of 60.0 V
2. A proton with a kinetic energy of 500 eV
3. An electron moving with a speed of 10^5 m s^{-1}
4. A photon with an energy of 3.0 eV

A 4, 3, 2, 1
B 4, 1, 2, 3
C 2, 3, 1, 4
D 2, 1, 3, 4

30 A spectral lines detector is set up to observe the spectrum produced by the sodium lamp as shown in Fig 30.1.
A container of Gas Q is placed in its path. The energy levels of the lowest states of sodium and Gas Q are shown in Fig 30.2 and Fig 30.3 respectively.

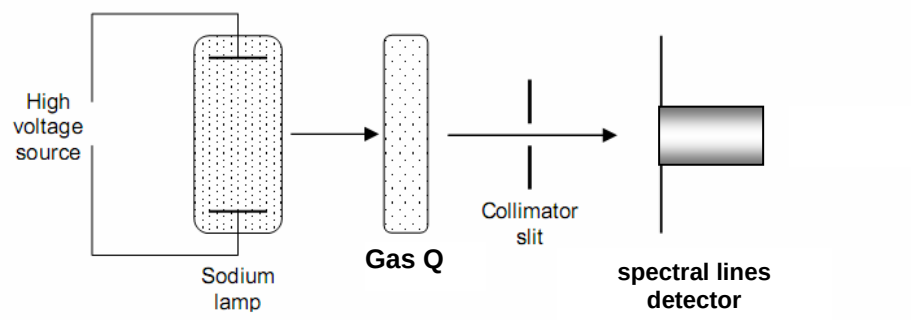


Fig. 30.1

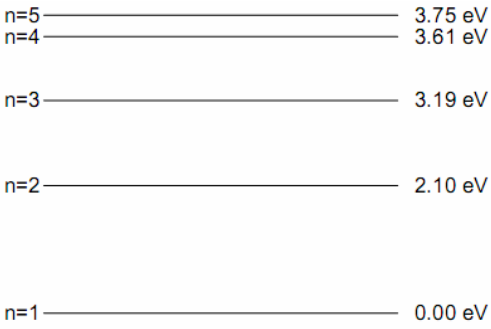


Fig. 30.2 Sodium atom

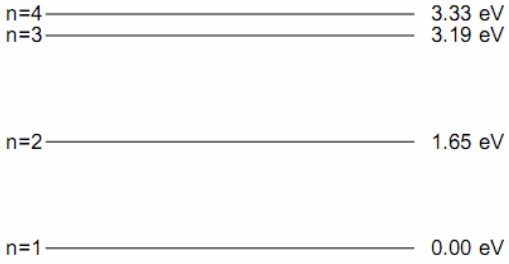


Fig. 30.3 Gas Q

The number of different spectral lines likely to be detected is

A 4 spectral lines
B 8 spectral lines
C 9 spectral lines
D 10 spectral lines

End of Paper