H

TAMPINES JUNIOR COLLEGE

PRELIMINARY EXAMINATIONS

Higher 1

PHYSICS 8866/01

Paper 1 Multiple Choice **Friday, 11 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 on the Answer Sheet in the spaces provided.

There are **thirty** questions on this paper. Answer **all** questions.
For each question there are four possible answers **A**, **B**, **C** and **D**.

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.

Data

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

A kg m s^{-1} **B** kg m^2 s^{-1} **C** kg m^2 s^{-2} **D** kg m^2 s^{-3}

2 Which estimate is realistic?

A The kinetic energy of a bus traveling on an expressway is 30 000 J.

B The power of a domestic light is 300 W.

C The temperature of a hot oven is 300 K.

D The volume of air in a car tyre is 0.03 m^3.

3 Argon and neon are monatomic gases. One mole of argon has mass 40 g and one mole of neon has mass 20 g.

What is the ratio $\frac{\text{number of atoms in 1 mole of argon}}{\text{number o fatoms in 1 mole of neon}}$?

A always 1

B always 2

C 1, only if both gases occupy the same volume

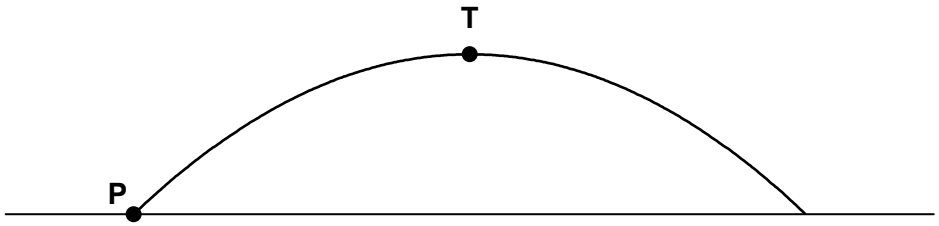
D 2, only if both gases occupy the same volume

4 The mass of an object is measured at the beginning and at the end of an experiment. The initial mass is found to be 64.0 ± 0.2 g and the final mass 52.4 ± 0.1 g.

What is the maximum percentage error in the loss of mass from these readings?

A 0.1% **B** 0.5% **C** 0.9% **D** 2.6%

5 In the absence of air resistance, a stone is thrown from **P** and follows a parabolic path in which the highest point reached is **T**.



The vertical component of acceleration of the stone is

A zero at **T**.

B greatest at **T**.

C greatest at **P**.

D the same at **P** as at **T**.

6 In Fig 6.1, object A is projected vertically upward at a speed *u* while object B is released from rest and falls vertically below to a depth of *y*. Fig 6.2 shows the velocity time graph of both objects. When the objects hit the ground, they rebound vertically upwards. Assume that the collisions between the objects and ground are perfectly elastic.

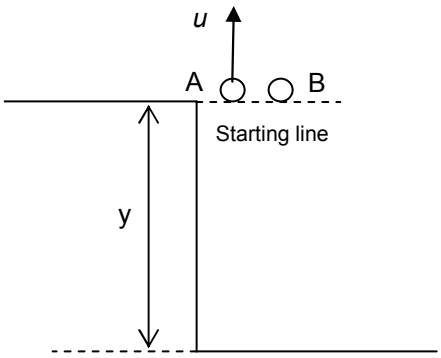


Fig 6.1

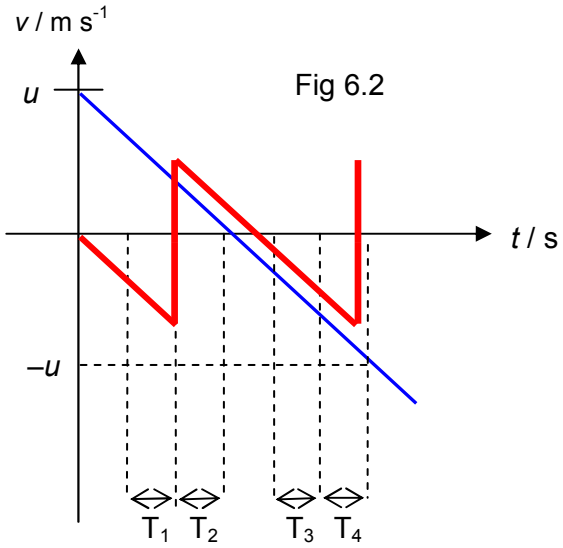


Fig 6.2

Which is the **first** time interval and direction where the two objects will be seen travelling in the same direction?

	Time Interval	*Direction of travel*
A	T_1	Upwards
B	T_2	Upwards
C	T_3	Downwards
D	T_4	Downwards

7 A bullet projected at a horizontal speed of 78.0 m s^{-1} hits a wall 20.0 m away. The impact creates a depression in the wall up to a maximum horizontal depth of 15.0 mm. Assume that air resistance and gravitational acceleration are negligible.

What is the average deceleration of the bullet when it hits the wall?

A 1.17×10^3 m s^{-2}

B 5.20×10^3 m s^{-2}

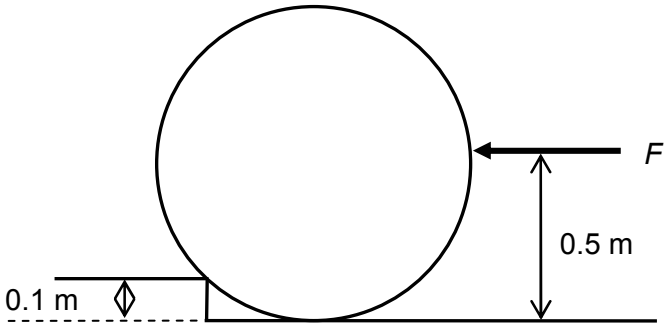
C 2.34×10^4 m s^{-2}

D 2.03×10^5 m s^{-2}

8 A car is travelling at a speed of 15 m s^{-1} and can be brought to rest with a uniform deceleration in a minimum time of 1.2 s if the brakes are applied. The reaction time of the driver is 0.1 s. If a stationary obstructing object is suddenly spotted by the driver, what is the minimum distance from the object if a collision is to be avoided?

A 9.00 m **B** 10.5 m **C** 12.0 m **D** 19.5 m

9 A horizontal force *F* is applied to a cylinder weighing 100 N as shown below.



Given that the radius of the cylinder is 0.5 m, what is the smallest value of *F* to cause the cylinder to roll up the step?

A 25 N **B** 60 N **C** 75 N **D** 100 N

10 The weight of an object indicated on a weighing scale is 100 N when in a stationary lift but becomes 80 N when the lift is moving. Which of the following situations is possible?

A The lift is moving upwards and slowing down.

B The lift is moving at a constant but high velocity.

C The lift is moving downwards and slowing down.

D The lift is moving upwards and speeding up.

11 A 70 kg man slipped and fell from a raised platform 0.50 m above the ground onto concrete ground while watching an outdoor performance. In a fluster, he somehow forgot to bend his knees while landing. What was the average force that the jump had on his bone structure if he took 15 ms to come to a complete stop after landing (assuming his velocity at the window ledge is zero)?

A 14.6 N

B 45.7 N

C 14.6×10^3 N

D 45.7×10^3 N

12 Two students, Sam and Pete, both wearing ice skates and initially at rest, push each other apart on a smooth icy surface. Given that Pete is more massive than Sam, upon pushing each other apart Pete will attain

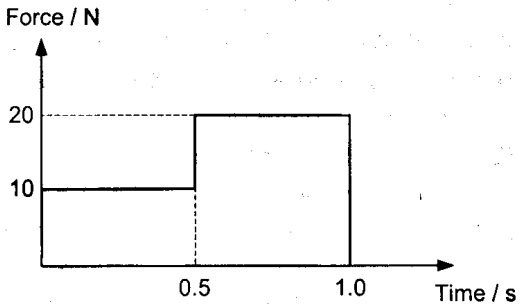
A less kinetic energy than Sam

B more kinetic energy than Sam

C less momentum than Sam

D more momentum than Sam

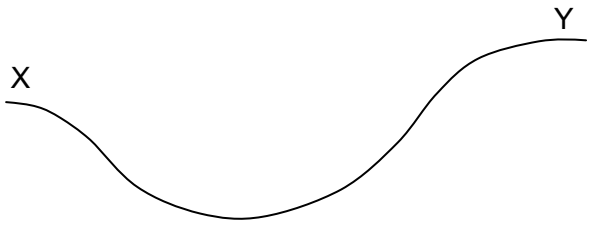
13 A 2.0 kg object is initially moving at a speed of *5*.0 m s^{-1} *on a frictionless horizontal* surface. A force as indicated in the graph is applied on the object in the direction of travel.



After one second, the speed of the object is

A 7.5 m s^{-1} **B** 10 m s^{-1} **C** 12.5 m s^{-1} **D** 15 m s^{-1}

14 A body moves from X to Y along a track. Its kinetic energy at Y is 25 J, and its potential energy is 30 J more than at X. If the work done by friction on the body along XY is −10 J, what is the original kinetic energy of the body at X?



A 35 J **B** 45 J **C** 55 J **D** 65 J

15 A motor draws 400 W of power from an electrical socket to raise a block of weight 120 N. If the block moves 8.0 m vertically in 4.0 s at constant speed, the efficiency of the motor is

A 60% **B** 48 % **C** 30% **D** 24%

16 The diagram below represents a longitudinal wave travelling from the left to the right at a frequency of 100 Hz. Two particles in the medium are labelled X and Y.
If the distance between X and Y is 100 m, what is the speed of the wave in the medium?

A 2000 ms^{-1} **B** 2222 ms^{-1} **C** 3333 ms^{-1} **D** 4000 ms^{-1}

17 A sound wave of frequency 370 Hz is traveling in a gas at a speed of 333 m s^{-1}.
What is the phase difference between two points 2.9 m apart in the direction of travel?

A 40° **B** 60° **C** 80° **D** 160°

18 A plane wave of amplitude A is incident on a surface of area S placed so that it is perpendicular to the direction of travel of the wave. The energy per unit time intercepted by the surface is E.

The amplitude of the wave is increased to $2A$ and the area of the surface is reduced to $S/2$.

How much energy per unit time is intercepted by this smaller surface?

A $4E$ **B** $2E$ **C** E **D** $E/2$

19 A pillar in a concert hall can block the view of the audience but it has little effect on their hearing. This is because

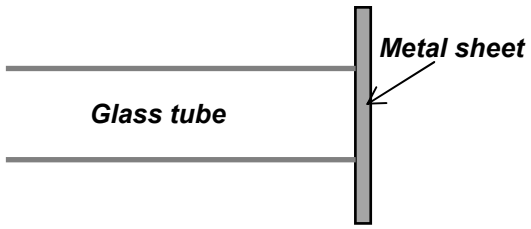
A sound waves have a much longer wavelength than light waves.

B sound waves are longitudinal whereas light waves are transverse.

C sound travels at a much slower speed than light.

D sound is a pressure wave whereas light is an electromagnetic wave.

20 A cylindrical glass tube with both ends open is closed at one end by covering it with a thick metal sheet as shown below. The fundamental resonant frequency is found to be 280 Hz.



If the metal sheet is now removed, what is the new fundamental frequency of the resulting open tube?

A 140 Hz **B** 280 Hz **C** 420 Hz **D** 560 Hz

21 The material of a wire has resistivity $1.72 \times 10^{-8}\ \Omega$ m. The wire has a diameter of 1.50 mm and its length is just enough to be wound tightly round an insulating rod 25 times. The circumference of the insulating rod is 30.0 cm.

What is the resistance of the wire?

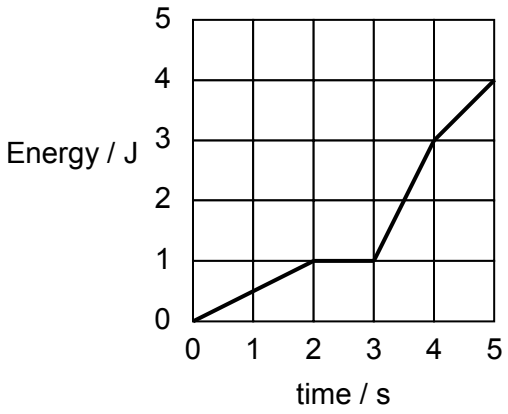
A $1.8 \times 10^{-2}\ \Omega$ **B** $7.3 \times 10^{-2}\ \Omega$ **C** $1.8 \times 10^{-6}\ \Omega$ **D** $7.3 \times 10^{-6}\ \Omega$

22 A battery of e.m.f. 12.0 V and internal resistance of 0.20 Ω is connected to two parallel resistors. The two resistors have the same resistance of 8.0 Ω.

Calculate the power loss in the battery.

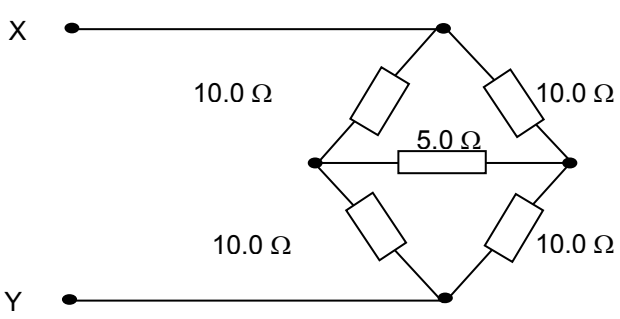
A 0.11 W **B** 1.6 W **C** 33 W **D** 130 W

23 A potential difference of 6.0 V is maintained across a light-dependent resistor (LDR). The total energy dissipated in the LDR during the first 5 seconds is as shown in the graph. What is the resistance value of the LDR at the peak power dissipation during these first 5 seconds?



A 18 Ω **B** 48 Ω **C** 72 Ω **D** 108 Ω

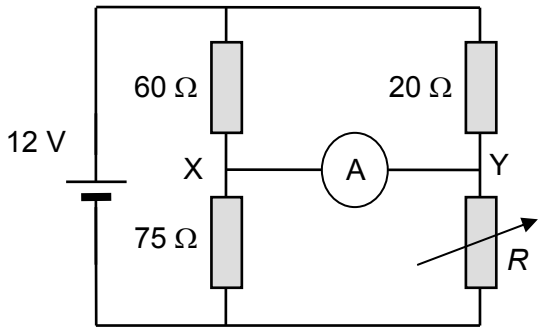
24



The five resistors in the diagram above can be replaced by a single resistor between terminals X and Y of value

A 5.0 Ω **B** 10 Ω **C** 20 Ω **D** 35 Ω

25 In the diagram below, what is the value of the variable resistor *R* which will result in no current flowing between point X and Y.



A 25 Ω **B** 36 Ω **C** 45 Ω **D** 115 Ω

26 An electron is moving along the axis of a solenoid carrying a current.
Which of the following is a correct statement about the electromagnetic force acting on the electron?

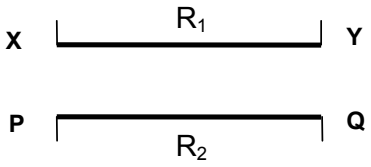
A The force acts radially inwards.

B The force acts radially outwards.

C The force acts in the direction of motion.

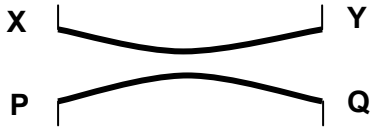
D No force acts.

27 Two identical, flexible conducting ribbons R_1 and R_2 are connected to junctions X and Y, and junctions P and Q, respectively. Direct currents *I* passes through R_1 and 2*I* passes through R_2 in opposite directions

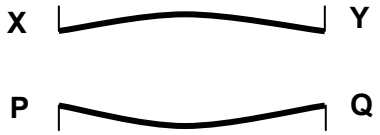


Which of the following diagram best represents the shapes of the ribbons?

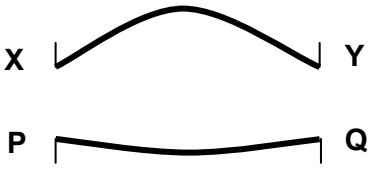
A



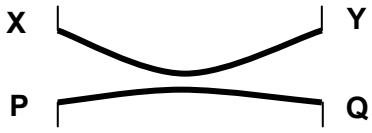
B



C



D



28 Photons of energies 0.6 eV, 1.9 eV and 2.5 eV are detected from a hot gas. Which of the following lists possible energy levels of the atoms in the gas?

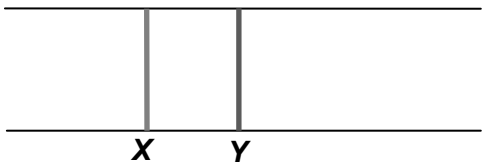
A -0.9 eV, -1.5 eV, -3.4 eV

B -0.6 eV, -1.9 eV, -2.5 eV

C -0.3 eV, -0.6 eV, -1.9 eV

D -1.2 eV, -1.8 eV, -2.4 eV

29



The diagram above shows two adjacent lines in the spectrum of a hot gas. Line X is brighter than line Y because

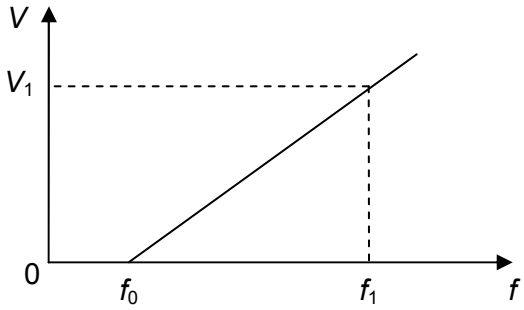
A line X has a higher frequency.

B line X has a longer wavelength.

C for line X, more electrons undergo the specific energy transition involved in the emission.

D for line X, electrons undergo energy transitions of a larger difference.

30 In a photoelectric experiment, the potential difference V that must be maintained between the illuminated surface and the collector so as just to prevent any electrons from reaching the collector is determined for different frequencies f of the incident illumination. The graph below is obtained.



What is the maximum kinetic energy of the electron emitted at frequency f_1?

A hf_1

B $h\,(f_1 - f_0)$

C V_1

D $eV_1 / (f_1 - f_0)$