Name: ____________________________ CTG: ___________ (   )

YISHUN JUNIOR COLLEGE
JC 2 Preliminary Examination 2011

PHYSICS 8866/01
Higher 1
Paper 1

25 August 2011
Thursday
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, CTG and Index Number on the multiple choice answer sheet in the spaces provided, unless this has been done for you.

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 separate multiple choice answer sheet.

Read the instructions on the multiple choice 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 booklet.

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	=	$R_1 + R_2 + \ldots\ldots\ldots$
resistors in parallel	$\frac{1}{R}$	=	$\frac{1}{R_1} + \frac{1}{R_2} + \ldots\ldots$

1 The drag force F acting on a moving sphere obeys an equation in the form $F = kAv^2$, where A represents the sphere's frontal area and v represents its speed.

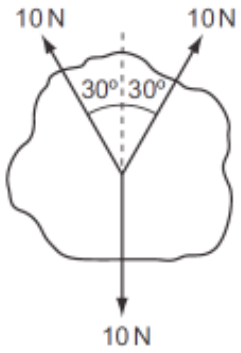
What are the base units of the constant k?

A kg m^{-3}
B kg m^{-2} s^{-1}
C kg m^{5} s^{-4}
D kg m^{-4} s^{2}

2 What is the order of magnitude of the inter-atomic spacing in a solid?

A 1000 nm
B 10 nm
C 0.1 nm
D 0.001 nm

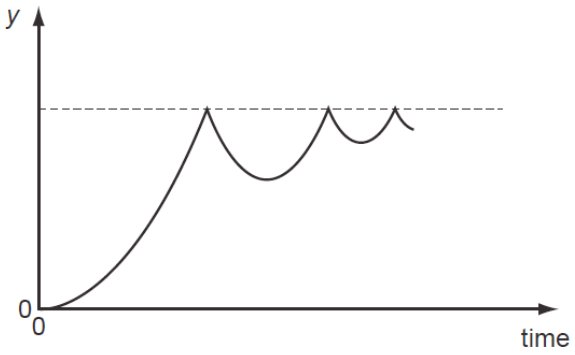
3 Three co-planar forces, each of magnitude 10 N, act through the same point of a body in the directions shown.



What is the magnitude of the resultant force?

A 0 N
B 1.3 N
C 7.3 N
D 10 N

4 A ball is released from rest above a horizontal surface and bounces several times. The graph shows how, for this ball, a quantity *y* varies with time.



What is the quantity *y*?

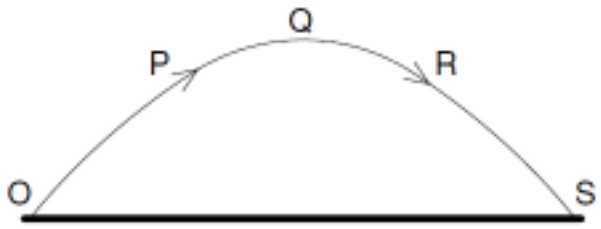
A acceleration
B displacement
C height of ball above ground
D velocity

5 On a particular railway, a train driver applies the brakes of the train at a yellow signal, a distance of 1.0 km from a red signal, where it stops. The maximum deceleration of the train is 0.2 m s^{-2}.

Assuming uniform deceleration, what is the maximum safe speed of the train at the yellow signal?

A 20 m s^{-1}
B 40 m s^{-1}
C 200 m s^{-1}
D 400 m s^{-1}

6 A projectile is launched at point O and follows the path OPQRS, as shown. Air resistance may be neglected.



Which statement is true of the projectile when it is at the highest point Q?

A The horizontal component of the projectile's acceleration is zero.
B The horizontal component of the projectile's velocity is zero.
C The kinetic energy of the projectile is zero.
D The momentum of the projectile is zero.

7 A force *F* of varying magnitude and direction is applied to a freely moving object. At one instance of time, the object has velocity *v* and acceleration *a*.

Which quantities **must** be in the same direction?

A *a* and *v* only
B *a* and *F* only
C *v* and *F* only
D *v*, *F* and *a*

8 A supermarket trolley of mass 30 kg is moving at 3.0 m s^{-1}. A retarding force of 60 N is applied to the trolley for 0.50 s in the opposite direction to the trolley's initial velocity.

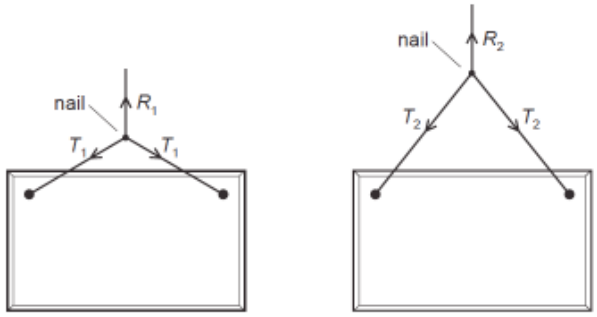
What is the trolley's new velocity after the application of the force?

A 1.0 m s^{-1}
B 1.5 m s^{-1}
C 2.0 m s^{-1}
D 2.8 m s^{-1}

9 Which statement about a ball that strikes a tennis racket and rebounds is always correct?

A Total kinetic energy of the ball is conserved.
B Total kinetic energy of the system is conserved.
C Total momentum of the ball is conserved.
D Total momentum of the system is conserved.

10 The diagrams show two ways of hanging the same picture.



In both cases, a string is attached to the same points on the picture and looped symmetrically over a nail in a wall. The forces shown are those that act on the nail.

In diagram 1, the string loop is shorter than in diagram 2.

Which information about the magnitude of the forces is correct?

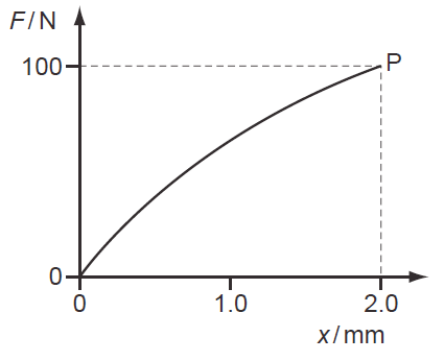
A $R_1 = R_2$, $T_1 = T_2$
B $R_1 = R_2$, $T_1 > T_2$
C $R_1 > R_2$, $T_1 < T_2$
D $R_1 < R_2$, $T_1 = T_2$

11 An electron is situated in a uniform electric field, as shown in the diagram.

What is the direction of the electric force acting on the electron?

A downwards
B to the left
C to the right
D upwards

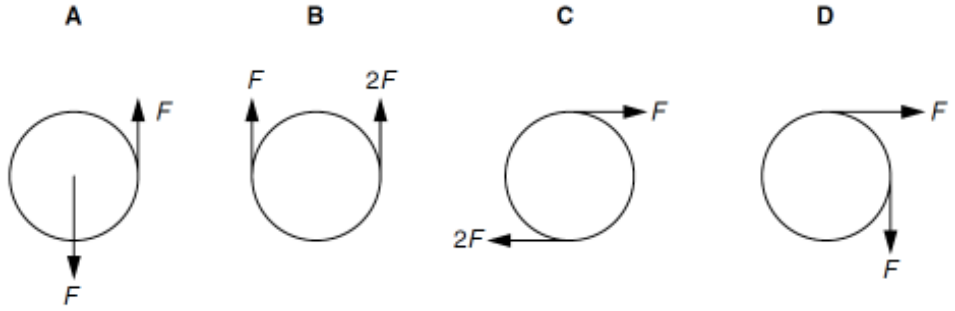
12 The graph shows the non-linear force-extension (*F* versus *x*) curve for a wire made from a new composite material.



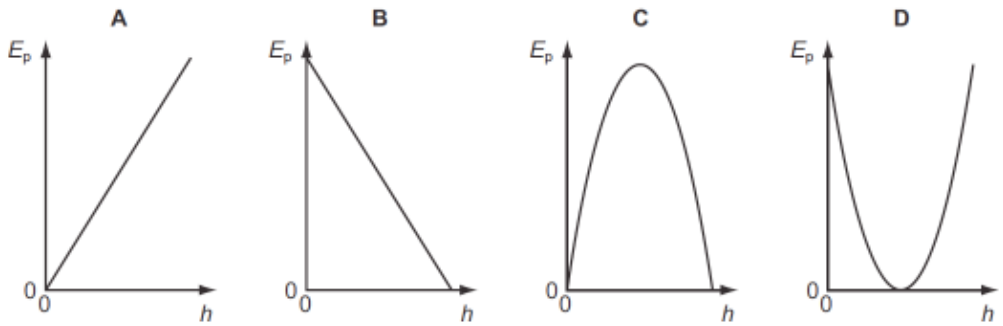
What could be the value of the elastic potential energy stored in the wire when it is stretched to point P?

A 0.09 J
B 0.10 J
C 0.11 J
D 0.20 J

13 Which of the following pairs of forces, acting on a circular object, constitute a couple?



14 An object is thrown into the air.
Which graph shows how the potential energy E_p of the object varies with height *h* above the ground?



15 A projectile is launched at 45^{o} to the horizontal with initial kinetic energy E.

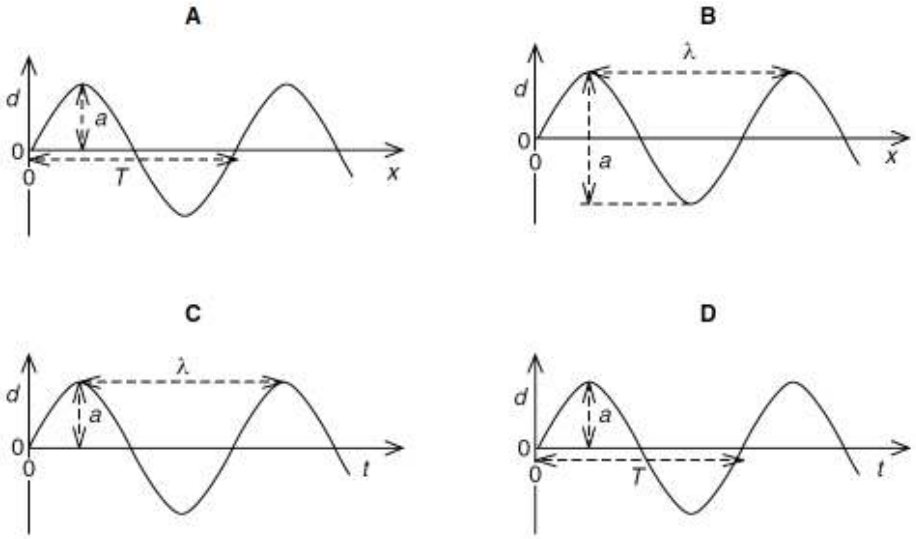
Assuming air resistance to be negligible, what will be the kinetic energy of the projectile when it reaches its highest point?

A 0.50E
B 0.71E
C 0.87E
D E

16 The four graphs represent a progressive wave on a stretched string. Graphs A and B show how the displacement d varies with distance x along the string at one instance. Graphs C and D show how the displacement d varies with time t at a particular value of x.

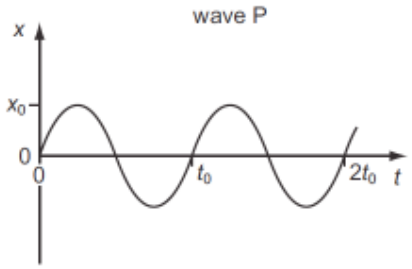
The labels on the graphs are intended to show the wavelength λ, the period T, and the amplitude a of the wave, but only one graph is correctly labelled.

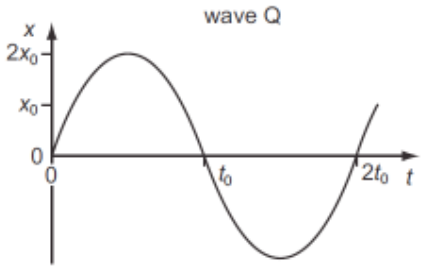
Which graph is correctly labelled?



17 The intensity I of a progressive wave is proportional to the square of the amplitude of the wave. It is also proportional to the square of the frequency.

The variations with time t of displacement x of particles in a medium, when two progressive waves P and Q pass separately through the medium, are shown on the graphs.



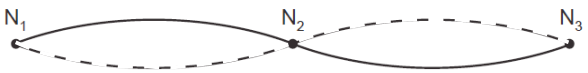


The intensity of wave P is I_0.

What is the intensity of wave Q?

A ½ I_0
B I_0
C 8 I_0
D 16 I_0

18 The diagram shows a standing wave on a string. The standing wave has three nodes N_1, N_2 and N_3.



Which statement is correct?

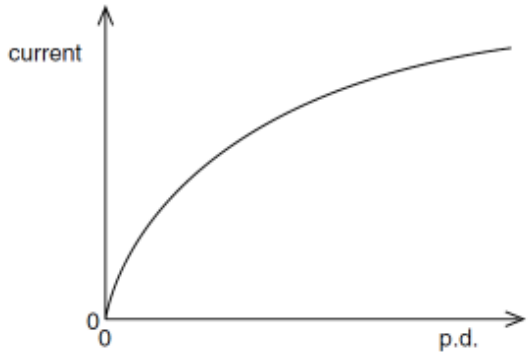
A All points on the string vibrate in phase.
B All points on the string vibrate with the same amplitude.
C Points equidistant from N_2 vibrate with the same frequency and in phase.
D Points equidistant from N_2 vibrate with the same frequency and the same amplitude.

19 Fringes of separation *y* are observed on a screen 1.00 m away from a Young's double-slit arrangement that is illuminated by yellow light of wavelength 600 nm.

At which distance from the slits would fringes of the same separation *y* be observed when using blue light of wavelength 400 nm?

A 0.33 m
B 0.67 m
C 0.75 m
D 1.50 m

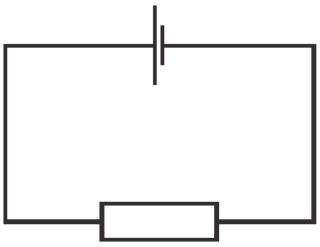
20 The graph shows the variation with potential difference (p.d.) across a lamp filament of the current flowing through it.



Which statement best explains the shape of this graph?

A As the filament temperature rises, electrons can pass more easily through the filament.
B It takes time for the filament to reach its working temperature.
C The power output of the filament is proportional to the square of the current through it.
D The resistance of the filament increases with a rise in temperature.

21 A cell is connected to a resistor. At any moment in time, the potential difference across the cell is less than its electromotive force.



Which statement best explains this?

A The cell is continually discharging.
B The connecting wire has some resistance.
C Energy is needed to drive charge through the cell.
D Power is dissipated when there is a current in the resistor.

22 Which values of current and resistance will dissipate energy at a rate of 16 J s^{-1}?

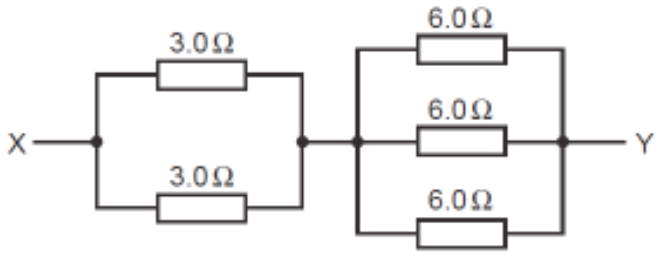
	Current / A	Resistance / Ω
A	1	4
B	2	8
C	4	1
D	16	1

23 A cylindrical wire 4.0 m long has a resistance of 31 Ω and is made of metal of resistivity 1.0×10^{-6} Ω m.

What is the radius of cross-section of the wire?

A 4.1×10^{-8} m
B 2.0×10^{-6} m
C 6.4×10^{-6} m
D 2.0×10^{-4} m

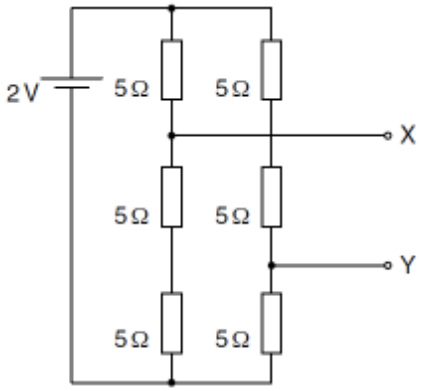
24 A network of resistors consists of two 3.0 Ω resistors and three 6.0 Ω resistors.



What is the combined resistance of this network between points X and Y?

A 0.86 Ω
B 1.2 Ω
C 3.5 Ω
D 24 Ω

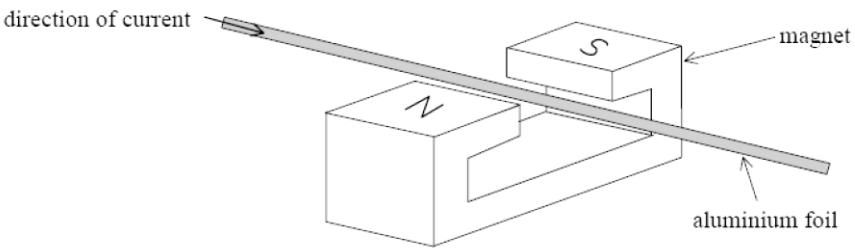
25 Six resistors, each of resistance 5 Ω, are connected to a 2-V cell of negligible internal resistance.



What is the potential difference between terminals X and Y?

A $\frac{2}{3}$ V
B $\frac{8}{9}$ V
C $\frac{4}{3}$ V
D 2 V

26 A strip of aluminum foil is held between the poles of a strong magnet, as shown below.



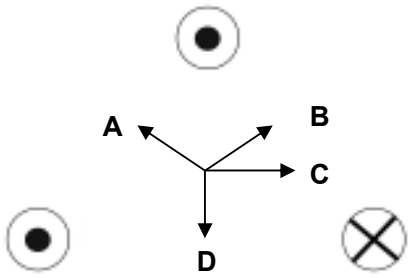
When a current is passed through the aluminum foil in the direction shown, the foil is deflected.

In which direction is this deflection?

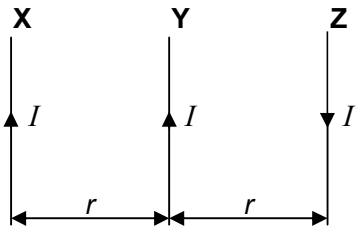
A Towards the North pole of the magnet
B Towards the South pole of the magnet
C Vertically downwards
D Vertically upwards

27 In the following diagram, three wires, seen in cross-section, each carry a current of identical value, are arranged as an equilateral triangle.

What is the direction of resultant magnetic field at the centre?



28 The diagram below shows three parallel wires **X**, **Y** and **Z** which carry currents I of equal magnitude in the direction shown.



The resultant force experienced by **Y** due to the currents in **X** and **Z** is

A along **Y**.
B towards **X**.
C towards **Z**.
D zero.

29 Which pair of the following experiments demonstrates the wave-particle duality of light?

A The diffraction of light and electrons
B The photoelectric effect and the diffraction of electrons
C The Young's double-slit experiment and the diffraction of electrons
D The Young's double-slit experiment and the photoelectric effect experiment

30 Let λ_o be the de-Broglie wavelength of an electron accelerated from rest through a potential difference of 10 V and let λ_1 be that of an electron accelerated from rest through a potential difference of 1000 V.

What is the value of the ratio $\frac{\lambda_o}{\lambda_1}$?

A 0.1
B 1
C 10
D 100

* * * End of Paper 1 * * *