EUNOIA JUNIOR COLLEGE
JC1 Promotional Examination 2018
General Certificate of Education Advanced Level
Higher 2

PHYSICS

Paper 1 Multiple Choice

9749/01

02 October 2018

40 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

There are **twenty** questions on this paper. 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 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 booklet.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **12** printed pages and **0** blank page.

Data

speed of light in free space,	c	=	3.00×10^{8} m s^{-1}
permeability of free space,	μ_o	=	$4\pi \times 10^{-7}$ H m^{-1}
permittivity of free space,	ε_o	=	8.85×10^{-12} F m^{-1} $(1/(36\,\pi)) \times 10^{-9}$ F m^{-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
molar gas constant,	R	=	8.31 J K^{-1} mol^{-1}
the Avogadro constant,	N_A	=	6.02×10^{23} mol^{-1}
the Boltzmann constant,	k	=	1.38×10^{-23} J K^{-1}
gravitational constant,	G	=	6.67×10^{-11} N m^2 kg^{-2}
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
gravitational potential,	ϕ	=	$-\frac{Gm}{r}$
temperature,	T/K	=	$T / {}^{o}C + 273.15$
pressure of an ideal gas,	p	=	$\frac{1}{3}\frac{Nm}{V}\langle c^2 \rangle$
mean translational kinetic energy of an ideal gas molecule	E	=	$\frac{3}{2}kT$
displacement of particle in s.h.m.	x	=	$x_o \sin \omega t$
velocity of particle in s.h.m.	v	=	$v_o \cos \omega t$
		=	$\pm \omega\sqrt{(x_o^2 - x^2)}$
electric current,	I	=	$Anvq$
resistors in series,	R	=	$R_1 + R_2 + \ldots$
resistors in parallel,	$1/R$	=	$1/R_1 + 1/R_2 + \ldots$
electric potential,	V	=	$\frac{Q}{4\pi\varepsilon_o r}$
alternating current/voltage,	x	=	$x_o \sin \omega t$
magnetic flux density due to a long straight wire	B	=	$\frac{\mu_o I}{2\pi d}$
magnetic flux density due to a flat circular coil	B	=	$\frac{\mu_o N I}{2r}$
magnetic flux density due to a long solenoid	B	=	$\mu_o n I$
radioactive decay,	x	=	$x_o \exp(-\lambda t)$
decay constant	λ	=	$\frac{\ln 2}{t_{\frac{1}{2}}}$

1 Which of the following could be the correct expression for the speed v of sound in a gas of density ρ and at a pressure P? (γ is a dimensionless constant.)

A $v = \sqrt{\frac{\gamma}{\rho P}}$ **B** $v = \sqrt{\frac{\gamma P}{\rho}}$ **C** $v = \sqrt{\frac{\gamma \rho}{P}}$ **D** $v = \sqrt{\gamma \rho P}$

2 The viscosity of a fluid, μ, can be determined by measuring the terminal velocity, v_T, of a sphere when it descends in the fluid. The fluid has a density, ρ_f, while the sphere has a density, ρ_s, and a diameter of d. The viscosity can then be calculated by the formula

$$\mu = \frac{5(\rho_s - \rho_f)}{9v_T} d^2$$

The values measured are

$v_T = (1.60 \pm 0.04)$ m s $^{-1}$

$\rho_s = (2700 \pm 20)$ kg m^{-3}

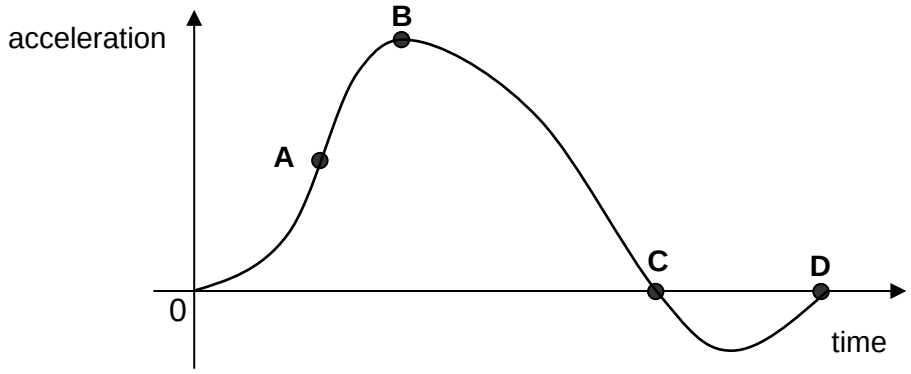
$\rho_f = (900 \pm 10)$ kg m^{-3}

$d = (20.0 \pm 0.4)$ mm

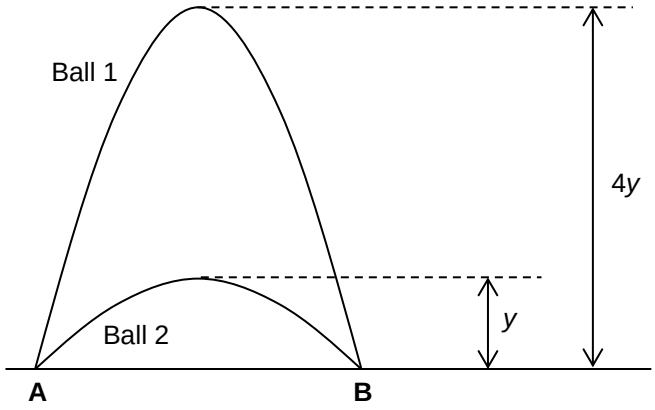
What is the percentage uncertainty in the value of μ?

A 6.2 % **B** 7.1 % **C** 8.2 % **D** 8.4 %

3 A car starts from rest and travels along a straight road. The graph below shows the variation with time of its acceleration during part of the journey. At which point on the graph does the car have its greatest velocity?



4 The figure below shows two paths of two similar balls kicked at the ground level from A to B.



Ignoring the effects of air, which of the following statements is true?

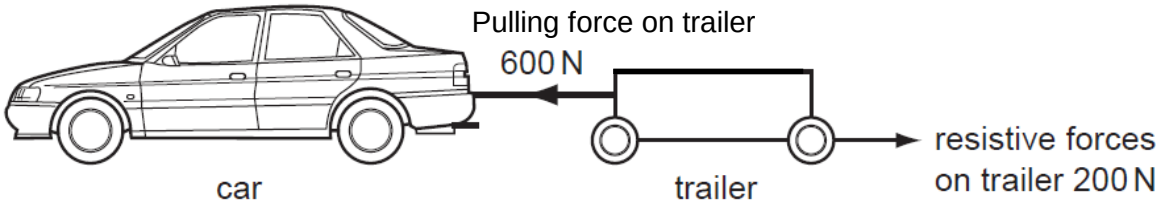
A The initial speed of Ball 1 is greater than the final speed of Ball 1.

B The final horizontal speed of Ball 1 is greater than the final horizontal speed of Ball 2.

C The time of flight of Ball 1 is four times the time of flight of Ball 2.

D The final vertical speed of Ball 1 is two times the final vertical speed of Ball 2.

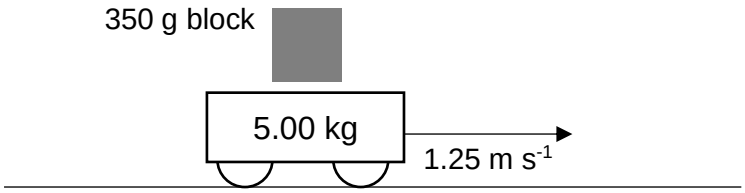
5 A trailer of mass 400 kg is pulled by a car of mass 1200 kg. The diagram shows the horizontal forces acting on the trailer.



What is the net force acting on the car alone?

A 400 N **B** 600 N **C** 1200 N **D** 1800 N

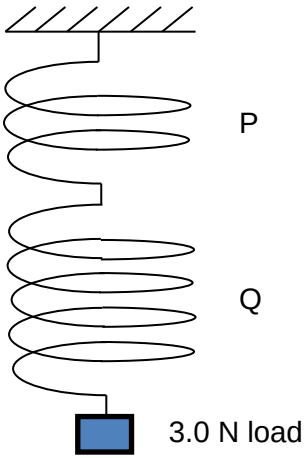
6 The diagram shows a trolley moving on a smooth horizontal table at a speed of 1.25 m s^{-1}. A block with mass 350 g is then dropped vertically onto the trolley from a height of 0.200 m above it and then remains on it.



After the block is dropped onto the trolley, what is the speed of the trolley?

A 0.0875 m s^{-1} **B** 0.856 m s^{-1} **C** 1.17 m s^{-1} **D** 1.25 m s^{-1}

7 The spring system shown is composed of two springs, P and Q, of negligible mass connected in series. P has a spring constant of 30 N m^{-1} and Q has a spring constant of 10 N m^{-1}.



When a 3.0 N load is supported by the system, which of the following is the overall extension produced?

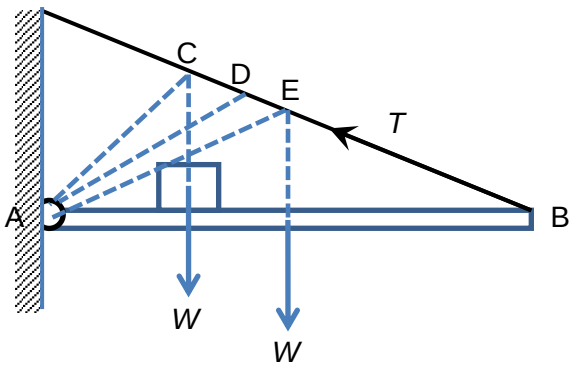
A 40 mm

B 150 mm

C 400 mm

D 433 mm

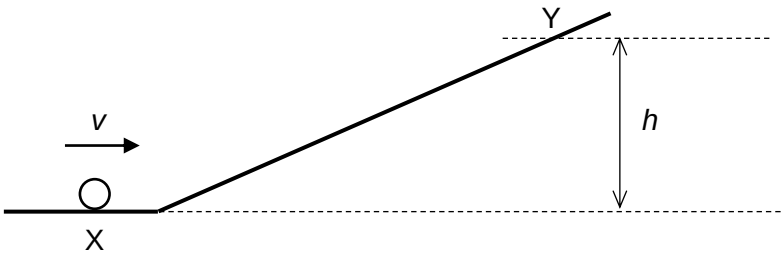
8 A uniform beam of weight *W* is hinged on one end at A and held by a wire on the other end at B. It carries a load, also of weight *W*, as shown. The tension in the wire is *T*.



Which of the following is the most likely direction of the force exerted by the hinge on the beam at A?

A AB **B** AC **C** AD **D** AE

9 An object of mass *m* passes a point X on the ground with a velocity *v* and slides up a frictionless incline. It stops at a point Y which is at a height *h* above the ground.



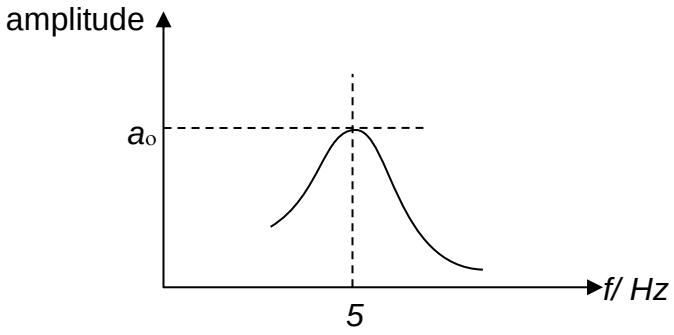
A second object of mass 0.50*m* passes the point X with a velocity of 0.50*v*. To what height will it rise?

A 0.25*h* **B** 0.50*h* **C** 0.71*h* **D** *h*

10 A block of mass 5.0 kg is released from a height of 1.0 m. What is the average power, in W, delivered to the block throughout its motion before it hits the ground? Take the acceleration of free fall to be *g*.

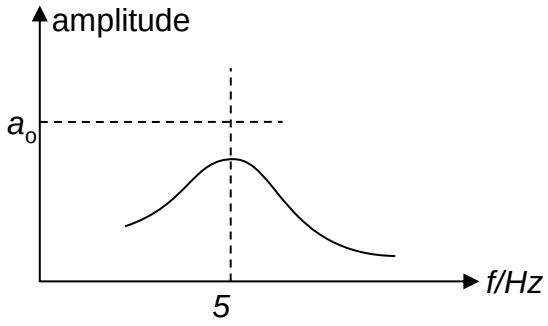
A $\frac{5}{2}g^{\frac{3}{2}}$ **B** $\frac{5\sqrt{2}}{2}g^{\frac{5}{2}}$ **C** $\frac{5\sqrt{2}}{2}g^{\frac{3}{2}}$ **D** $\frac{5\sqrt{2}}{2}g^{2}$

11 A pendulum is constructed from a fixed length of light thread and a spherical pendulum bob. It is forced to oscillate in air at different frequencies *f*. The following diagram shows how the amplitude of its oscillation varies with *f*.

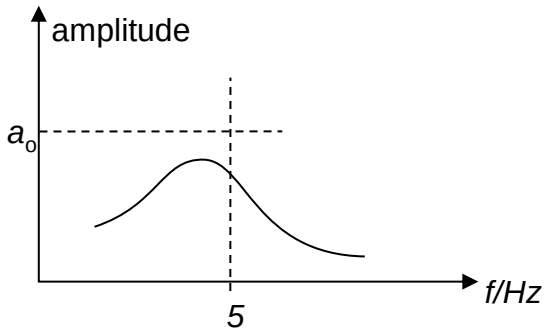


If the experiment is repeated in a partial vacuum, which graph best represents the variation with *f* of the amplitude?

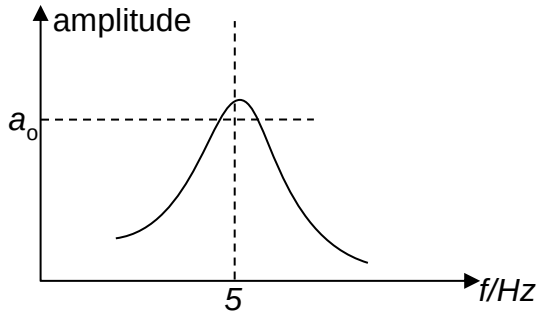
A



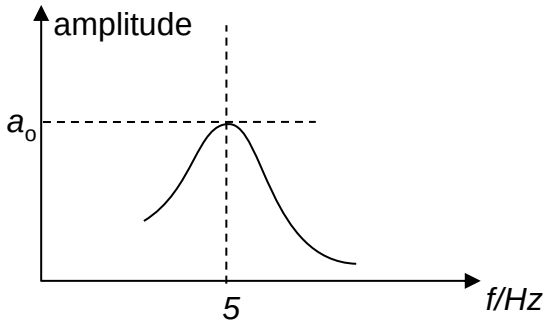
B



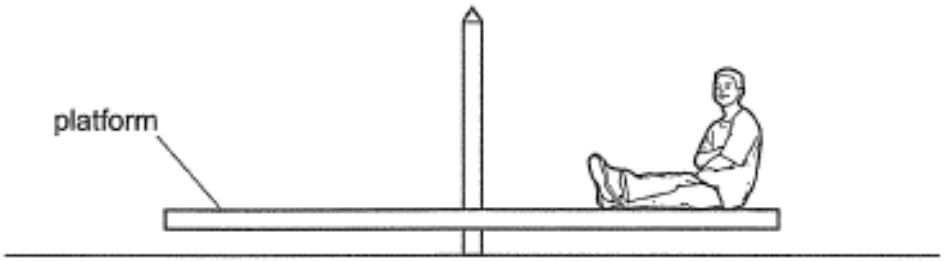
C



D

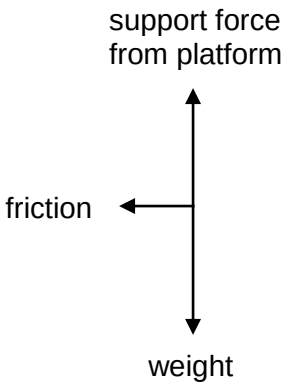


12 The diagram shows a child sitting on a playground turntable, which is turning with constant angular velocity.

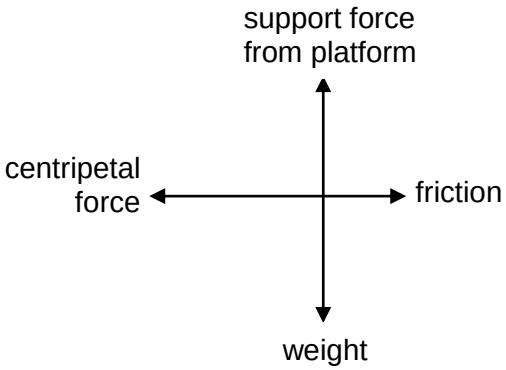


Which diagram shows the forces acting on the child when in the position shown?

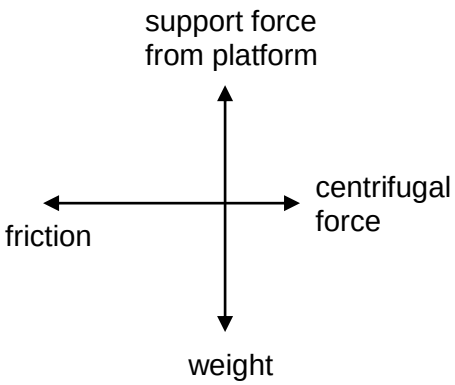
A



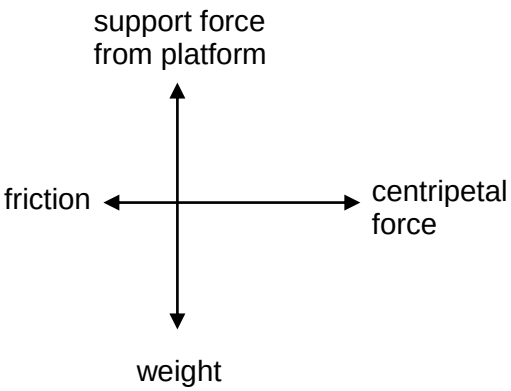
B



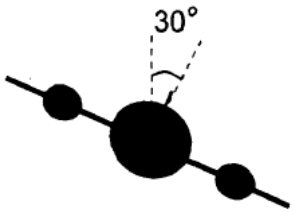
C



D



13 An aircraft is moving in a horizontal plane at a constant speed. It banks at angle of 30^0 to the vertical in order to make a turn as shown in the diagram below. The radius of the turn is 5000 m.



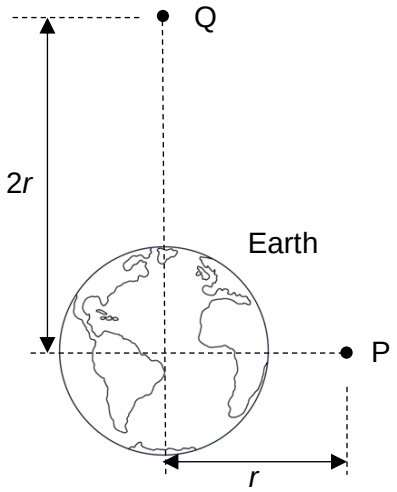
What is the speed of the aircraft?

A 40 m s^{-1} **B** 54 m s^{-1} **C** 168 m s^{-1} **D** 291 m s^{-1}

14 Which of the following statement about two satellites of masses X and Y in the geostationary orbit around the Earth is always false?

A The gravitational potential energy of each satellite is different.
B The kinetic energy of each satellite is different.
C The magnitude of the centripetal acceleration of each satellite is different.
D The magnitude of the angular velocity of each satellite is the same.

15 P and Q are two points above Earth's surface at distances *r* and 2*r* respectively from the centre of the Earth.



The gravitational potential at P is –800 kJ kg^{-1}. When a 0.50 kg mass is taken from P to Q, what is the work done on the mass?

A - 200 kJ **B** - 100 kJ **C** 200 kJ **D** 400 kJ

16 A transverse wave of wavelength λ is travelling on a horizontal rope. The points P and Q on the rope are $\frac{3\lambda}{2}$ apart and the waves are travelling from P to Q. At a particular instant, P is displaced upwards and is moving upwards.

What are the directions of the displacement and movement of Q?

	displacement of Q	movement of Q
A	upwards	downwards
B	upwards	upwards
C	downwards	upwards
D	downwards	downwards

17 A surface of area *S* is placed perpendicular to the direction of travel of a plane wave. The energy per unit time intercepted by the surface is *E* when the amplitude of the wave is *A*. The area of the surface is reduced to $\frac{1}{2}S$ and the amplitude of the wave is increased to 3*A*.

What is the energy per unit time intercepted by this smaller surface?

A $\frac{1}{2}E$ **B** $\frac{3}{2}E$ **C** $\frac{9}{2}E$ **D** $\frac{9}{4}E$

18 Which of the following statements best describes the *principle of superposition*?

A The total displacement due to several waves is the vector sum of the displacement due to those waves acting individually.

B Two stationary waves superimpose to give two progressive waves.

C A diffraction pattern consists of many interfere patterns superimposed on one another.

D Two progressive waves superimpose to give a stationary wave.

19 When coherent monochromatic light falls on two narrow parallel slits, interference pattern is observed on a screen some distance beyond the slits.

Which of the following will increase the separation between the dark lines of the interference pattern?

A decreasing the distance between the screen and the slits
B increasing the distance between the slits
C using monochromatic light of higher frequency
D using monochromatic light of a longer wavelength

20 A double star is at a distance of 5.5×10^{16} m from the Earth. The approximate distance between the two stars of the double star is 3.0×10^{11} m.
What is the minimum size of the diameter of the optical telescope so that the individual stars can be detected?

A 0.1 m
B 10 m
C 100 m
D 100 km

End of Paper