RAFFLES INSTITUTION

2020 YEAR 5 TERM 3 TIMED PRACTICE

24 June 2020 2 hr 10 min

H2 PHYSICS

Section A

INSTRUCTIONS TO CANDIDATES

There are 2 sections in this paper.

Section A consists of 11 multiple-choice questions. For each question, four suggested answers are given. You are to choose the most appropriate one and shade your answer on the OMR form.

Section B consists of 5 structured questions and 1 data analysis question. You are to write your answers in the spaces provided.

Attempt ALL questions in Sections A and B.

There are **6** printed pages in this booklet.

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DATA AND FORMULAE

Data

speed of light in free space	$c = 3.00 \times 10^8$ m s^{-1}
permeability of free space	$\mu_0 = 4\pi \times 10^{-7}$ H m^{-1}
permittivity of free space	$\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1} = $(1/(36\pi)) \times 10^{-9}$ F m^{-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
molar gas constant	$R = 8.31$ J K^{-1} mol^{-1}
the Avogadro constant	$N_A = 6.02 \times 10^{23}$ mol^{-1}
the Boltzmann constant	$k = 1.38 \times 10^{-23}$ J K^{-1}
gravitational constant	$G = 6.67 \times 10^{-11}$ 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	$p = \rho gh$
gravitational potential	$\phi = -Gm/r$
temperature	T/K = T/°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.	$x = x_0 \sin \omega t$
velocity of particle in s.h.m.	$v = v_0 \cos \omega t = \pm\omega\sqrt{x_0^2 - x^2}$
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	$V = Q/(4\pi\varepsilon_0 r)$
alternating current/voltage	$x = x_0 \sin \omega t$
magnetic flux density due to a long straight wire	$B = \frac{\mu_0 I}{2\pi d}$
magnetic flux density due to a flat circular coil	$B = \frac{\mu_0 NI}{2r}$
magnetic flux density due to a long solenoid	$B = \mu_0 nI$
radioactive decay	$x = x_0 \exp(-\lambda t)$
decay constant	$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$

1 What is the order-of-magnitude of the maximum power of a one-litre kettle?

A 1 W **B** 10 W **C** 100 W **D** 1000 W

2 A student made a series of measurements of the acceleration of free fall using two different methods. The table shows the results obtained.

method	acceleration of free fall / m s^{-2}			
P	9.51	9.68	10.12	9.73
Q	9.59	9.51	9.61	9.53

The acceleration of free fall in Singapore is 9.79 m s^{-2}.

Which statement about the results obtained from the two methods is correct?

A Results obtained using method P are more precise and more accurate than method Q.

B Results obtained using method P are more precise but less accurate than method Q.

C Results obtained using method P are less precise but more accurate than method Q.

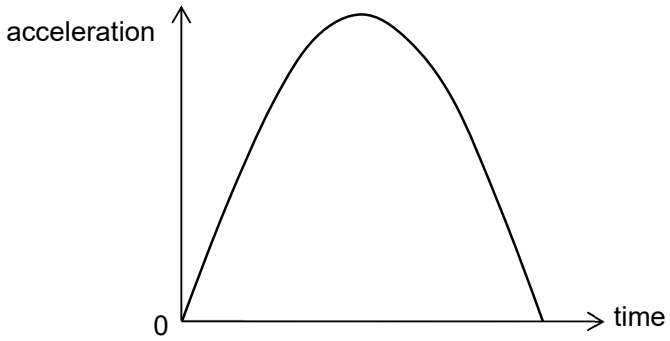
D Results obtained using method P are less precise and less accurate than method Q.

3 A stone falls freely from rest to the ground. The effect of air resistance on the stone is negligible. From the point of release, the stone travels half the total distance to the ground in time *t*.

What is the time taken for the stone to travel the remaining distance?

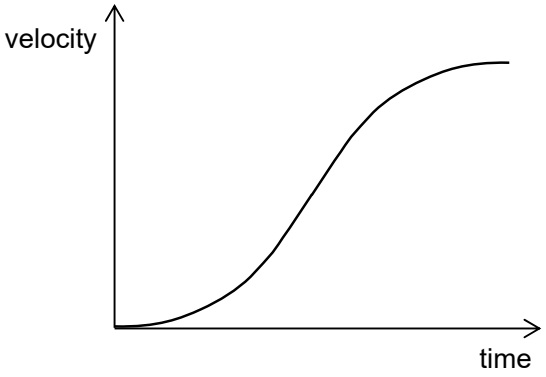
A 0.41 *t* **B** 0.50 *t* **C** 0.71 *t* **D** 1.4 *t*

4 The graph shows the variation with time of the acceleration of an object moving in a straight line.

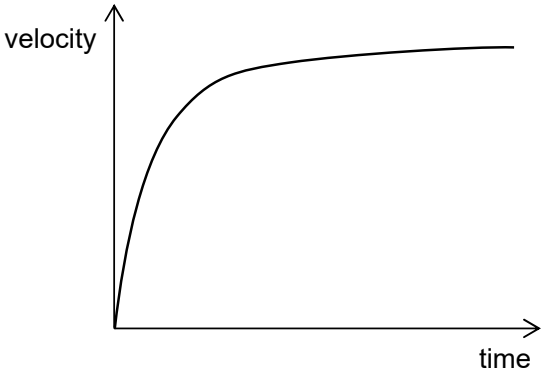


Which graph represents the variation with time of the velocity of the object?

A



B



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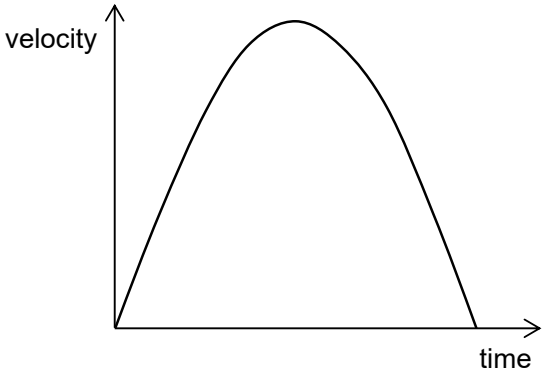

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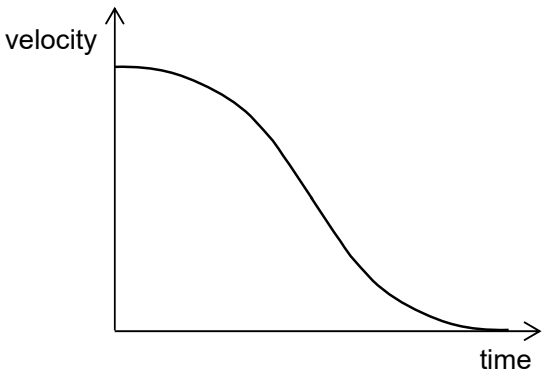
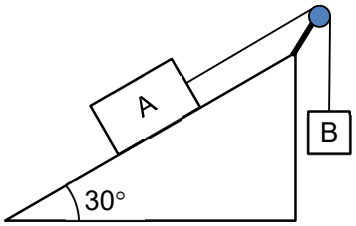


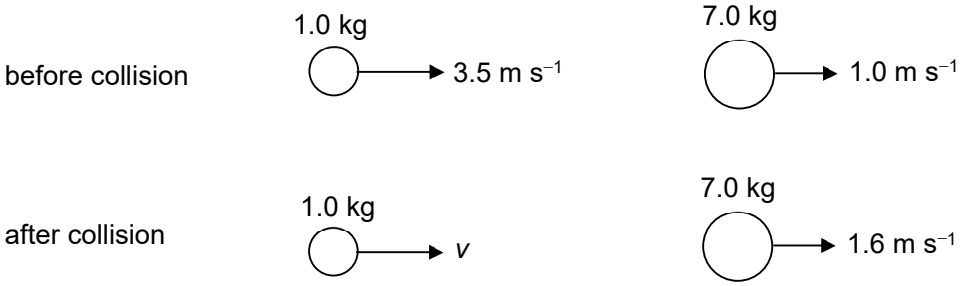
5 Blocks A and B of masses 4.0 kg and 3.0 kg respectively, are connected by a light string that passes over a frictionless pulley. Block A lies on a rough plane inclined at 30° to the horizontal.



If block B is accelerating downwards at 1.0 m s^{-2}, what is the magnitude of the frictional force acting on block A?

A 2.5 N **B** 2.8 N **C** 5.8 N **D** 8.8 N

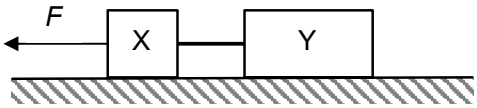
6 The velocities before and after a head-on collision between two objects of masses 1.0 kg and 7.0 kg are shown below.



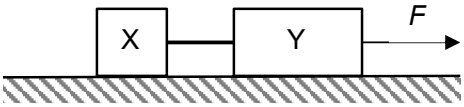
What is the final velocity *v* of the 1.0 kg mass?

A – 0.90 m s^{-1} **B** – 0.70 m s^{-1} **C** + 0.70 m s^{-1} **D** + 4.1 m s^{-1}

7 Two blocks X and Y of masses *m* and 3*m* respectively, are connected by a light string and accelerated along a smooth horizontal surface by a force *F* applied to block X as shown.



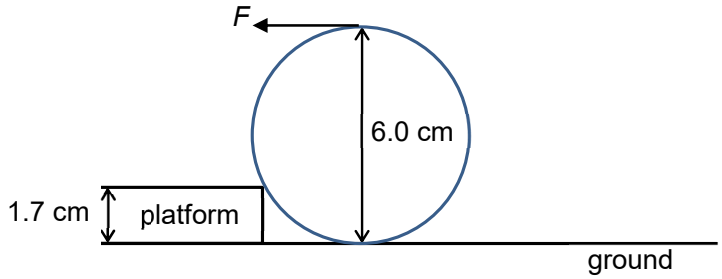
The same force *F* is then applied to block Y.



What is the ratio of the tension in the string in the first case to that in the second case?

A 1:1 **B** 4:3 **C** 3:1 **D** 4:1

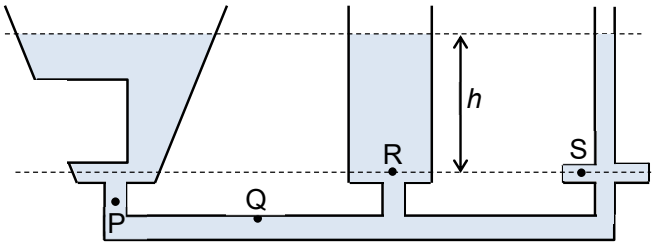
8 A uniform solid disc of weight 9.0 N and diameter 6.0 cm is at rest on a floor placed against the edge of a rough platform of height 1.7 cm. A force *F* acts horizontally on the top edge of the solid disc.



What is the magnitude of *F* required for the disc to just lift off the ground?

A 2.7 N **B** 5.7 N **C** 6.3 N **D** 15 N

9 An odd shaped container is filled with water of density ρ as shown. *h* is the depth of points R and S from the water surface.



Which statement is correct?

A The pressure at Q is zero as there is no liquid above it.

B The pressures at R and S are both equal to ρgh.

C The pressure at Q is less than the pressure at R.

D The pressure at P is larger than the pressure at S.

10 Two stones of masses *m* and 2*m* are projected vertically upwards with the same kinetic energy.

If the maximum height reached by the stone of mass *m* is *h*, what is the maximum height reached by the other stone? Ignore air resistance.

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

11 A car of mass 1500 kg is travelling at a constant speed of 17 m s^{-1} up a slope that is inclined at an angle of 3.2° to the horizontal. The total resistive force acting on the car is 240 N.

What is the power supplied by the car engine?

A 1.1 kW **B** 5.5 kW **C** 9.9 kW **D** 18 kW