Name:		Index Number:		Class:	

DUNMAN HIGH SCHOOL
Promotional Examination
Year 5

H2 PHYSICS — 9749/01

Paper 1 Multiple Choice Questions

1 October 2024
30 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

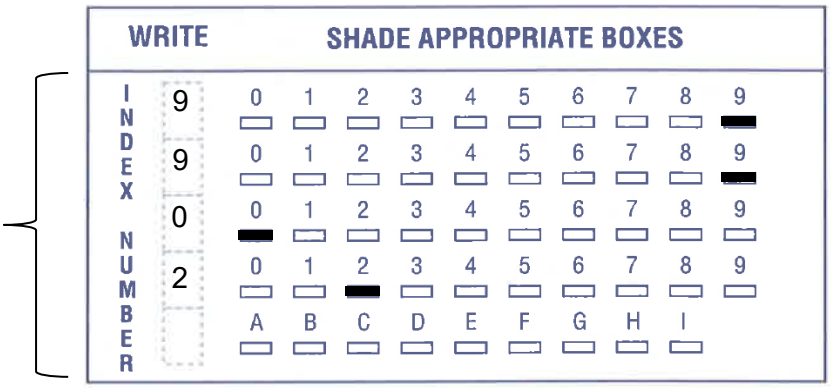
Write your class, index number and name at the top of this page.
Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.

There are **fifteen** 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.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
The use of an approved scientific calculator is expected, where appropriate.

Write your name and class on the Multiple Choice Answer Sheet. Write and shade the Index Number as follows.

For illustration only:

A student from class 5C99, with index number 02, should shade "9902".



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	$p = \rho gh$
gravitational potential	$\phi = -\frac{Gm}{r}$
temperature	$T / \text{K} = T / ^\circ\text{C} + 273.15$
pressure of an ideal gas	$p = \frac{1}{3}\frac{Nm}{V} < c^2 >$
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.	$v = v_0 \cos \omega t$ $= \pm\ \omega \sqrt{\left(x_0^2 - x^2\right)}$
electric current	$I = Anvq$
resistors in series	$R = R_1 + R_2 + ...$
resistors in parallel	$1/R = 1/R_1 + 1/R_2 + ...$
electric potential	$V = \frac{Q}{4\pi\varepsilon_0 r}$
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 denxity 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	$x = x_0 \exp\left(-\lambda t\right)$
decay constant	$\lambda = \frac{\ln 2}{t_{\frac{1}{2}}}$

1 Which of the following options gives the best estimate for the size of a hydrogen atom?

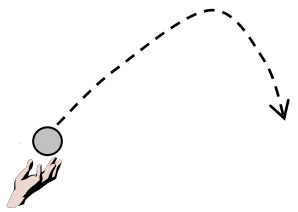
A 10^{-8} m **B** 10^{-9} m **C** 10^{-10} m **D** 10^{-11} m

2 Four students made a series of measurements for the acceleration of free fall, g.

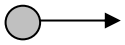
Which student's data can be said to be precise but not accurate?

Student	Results, g / m s^{-2}			
A	9.81	9.72	9.84	9.83
B	9.81	10.12	9.89	8.94
C	9.45	9.21	8.99	8.76
D	8.45	8.46	8.50	8.41

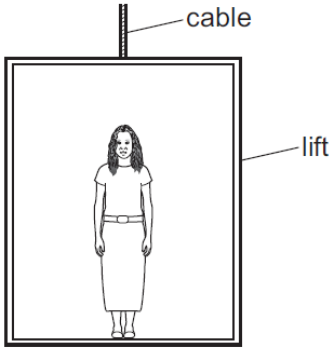
3 A ball, thrown at an angle with the horizontal, travels **in air** with a trajectory as shown below.



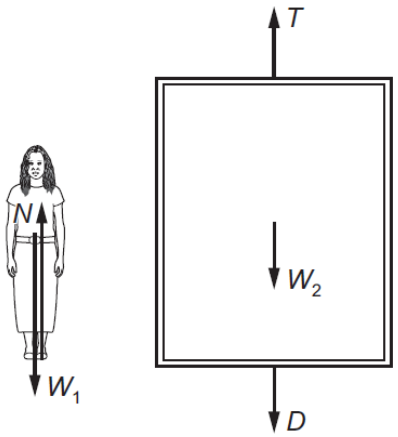
When the ball is at the top of its flight, which of the following shows the direction of its resultant acceleration?

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

4 The diagram shows a woman standing in a lift.



The forces acting on the woman and the forces acting on the lift are shown below.



N is the force from the lift floor on the woman.

W_1 is the weight of the woman.

T is the tension in the lift cable.

W_2 is the weight of the lift.

D is the force from the woman on the lift floor.

Which statement is correct?

A N and W_1 are always equal and opposite.

B If $T = (D + W_2)$, the lift must have a constant velocity.

C If $N = W_1$, the lift must be at rest.

D $(W_1 + W_2)$ is always equal to T.

5 A racing car of mass 500 kg, including driver but not fuel, decelerates from a speed of 50 m s^{-1} to 30 m s^{-1} when approaching a bend.

The brakes exert a fixed retarding force of 7000 N. The time for the car to decelerate when it is almost out of fuel is t_1. The time for the car to decelerate when it has a full load of 130 kg of fuel is t_2.

What is the difference between $(t_2 - t_1)$?

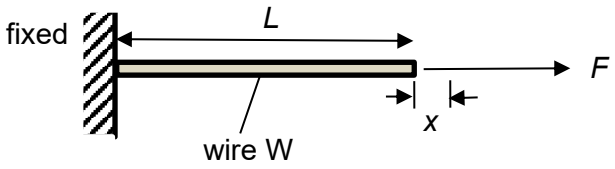
A 0.37 s

B 0.56 s

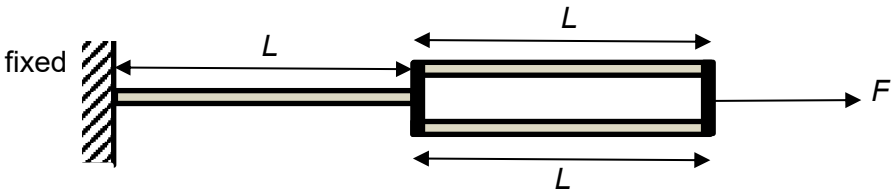
C 0.93 s

D 1.43 s

6 A wire W, initially of length *L*, is fixed at one end and pulled by a force *F* at the other end. The wire extends by *x*.



Three wires, all identical to wire W, are connected as shown to form a composite wire.

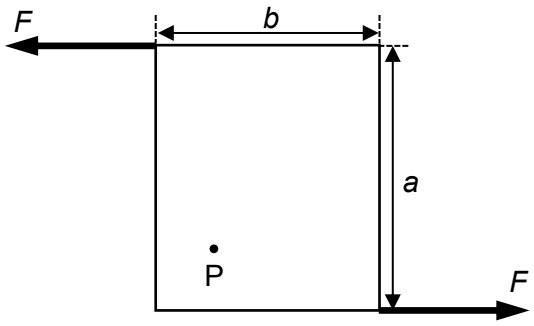


The composite wire is fixed at one end and pulled by the same force *F* at the other end.

What is the total extension of the composite wire?

A $\frac{5}{6}x$ **B** $\frac{4}{3}x$ **C** $\frac{3}{2}x$ **D** $2x$

7 Two forces, each of magnitude F, act along the edges of a light rigid card, as shown.



The card has length a and width b.

What is the torque about point P?

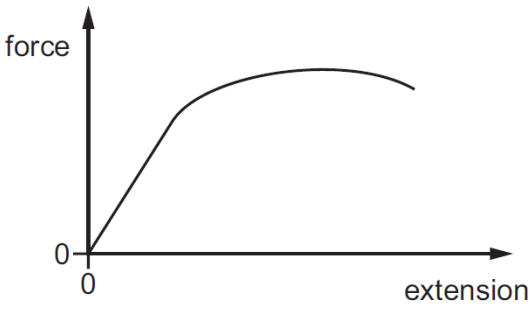
A Fa **B** Fb **C** $2Fa$ **D** $2Fb$

8 An area of land is at an average depth of 2.0 m below the sea level. To prevent flooding, pumps are used to lift rainwater up to the sea level.

What is the minimum pump output power required to deal with 1.3×10^9 kg of rain per day?

A 15 kW **B** 30 kW **C** 150 kW **D** 300 kW

9 A metal wire is stretched by a load. The force-extension graph is shown below.



What is represented by the area under the whole graph?

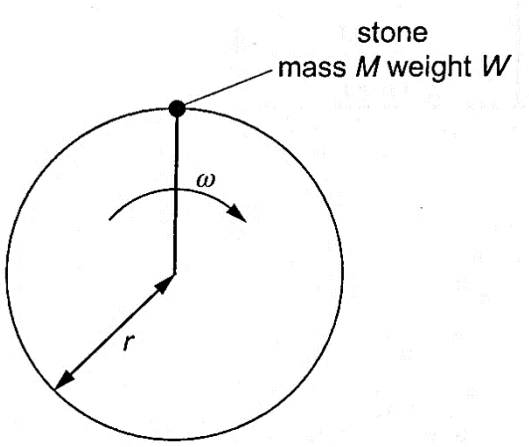
A the change in gravitational potential energy of the wire.

B the work done in stretching the wire.

C the energy transferred into heat energy in the wire.

D the energy that would be released from the wire if the final load was removed.

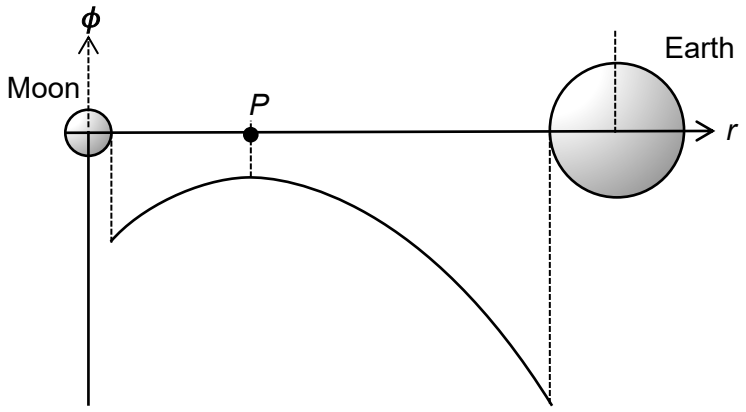
10 A stone of mass M and weight W is attached to a string and is rotated in a vertical circle of radius r. The stone has an angular velocity ω when it is vertically above the centre of the circle.



What is the tension in the string when the stone is vertically below the centre of the circle?

A $Mr\omega^2 - W$ **B** $Mr\omega^2$ **C** $W - Mr\omega^2$ **D** $W + Mr\omega^2$

11 The variation of the gravitational potential ϕ with the distance r from the surface of the Moon to the surface of Earth, is shown below.



Which of the following statements is **not** true?

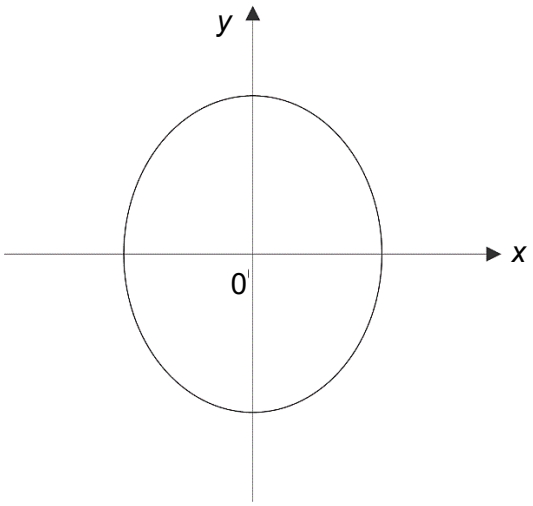
A The gravitational field strength at P is zero.

B The gravitational field strength at P is the vector sum of the individual field strengths of the Moon and the Earth at point P.

C The gravitational field strength at P is the scalar sum of the individual field strengths of the Moon and the Earth at point P.

D The gravitational field strength at P is given by the rate of change of ϕ with respect to r.

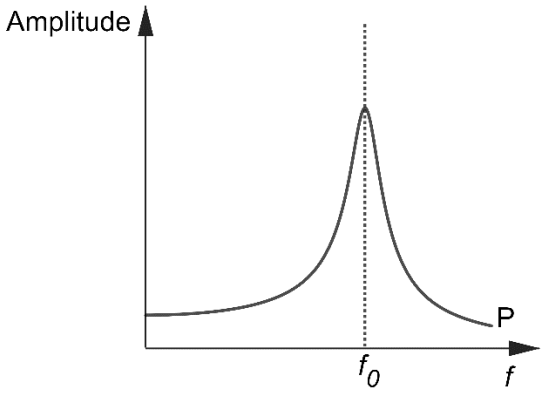
12 The diagram shows one possible graph for an object undergoing simple harmonic motion.



Which row in the table gives the correct quantities *x* and *y*?

	x	*y*
A	displacement	acceleration
B	time	acceleration
C	time	displacement
D	velocity	displacement

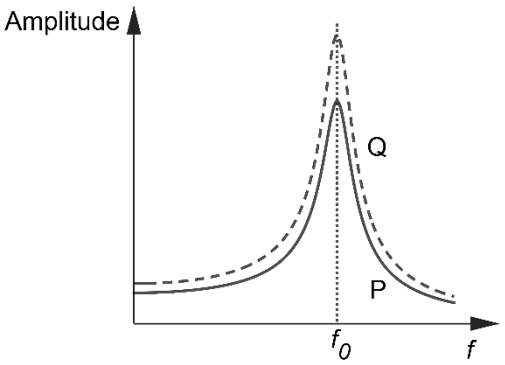
13 A vertical spring-mass system, with a plasticine ball as the mass, is forced to oscillate at different frequencies f in air. The mass oscillates at maximum amplitude when f is equal to f_0, as shown below.



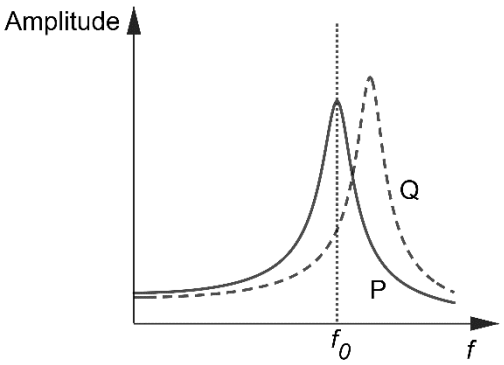
The plasticine is now flattened to increase its surface area, reattached to the spring and the experiment is repeated.

Which of the following graphs best represents the new results as shown by line Q?

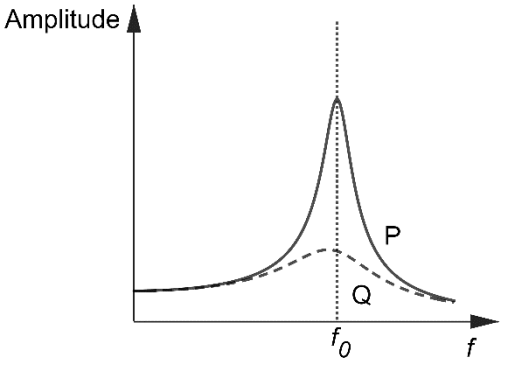
A



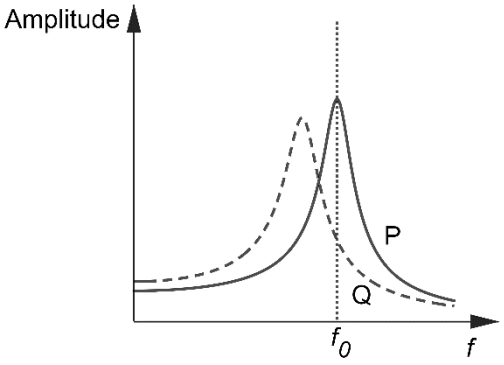
B



C



D



14 Two heater coils **X** and **Y** dissipate the same power when the potential difference across coil **X** and coil **Y** is 12 V and 6.0 V, respectively. The coils are made from equal length of wire of the same material, but with different diameter.

What is the ratio $\frac{\text{diameter of wire } \mathbf{X}}{\text{diameter of wire } \mathbf{Y}}$?

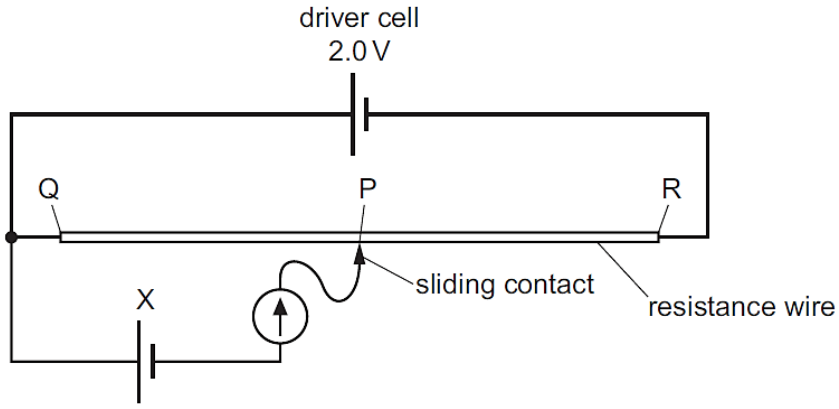
A $\frac{1}{4}$

B $\frac{1}{2}$

C 2

D 4

15 A potentiometer circuit is used to investigate the electromotive force (e.m.f.) of a cell X.



The e.m.f. of cell X is known to be approximately 0.50 V.

The driver cell has negligible internal resistance and an e.m.f. of 2.0 V. The sliding contact is moved along the uniform resistance wire between ends Q and R to a point P where the reading on the galvanometer is zero.

What is an expression for the approximate length QP?

A $\frac{QR}{4}$ **B** $\frac{QR}{3}$ **C** $\frac{2QR}{3}$ **D** $\frac{3QR}{4}$

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