Name:.. Centre Number:........................

Candidate Number:............................ Set (Please circle): 4P1 AF 4P2 WEB 4P3 JAAB 4P4 JWC 4P5 MJR

Winchester College Physics Mock
Paper 1
Monday 24th April 2017

Time allowed: 50 min

Multiple choice questions are worth <u>*two*</u> marks each.

Write all answers on the multiple choice answer grid, following the instructions on that sheet.

You may use a calculator.

$g = 9.81 ms^{-2}$

1) Which pair contains one vector and one scalar quantity?

A displacement : acceleration

B force : kinetic energy

C momentum : velocity

D power : speed

2) Which piece of evidence about the photoelectric effect **cannot** be explained using a wave model?

A Increasing the intensity of the illumination increases the rate at which electrons are ejected.

B Shining ultraviolet radiation onto a zinc surface ejects electrons.

C Shining visible light onto a potassium surface ejects electrons.

D There is a threshold frequency below which no electrons are ejected from a metal surface.

3) In a simple electrical circuit, the current in a resistor is measured as (2.50 ± 0.05) mA. The resistor is marked as having a value of 4.7 Ω ± 2%.

If these values were used to calculate the power dissipated in the resistor, what would be the percentage uncertainty in the value obtained?

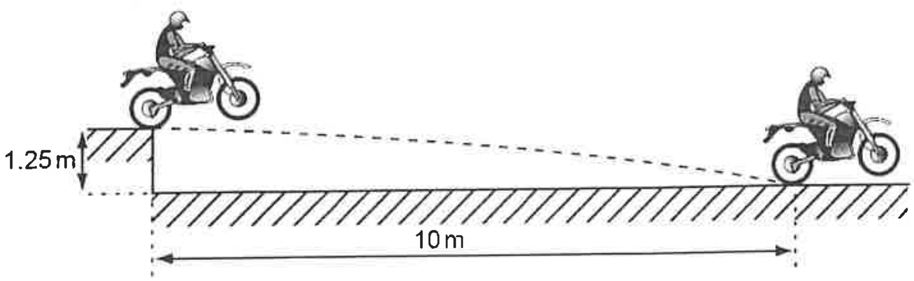
A 2% **B** 4% **C** 6% **D** 8%

4) A car is travelling with uniform acceleration along a straight road. The road has marker posts every 100 m. When the car passes one post, it has a speed of $10\,\mathrm{m\,s^{-1}}$ and, when it passes the next one, its speed is $20\,\mathrm{m\,s^{-1}}$.

What is the car's acceleration?

A $0.67\,\mathrm{m\,s^{-2}}$ **B** $1.5\,\mathrm{m\,s^{-2}}$ **C** $2.5\,\mathrm{m\,s^{-2}}$ **D** $6.0\,\mathrm{m\,s^{-2}}$

5) A motorcycle stunt-rider moving horizontally takes off from a point 1.25 m above the ground, landing 10 m away as shown.

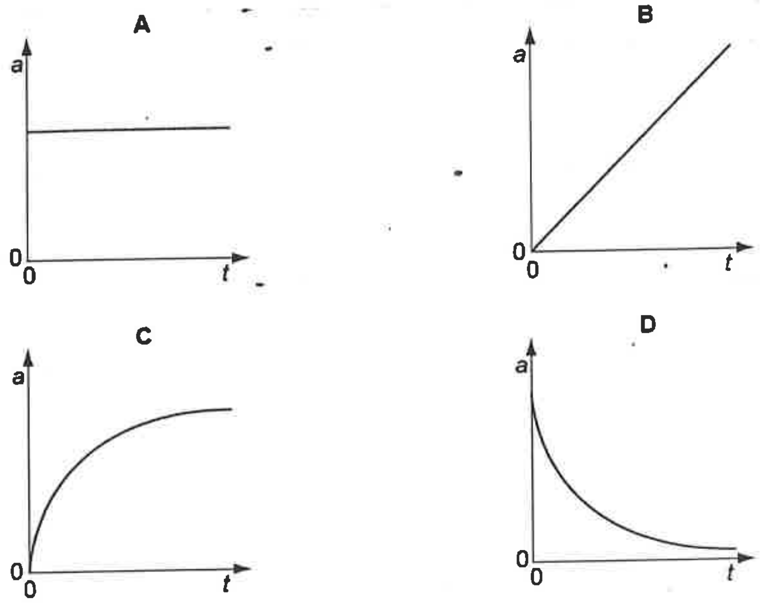


What was the speed at take-off?

A $5\,\mathrm{m\,s^{-1}}$ **B** $10\,\mathrm{m\,s^{-1}}$ **C** $15\,\mathrm{m\,s^{-1}}$ **D** $20\,\mathrm{m\,s^{-1}}$

6) A tennis ball is released from rest at the top of a tall building.

Which graph best represents the variation with time t of the acceleration a of the ball as it falls, assuming that the effects of air resistance are appreciable?



7) A ball falls vertically and bounces on the ground.

The following statements are about the forces acting while the ball is in contact with the ground.

Which statement is correct?

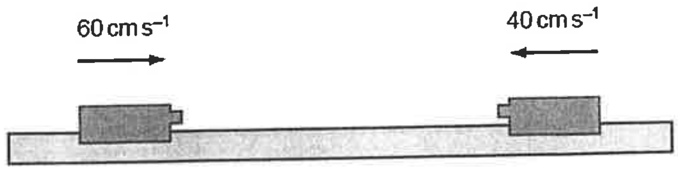
A The force that the ball exerts on the ground is always equal to the weight of the ball.

B The force that the ball exerts on the ground is always equal in magnitude and opposite in direction to the force the ground exerts on the ball.

C The force that the ball exerts on the ground is always less than the weight of the ball.

D The weight of the ball is always equal in magnitude and opposite in direction to the force that the ground exerts on the ball.

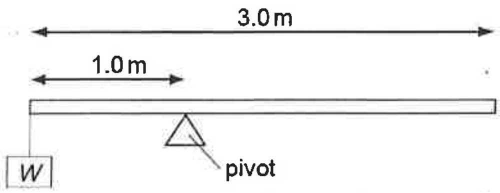
8) Two equal masses travel towards each other on a frictionless air track at speeds of $60\,\text{cm s}^{-1}$ and $40\,\text{cm s}^{-1}$. They stick together on impact.



What is the speed of the masses after impact?

A $10\,\text{cm s}^{-1}$ **B** $20\,\text{cm s}^{-1}$ **C** $40\,\text{cm s}^{-1}$ **D** $50\,\text{cm s}^{-1}$

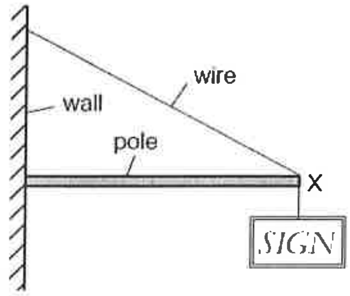
9) A uniform beam of weight 50 N is 3.0 m long and is supported on a pivot situated 1.0 m from one end. When a load of weight W is hung from that end, the beam is in equilibrium, as shown in the diagram.



What is the value of W?

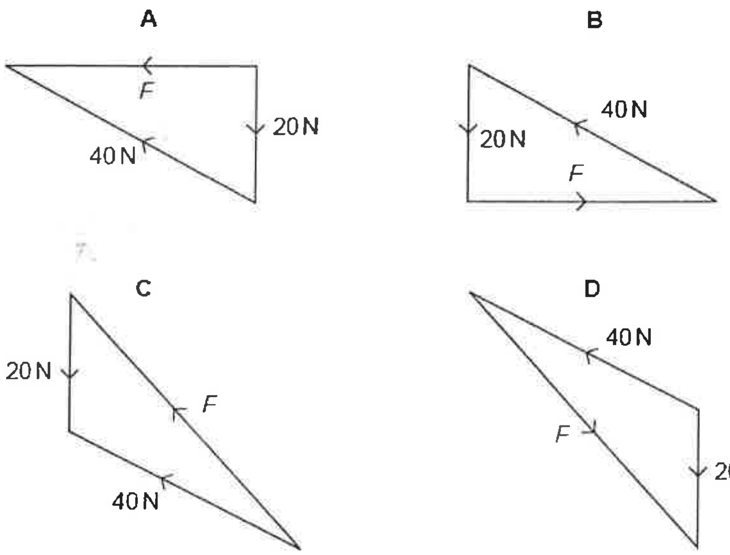
A 25 N **B** 50 N **C** 75 N **D** 100 N

10) The diagram shows a sign of weight 20 N suspended from a pole, attached to a wall. The pole is kept in equilibrium by a wire attached at point X of the pole.



The force exerted by the pole at point X is F, and the tension in the wire is 40 N.

Which diagram represents the three forces acting at point X?



11) What is the expression used to **define** power?

A $\frac{\text{energy output}}{\text{energy input}}$

B energy x time taken

C force x velocity

D $\frac{\text{work done}}{\text{time taken}}$

12) A ball is thrown vertically upwards.

Neglecting air resistance, which statement is correct?

A The kinetic energy of the ball is greatest at the greatest height attained.

B By the principle of conservation of energy, the total energy of the ball is constant throughout its motion.

C By the principle of conservation of momentum, the momentum of the ball is constant throughout its motion.

D The potential energy of the ball increases uniformly with time during the ascent.

13) Car X is travelling at half the speed of car Y. Car X has twice the mass of car Y.

Which statement is correct?

A Car X has half the kinetic energy of car Y.

B Car X has one quarter of the kinetic energy of car Y.

C Car X has twice the kinetic energy of car Y.

D The two cars have the same kinetic energy.

14) 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 reaching the surface is E.

The amplitude of the wave is increased to $2A$ and the area of the surface is reduced to $\frac{1}{2}S$.

How much energy per unit time reaches this smaller surface?

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

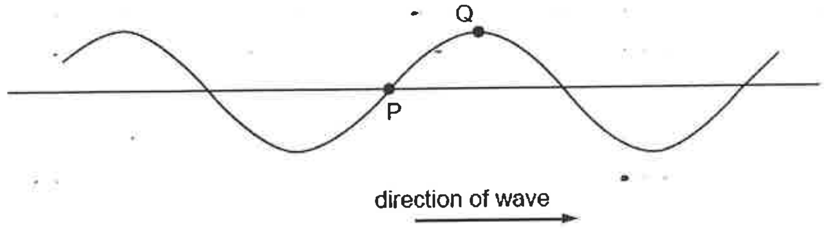
15) The lines of a diffraction grating have a spacing of 1.6×10^{-6} m. A beam of light is incident normally on the grating. The first order maximum makes an angle of 20° with the undeviated beam.

What is the wavelength of the incident light?

A 210 nm **B** 270 nm **C** 420 nm **D** 550 nm

16) The diagram shows a transverse wave on a rope. The wave is travelling from left to right.

At the instant shown, the points P and Q on the rope have zero displacement and maximum displacement respectively.



Which of the following describes the direction of motion, if any, of the points P and Q at this instant?

	point P	point Q
A	downwards	stationary
B	stationary	downwards
C	stationary	upwards
D	upwards	stationary

17) T is a microwave transmitter placed at a fixed distance from a flat reflecting surface S.

A small microwave receiver is moved steadily from T towards S and receives signals of alternate maxima and minima of intensity.

The distance between successive maxima is 15 mm.

What is the frequency of the microwaves?

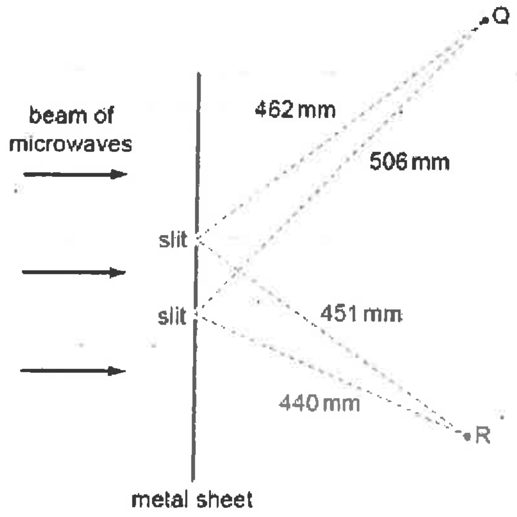
A 1.0×10^{7} Hz

B 2.0×10^{7} Hz

C 1.0×10^{10} Hz

D 2.0×10^{10} Hz

18) A beam of microwaves, with wavelength 22 mm, passes through two slits in a metal sheet. Q and R are microwave detectors.



When Q and R are at the distances shown, what are their readings?

	Q	R
A	maximum	maximum
B	maximum	zero
C	zero	maximum
D	zero	zero

19) The terminal voltage of a battery is observed to fall when the battery supplies a current to an external resistor.

What quantities are needed to calculate the fall in voltage?

A the battery's e.m.f. and its internal resistance

B the battery's e.m.f. and the current

C the current and the battery's internal resistance

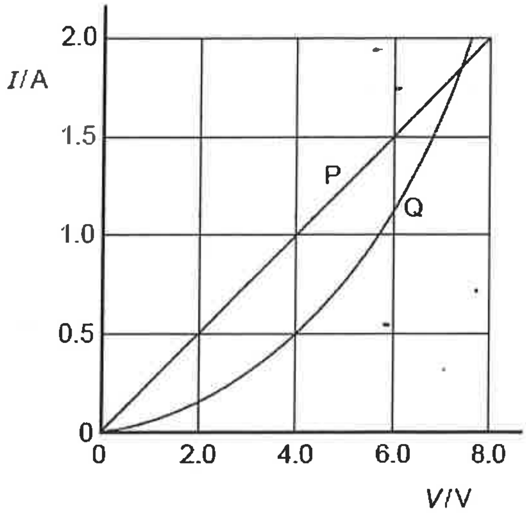
D the current and the external resistance

20) Kirchhoff's two laws for electric circuits can be derived by using conservation laws.

On which conservation laws do Kirchhoff's laws depend?

	Kirchhoff's first law	Kirchhoff's second law
A	charge	current
B	charge	energy
C	current	mass
D	energy	current

21) The I-V characteristics of two electrical components P and Q are shown below.



Which statement is correct?

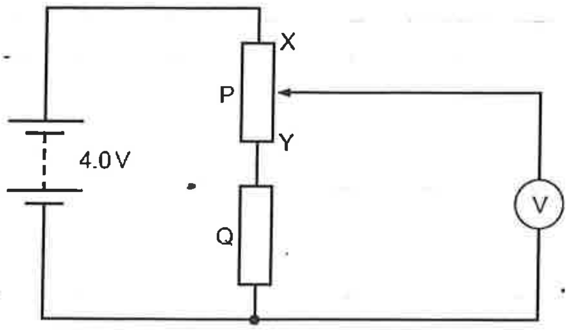
A P is a resistor and Q is a filament lamp.

B The resistance of Q increases as the current in it increases.

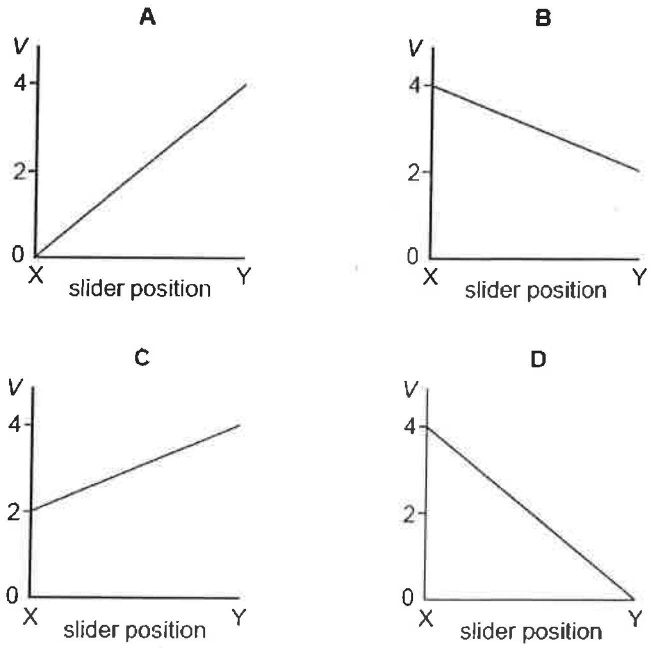
C At 1.9 A the resistance of Q is approximately half that of P.

D At 0.5 A the power dissipated in Q is double that in P.

22) In the circuit below, P is a potentiometer of total resistance 10 Ω and Q is a fixed resistor of resistance 10 Ω. The battery has an e.m.f. of 4.0 V and negligible internal resistance. The voltmeter has a very high resistance. The slider on the potentiometer is moved from X to Y and a graph of voltmeter reading *V* is plotted against slider position.



Which graph is obtained?

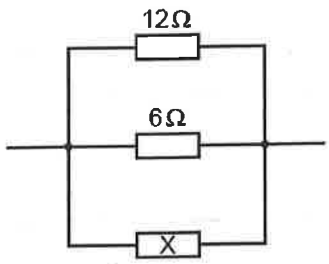


23) A cylindrical piece of a soft, electrically-conducting material has resistance *R*. It is rolled out so that its length is doubled but its volume stays constant.

What is its new resistance?

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

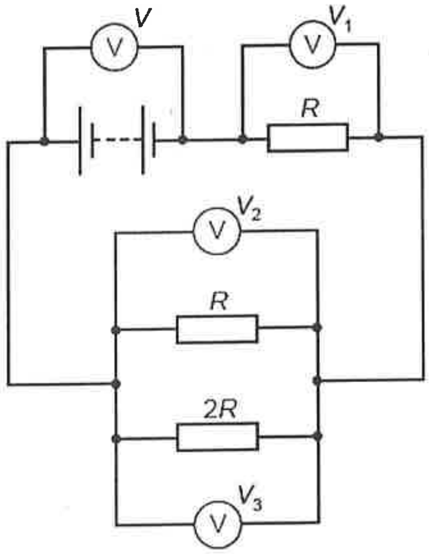
24) The diagram shows a parallel combination of three resistors. The total resistance of the combination is 3Ω.



What is the resistance of resistor X?

A 2Ω **B** 3Ω **C** 6Ω **D** 12Ω

25) The diagram shows a circuit with four voltmeter readings V, V_1, V_2 and V_3.



Which equation relating the voltmeter readings must be true?

A $V = V_1 + V_2 + V_3$

B $V + V_1 = V_2 + V_3$

C $V_3 = 2(V_2)$

D $V - V_1 = V_3$

Total marks for Multiple Choice [50]