Mechanical Energy *[10 marks]*

1. What is the phase difference, in rad, between the centre of a compression and the centre of a rarefaction for a longitudinal travelling wave? *[1 mark]*

   A. 0

   B. $\frac{\pi}{2}$

   C. π

   D. 2π

Markscheme

C

2. A pipe of fixed length is closed at one end. What is $\frac{\text{third harmonic frequency of pipe}}{\text{first harmonic frequency of pipe}}$? *[1 mark]*

   A. $\frac{1}{5}$

   B. $\frac{1}{3}$

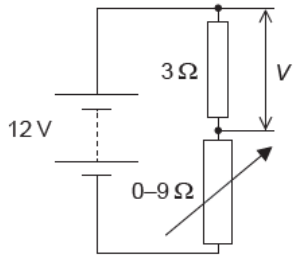
   C. 3

   D. 5

Markscheme

C

3. In the circuit shown, the fixed resistor has a value of 3 Ω and the variable resistor can be varied between 0 Ω and 9 Ω. *[1 mark]*



   The power supply has an emf of 12 V and negligible internal resistance. What is the difference between the maximum and minimum values of voltage *V* across the 3 Ω resistor?

   A. 3 V

   B. 6 V

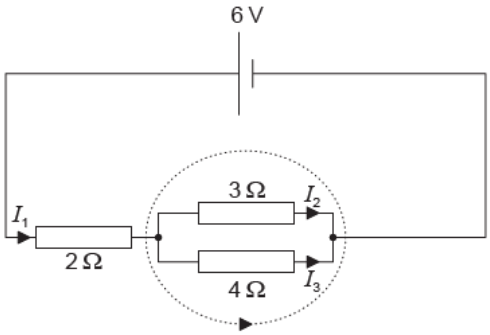
   C. 9 V

   D. 12 V

Markscheme

C

4. Kirchhoff's laws are applied to the circuit shown. *[1 mark]*



What is the equation for the dotted loop?

A. $0 = 3I_2 + 4I_3$

B. $0 = 4I_3 - 3I_2$

C. $6 = 2I_1 + 3I_2 + 4I_3$

D. $6 = 3I_2 + 4I_3$

Markscheme

B

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5. An object is positioned in a gravitational field. The measurement of gravitational force acting on the object has an uncertainty of 3 % and the uncertainty in the mass of the object is 9 %. What is the uncertainty in the gravitational field strength of the field? *[1 mark]*

A. 3 %

B. 6 %

C. 12 %

D. 27 %

Markscheme

C

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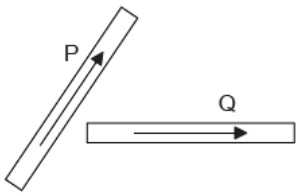
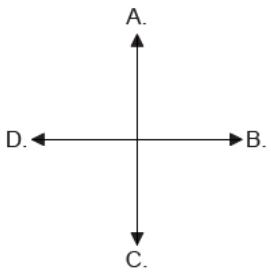
6. The diagram shows two current-carrying wires, P and Q, that both lie in the plane of the paper. The arrows show the conventional current direction in the wires. *[1 mark]*



The electromagnetic force on Q is in the same plane as that of the wires. What is the direction of the electromagnetic force acting on Q?



Markscheme

A

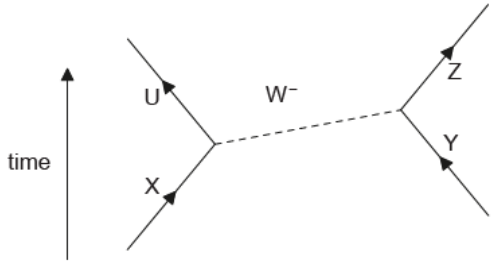
7. What gives the total change in nuclear mass and the change in nuclear binding energy as a result of a nuclear fusion reaction? *[1 mark]*

	Nuclear mass	Nuclear binding energy
A.	decreases	decreases
B.	decreases	increases
C.	increases	decreases
D.	increases	increases

Markscheme

B

8. The Feynman diagram shows a particle interaction involving a W^- boson. *[1 mark]*



Which particles are interacting?

A. U and Y

B. W^- boson and Y

C. X and Y

D. U and X

Markscheme

C

9. Which of the energy sources are classified as renewable and non-renewable? *[1 mark]*

	Renewable	Non-renewable
A.	Sun	wind
B.	natural gas	geothermal
C.	biomass	crude oil
D.	uranium-235	coal

Markscheme

C

10. The energy density of a substance can be calculated by multiplying its specific energy with which quantity? *[1 mark]*

A. mass

B. volume

C. $\frac{\text{mass}}{\text{volume}}$

D. $\frac{\text{volume}}{\text{mass}}$

Markscheme

C

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