P1a answers

Remember: Check which grade you are working at.

Page 48 Heat energy

1 a Heat transfer is the movement of heat energy *(1)*; from one place to a cooler place *(1)*

b Heat energy travels from a warmer place *(1)*; to a cooler place *(1)*

2 a Travel at speed of light *(1)*; travel through vacuum *(1)*; travel in straight lines *(1)*

b i Drawing the curtains stops heat radiation coming into the house *(1)*; through the glass *(1)*

ii Paint the house white *(1)*; white reflects heat *(1)*; reduces heat transfers into the house *(1)*

Page 48 Thermal radiation

3

1	2	3	4
C	A	B	D

(4)

4

1	2	3	4
A	D	C	B

(4)

Page 49 Conduction and convection

1

1	2	3	4
C	D	A	B

(4)

2 a

1	2	3	4
D	A	B	C

(4)

b i Heat conduction *(1)*

ii As each particle becomes warmer it vibrates more *(1)*; the vibration is passed from particle to particle *(1)*; this transmits the energy *(1)*

c The best conductor heats up quickest *(1)*; touch the end of each one to feel which gets hot first *(1)*

Page 49 Heat transfer

3 a The carpet has trapped air pockets *(1)*; air is a poor heat conductor / good insulators *(1)*; these stop heat losses by conduction *(1)*

b Free electrons are not bound to any atoms *(1)*; can travel between them, moving through the material *(1)*

c Free electrons carry heat energy from one part of the substance to another *(1)*; aluminium contains free electrons so it conducts heat well *(1)*; wool has no free electrons so cannot conduct heat well *(1)*

P1a answers

Page 50 Types of energy

1

1	2	3	4
A	D	C	B

(4)

Page 50 Energy changes

2 a Chemical energy *(1)* → kinetic energy *(1)*

b Heat *(1)*; sound *(1)*

c It spreads to the surroundings *(1)*; making them warm up a bit *(1)*

d Chemical energy from fuel changes into (gravitational) potential energy *(1)*; and kinetic energy *(1)*; and then into heat (in the brakes) *(1)*; also wasted forms of energy: sound/heat *(1)*

3 a A *(1)*

b C *(1)*

c D *(1)*

d B *(1)*

Page 51 Energy diagrams

1

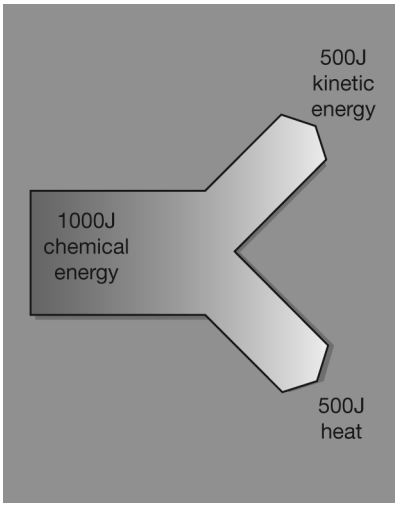
1	2	3	4
C	D	A	B

(4)

2 a 700J *(1)*

b Heat *(1)*

c Sankey diagram *(see diagram)* with one input which splits into two output arrows *(1)*; equal width *(1)* input labelled 1000J, each output labelled 500J *(1)*; input labelled chemical energy and output labelled kinetic energy and heat *(1)*



Page 51 Energy and heat

3 a C *(1)*

b A *(1)*

c B *(1)*

d D *(1)*

P1a answers

Page 52 Energy, work and power

1

1	2	3	4
D	A	B	C

(4)

2 a Work done = force x distance *(1)*
500 x 60 *(1)*
30 000 J *(1)*

b Power = work done ÷ time taken *(1)*
30 000 ÷ 75 *(1)*
400 W *(1)*

c *(Any 1:)* Energy is lost as heat / sound to surroundings; the ski lift carries more people / chairs than Molly

d *(Any 2:)* Efficiency measures the proportion of energy usefully transferred *(1)*; the new lift wastes less energy doing the same work *(1)*; more of the input energy is usefully transformed *(1)*

Page 52 Efficiency

3 a B

b D

c A

d C

Page 53 Using energy effectively

1 a Saves money *(1)*; good for the environment *(1)*

b i Reduces electricity used *(1)*

ii Stops heat escaping / reduces heating bills *(1)*

c Keep doors closed – only heated rooms used; close windows – reduces costs of heating; don't fill kettles full – saves electricity *(2)*

2 a Time taken *(1)* for the savings to match the costs *(1)*

b *(Any 2:)* Reduces heating bills; stop draughts; easy to install; cheap to install

c *(Any 3:)* Annual savings are smallest *(1)*; over several years in the same home, savings using other methods will be greater *(1)*; over 10 years, draught proofing saves 150 - 45 = £105 but loft insulation saves more *(1);* £600 - 240 = £360 *(1)*

Page 53 Why use electricity

3

1	2	3	4
C	A	B	D

(4)

P1a answers

Page 54 Electricity and heat

1 a Electricity → heat *(1)*

b Current too large *(1)*; fuse melts *(1)*; breaks the circuit *(1)*

c 15 A fuse wire is thicker *(1)*; can carry larger current before melting *(1)*

2 a Energy transferred *(1)*; per second *(1)*

b 2400 W *(1)*

c **i** 2 x 4 = 8 kWh *(2)*

ii 1.5 x $^{1}/_{4}$ = 0.375 kWh *(3)*

Page 54 The cost of electricity

3

1	2	3	4
B	A	D	C

(4)

Page 55 The National Grid

1

1	2	3	4
B	C	D	A

(4)

2

1	2	3	4
D	A	C	B

(4)

3 a 230 V *(1)*

b Reduces the size of the voltage *(1)*

c High voltage means small current is needed *(1)*; less energy is wasted as heat *(1)*

Page 55 Generating electricity

4 a **i** Wheels have kinetic energy which changes into electrical energy in the dynamo *(1)*

ii Gets brighter *(1)*

P1a answers

Page 56 Power stations

1 a Fuel is burned *(1)* and used to heat the water *(1)*

b i Chemical → heat → kinetic *(2)*

ii kinetic → electrical *(1)*

c *(Any 1:)* Reliable; abundant; concentrated energy source

d *(Any 2:)* Changed in to heat energy; spreads to surroundings; surroundings become warmer

2

1	2	3	4
D	A	C	B

(4)

Page 56 Renewable energy

3 a There is no electricity produced if it is calm or stormy *(1)*

b i A barrage / dam is built across an estuary / river mouth *(1)*; as tidal water moves in or out through pipes in the wall *(1)*; it forces turbines in the pipes to spin *(1)*

ii Only a few suitable sites / floods local area / effect on local ecosystems / only provides electricity when the tide in or out *(1)*

Page 57 Electricity and the environment

1 a Release of greenhouse gases *(1)*; causes acid rain *(1)*

b *(Any 2:)* Wind turbines can be stand-alone; power lines from the National Grid are not needed; produce electricity directly from the wind

Page 57 Making comparisons

2 a i Coal fired power station *(1)*

ii Coal / nuclear fuels *(1)*

b *(Any 3:)* Availability of fuel; transport links; local population; land costs and availability

3 a

1	2	3	4
B	A	D	C

(4)

4 a Cost of fuel *(1)*; cost of building power stations *(1)*

b No fuel costs for Hydroelectricity *(1)*; ongoing fuel costs for oil *(1)* (relatively cheap at the moment, but varies and will rise as oil starts to run out)

P1b answers

Remember: Check which grade you are working at.

Page 59 Uses of electromagnetic radiation

1 a Continuous range of values *(1)*

b All travel at same speed *(1)*; can travel through vacuum *(1)*; travel in straight lines *(1)*

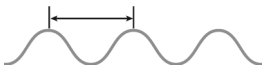
Page 59 Electromagnetic spectrum 1

2 a 1 Microwave *(1)*; 2 visible *(1)*; 3 X-rays *(1)*

b As frequency increases, energy increases *(1)*

3

1	2	3	4
D	B	A	C

4 a  *(1)*

b 

Wave smaller, constant wavelength = (1) same amplitude = (1)

Page 60 Electromagnetic spectrum 2

1

1	2	3	4
B	C	D	A

(4)

2 a **i** Microwaves *(1)*

ii Gamma *(1)*

iii Infrared *(1)*

b **i** Transmitted *(1)*

ii Absorbed *(1)*

iii Reflected *(1)*

Page 60 Waves and matter

3 a X-rays *(1)*

b X-rays pass through soft tissue *(1);* they are absorbed by bones *(1);* and detected / absorbed by photographic plate under the person *(1)*

c X-rays can ionise / damage cells *(1)*

P1b answers

Page 61 Dangers of radiation

1

1	2	3	4
A	D	C	B

(4)

2 a Ultraviolet *(1)*

b Sun burn *(1)*; premature skin aging / wrinkling *(1)*; skin cancer *(1)*

c Dark skin cells on the surface absorb the UV *(1)*; so it does not penetrate *(1)*; to more vulnerable cells under the surface *(1)*

Page 61 Telecommunications

3 a Analogue *(1)*

b Infrared / visible pulses *(1)*; sent down optic fibres *(1)*

c Disruption digging up roads better alternatives e.g. satellite links *(1)*

d *(Any 2:)* Links possible to countries further away; information travels very rapidly; can reach remote areas; very clear signals possible

Page 62 Fibre optics: digital signals

1 a Pulses of light *(1)*; repeatedly reflect from the inside surfaces of the optic fibre *(1);* emerge from the other end *(1)*

b

Diagram should show reflections off inside of fibre = (1) emerges from far end = (1) reflected angles approximately equal to incident angles = (1)

ii Total internal reflection

iii *(Any 3:)* Cheaper; thinner cable so more can be packed into the same space; quality of transmission is better; thousands of simultaneous signals can be sent; no fire hazard

Page 62 Radioactivity

2

1	2	3	4
A	D	B	C

(4)

3 a A; B *(1)*

b 6 *(1)*

c 14 *(1)*

d This is when particles / bursts of radiation *(1)*; are emitted from the nucleus *(1)*

P1b answers

Page 63 Alpha, beta and gamma rays 1

1 a i Gamma *(1)*

ii Alpha *(1)*

iii Alpha / beta *(1)*

2 a Helium nucleus / 2 protons and 2 neutrons *(1)*; emitted from nuclei *(1)*

b They cannot penetrate through skin *(1)*

c Smoke detector *(1)*; localised destruction of cancer cells *(1)*

d Gamma rays have no charge *(1)*; no mass / or do not interact with atoms easily *(1)*

Page 63 Background radiation 1

3 a C *(1)*

b B *(1)*

c A *(1)*

d D *(1)*

Page 64 Half-life

1 a D *(1)*

Note: the multiple choice options to C and D should be 'three quarters' instead of 'half'. This means the correct answer is D: about three quarters of the atoms will decay.

b A *(1)*

c B *(1)*

d C *(1)*

Page 64 Uses of nuclear radiation

2 a Using radioactive materials to treat illnesses *(1)*

b *(Any 2:)* High doses of gamma needed to kill cells *(1)*; cancer cells are targeted to receive high doses *(1)*; healthy cells are targeted to receive lower doses *(1)*

c *(Any 2:)* Radioactive sample injected into blood stream *(1)*; detector used outside the body *(1)*; to measure level of radioactivity in different places *(1)*

d Sterilising equipment / producing images of some organs *(1)*

3 a Maintains quality of product / stops wastage *(1)*

b Can't be detected through paper *(1)*

c Less radiation means the thickness is too big *(1)*; so the rollers should come closer *(1)*

P1b answers

Page 65 Safety first

1 a D *(1)*

b B *(1)*

c A *(1)*

Page 65 Searching space

2 a C *(1)*

b A lens *(1)*

c Large diameter *(1)*; to collect more light *(1)*

d Telescope in orbit / in space *(1)*; transmits images back to earth *(1)*

e *(Any 2:)* Less distortion due to pollution; better quality images; very large telescope so can collect very faint images

Page 66 Gravity

1 a

1	2	3	4
B	A	D	C

(4)

2 a Effect of gravity *(1)*

b Effect increased *(1)*

Page 66 Birth of a star

3

1	2	3	4
B	D	A	C

(4)

4

1	2	3	4
C	A	D	B

(4)

P1b answers

Page 67 Formation of the Solar System

1

1	2	3	4
D	A	C	B

(4)

2 a The dust was flung outwards *(1)*

b Rocks are heavier than dust particles *(1)*; are attracted more strongly to the Sun *(1)*

Page 67 Life and death of a star

3 a The mass is lost as energy given out by the Sun *(1)*

b Red giant *(1)* → white dwarf *(1)* → black dwarf *(1)*

c Gravity *(1)*; pressure due to fusion reactions *(1)*

4

1	2	3	4
C	D	B	A

(4)

Page 68 In the beginning

1 a Billions of years ago *(1)*

b Universe began from a very small initial point *(1)*; that exploded apart in an instant *(1)*

c Quarks join to form atomic particles *(1)*; these join to form hydrogen atoms *(1)*; hydrogen fuses to form heavier atoms *(1)*

Page 68 The expanding Universe

2 a Light from a moving source *(1)*; is redder than expected / shifted to the red end of the spectrum *(1)*

b They are moving away from us *(1)*

3 a B *(1)*

b C *(1)*

c A *(1)*

d D *(1)*