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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Energy, Work & Power — Paper 1

Worked Answer Key (Multiple Choice)

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Energy, Work & Power — Paper 1 · Worked Answer Key

These are **Megalecture worked answers** for the topical multiple-choice compilation on **Energy, Work & Power (IGCSE Physics 0625, Paper 1)**. Every answer below was solved from first principles by the Megalecture team; calculations use the data given in each question (with g as stated, usually 10 N/kg) and the standard relations $KE = \frac{1}{2}mv^2$, $GPE = mgh$, $W = Fd$, $P = E/t$ and efficiency = useful ÷ input. Use this key to mark your work and to see the one-line reasoning behind each correct letter. The compilation is organised into three parts — keep your eye on the part heading, as the exam-paper question numbering restarts in each part.

Part A · Energy Forms and Major Sources of Energy

Q #	Exam reference	Answer	Brief working / reason
A1	M/J 16 P11	**B**	Non-renewable means fuel that cannot be replaced once used. A nuclear power station burns nuclear fuel (uranium) → **a nuclear power station**. Geothermal, solar and wind are all renewable.
A2	M/J 16 P11	**C**	Energy in the Sun is released when hydrogen nuclei join to form helium → **nuclear fusion**.
A3	M/J 17 P12	**A**	Solar, tidal and wind are all renewable. Nuclear fuel runs out → **nuclear energy** is non-renewable.
A4	M/J 17 P12	**B**	Burning coal heats water in the boiler → steam drives the turbine → turbine spins the generator: **boiler** → **turbine** → **generator**.
A5	M/J 18 P11	**A**	Steam/turbine/generator stages are common to both. The difference is the waste: an oil-fired station burns fuel, so **gases emitted by hot fuel are emitted into the atmosphere**; a nuclear station has no combustion gases.
A6	M/J 18 P12	**A**	Carbon dioxide is a product of burning a fossil fuel. Only the **gas-fired power station** burns fuel here; geothermal, nuclear and wind do not produce CO_2 when operating.
A7	M/J 19 P12	**B**	Geothermal, wave and wind stations all spin an a.c. generator. **Solar panels** (photovoltaic cells) produce electricity directly and use no a.c. generator.
A8	M/J 20 P11	**D**	Fusion of hydrogen into helium occurs only where temperatures and pressures are huge → **in the centre of the Sun**. (The Earth's core and radioactive decay involve fission/decay, not fusion.)
A9	M/J 20 P12	**A**	Correct order is burn coal (4) → water becomes hot (2) → steam produced (6) → steam turns turbine (3) → turbine turns generator (1) → induction makes electricity (5). After the given 4 → 2, the rest is **6** → **3** → **1** → **5**.

Q #	Exam reference	Answer	Brief working / reason
A10	M/J 20 P12	**B**	"Heat transfer" means useful output ends up as thermal energy. A car driven at constant speed gains no KE or GPE, so all the chemical energy supplied is transferred to heat by friction/air resistance → **a car moving along a horizontal road at constant speed**.
A11	O/N 16 P12	**B**	All listed must be renewable. Hydroelectric, solar and wind are renewable; "oil-fired" is not. The only all-renewable set is **hydroelectric, solar, wind power stations**.
A12	O/N 18 P12	**D**	Compressing the ball does work on the trapped air, raising both the kinetic energy of its molecules and the temperature of the ball → **both increase**.
A13	O/N 18 P12	**D**	A geothermal station uses hot underground water (thermal energy) to drive a turbine-generator that makes electricity → **thermal energy → electrical energy**.
A14	O/N 19 P11	**D**	Hydrogen-to-helium fusion happens in the Sun's core → **in the core of the Sun**.
A15	O/N 20 P11	**B**	A current in a resistor heats it: electrical energy is converted to thermal (internal) energy → **electrical → internal**.
A16	O/N 20 P11	**D**	Solar cells, hydroelectric generators and wind turbines are renewable. **Nuclear reactors** use a fuel that runs out, so they are not renewable.

Part B · Work, Kinetic Energy, Potential Energy & Conservation

Q #	Exam reference	Answer	Brief working / reason
B1	M/J 16 P11	**A**	ΔGPE = Wh = 250 × 7.0 = **1750 J**. Final KE = ΔGPE − friction loss = 1750 − 1300 = **450 J** → row A.
B2	M/J 16 P11	**C**	Work done by the 300 N force = force × distance moved *along its line of action* (the 5.0 m ramp) = 300 × 5.0 = **1500 J**.
B3	M/J 17 P11	**B**	Constant speed up a hill means KE is constant but height rises, so only **gravitational potential energy** is increasing (constant and greater than zero).
B4	M/J 17 P11	**A**	Work = force × distance moved *in the direction of the force* → **the distance travelled in the direction of the force**.
B5	M/J 17 P12	**C**	Work against gravity = mgh using the *vertical* rise = 60 × 10 × 1.5 = **900 J** (the 2.0 m horizontal distance does no work against gravity).
B6	M/J 18 P12	**A**	GPE gained E = weight × vertical rise = 500 × 3.0 = **1500 J**. Total work by the 400 N force = 400 × 5.0 = 2000 J, so work against friction W = 2000 − 1500 = **500 J** → row A.

Q #	Exam reference	Answer	Brief working / reason
B7	M/J 19 P11	**A**	All chairs have equal mass, so GPE = mgh depends only on height. Chair **A** is at the top of the wheel, the greatest height → most GPE.
B8	M/J 19 P11	**B**	Work against gravity = mgh using the vertical rise of 10 m: 500 × 10 × 10 = **5.0×10^4 J** (the 200 m along the road is not the height).
B9	M/J 19 P12	**D**	GPE gained = mgh, i.e. weight (= mg) × the rise in height → **weight multiplied by the increase in height**.
B10	M/J 20 P12	**C**	KE = $\frac{1}{2}mv^2$. The mass M is unchanged but the speed doubles, and $(2v)^2 = 4v^2$, so the kinetic energy **increases by a factor of four**.
B11	M/J 20 P11	**C**	ΔGPE = mgh with the *vertical* rise of 50 m: 1000 × 10 × 50 = **500 000 J** (the 200 m slope length is not used).
B12	M/J 20 P11	**B**	All GPE → KE: $\frac{1}{2}mv^2 = mgh$ → $v = \sqrt{2gh} = \sqrt{2 \times 10 \times 2.0} = \sqrt{40}$ = **6.3 m/s**.
B13	M/J 20 P11	**A**	Work = force × distance moved along the force. The force F acts along the slope, whose length is r, so work = ***F* × *r***.
B14	O/N 16 P11	**B**	Work against gravity = weight × vertical rise = 2000 × 0.80 = **1600 J** (the 2.0 m plank length is not the height).
B15	O/N 16 P11	**D**	KE = $\frac{1}{2}mv^2$: P = $\frac{1}{2}(1.0)(3.0)^2$ = 4.5 J; Q = $\frac{1}{2}(2.0)(2.0)^2$ = 4.0 J; R = $\frac{1}{2}(5.0)(1.0)^2$ = 2.5 J. Increasing order is R < Q < P → **R → Q → P**.
B16	O/N 16 P11	**B**	GPE = mgh → m = GPE ÷ (g × h) = 4500 ÷ (10 × 1.8) = 4500 ÷ 18 = **250 kg**.
B17	O/N 16 P12	**C**	A force does no work when there is no movement in its direction. For a satellite in a circular orbit the gravitational force is perpendicular to the motion, so **the force that causes a satellite to move in a circular orbit** does no work.
B18	O/N 17 P11	**D**	Landing KE = GPE lost = $\frac{1}{2}mv^2$ → $v = \sqrt{2 \times KE \div m} = \sqrt{2 \times 0.96 \div 3.0} = \sqrt{0.64}$ = **0.80 m/s**.
B19	O/N 17 P12	**A**	KE = $\frac{1}{2}mv^2$ needs SI units: m = 56 g = 0.056 kg and v = 1500 m/min = 1500/60 = 25 m/s. So KE = **$\frac{1}{2} \times 0.056 \times (25)^2$**.
B20	O/N 19 P11	**A**	Work by weight = force × vertical distance moved in the force's direction. The weight W acts vertically, and the vertical drop is x, so work = ***Wx***.
B21	O/N 19 P12	**D**	KE = $\frac{1}{2}mv^2$. For Y, mass = $2m$ and speed = $2v$, so $KE_Y = \frac{1}{2}(2m)(2v)^2 = 4mv^2$. Ratio $KE_Y/KE_X = 4mv^2 \div (\frac{1}{2}mv^2)$ = **8**.
B22	O/N 20 P11	**A**	With no air resistance, mechanical energy is conserved as the ball falls (GPE converts to KE), so the **total energy is the same at all points**.
B23	O/N 20 P11		

Q #	Exam reference	Answer	Brief working / reason
		B	Height jumped h = GPE ÷ weight. A: 1320/600 = 2.20 m; B: 1610/700 = 2.30 m; C: 1760/800 = 2.20 m; D: 1800/900 = 2.00 m. Greatest height is **B**.
B24	O/N 20 P11	B	Work against gravity = weight × vertical rise = 2000 × 0.80 = **1600 J** (the 2.0 m plank length is not the height).
B25	O/N 20 P12	A	Work done pushing horizontally = force × distance = ***F* × *d***. The mass and g are distractors because no lifting occurs.

Part C · Efficiency and Power

Q #	Exam reference	Answer	Brief working / reason
C1	M/J 17 P11	D	Electrical energy in = power × time = 10 × (5.0 × 60) = 10 × 300 = **3000 J**.
C2	M/J 17 P12	B	Input power = mgh/t = (20 × 10 × 15) = 3000 W each second. Useful output = efficiency × input = 0.60 × 3000 = 1800 W = **1.8 kW**.
C3	M/J 18 P11	B	Power = energy ÷ time, and the energy supplied to each stair is GPE = mgh = weight × height. So power = **(height × weight) ÷ time**.
C4	M/J 19 P12	B	Input per panel = 0.80 kJ in 1.0 s = 800 W, over 7.2 m^2 total = 5760 W. Efficiency = useful ÷ input = 1000 ÷ 5760 = 0.17 = **17%**.
C5	M/J 19 P12	B	Power = energy transferred per second (1) and = rate of doing work (3), both correct. Statement 2, "force × distance moved", is the definition of *work*, not power. So only **1 and 3** are correct.
C6	M/J 20 P11	D	Total mass = 20 + 80 + 80 = 180 kg. GPE = mgh = 180 × 10 × 2.5 = 4500 J. Power = energy ÷ time = 4500 ÷ 0.50 = 9000 W = **9.0 kW**.
C7	M/J 20 P12	B	Energy supplied = VIt = 200 × 33 × (4.0 × 3600) = 95 MJ. Usable energy stored = efficiency × input = 0.90 × 95 ≈ **86 MJ**.
C8	M/J 20 P12	C	Power output = work done ÷ time = (known load weight × height lifted) ÷ time. The load is already known, so the extra measurements are the height (with a **metre rule**) and the time (with a **stop-watch**).
C9	O/N 16 P11	C	Power = work done ÷ time taken → **(work done) ÷ (time taken)**.
C10	O/N 16 P12	C	Power = work ÷ time = 140 000 ÷ 70 = 2000 W = **2.0 kilowatts**.
C11	O/N 16 P12	A	For a generator the useful output is electrical energy and the input is the total energy supplied, so efficiency = **(electrical energy output) ÷ (total energy input)** → row A.

Q #	Exam reference	Answer	Brief working / reason
C12	O/N 17 P11	**D**	Power = work ÷ time = (force × distance) ÷ time = (1000 × 200) ÷ 20 = 200 000 ÷ 20 = **10 000 W**.
C13	O/N 17 P12	**D**	Power = energy per second = mgh/t = (4.2×10^5) × 10 × 50 per second = **2.1×10^8 W**.
C14	O/N 18 P11	**B**	Efficiency rises when wasted energy falls. The fuse only protects the circuit, so the only useful change is to **reduce the energy losses in the motor**.
C15	O/N 18 P12	**C**	Useful work = weight × height = 40 × 0.50 = 20 J. At 25% efficiency, input energy = 20 ÷ 0.25 = 80 J. Time = energy ÷ power = 80 ÷ 20 = **4.0 s**.
C16	O/N 19 P12	**C**	($F \times d$) is work done; dividing by time t gives work per unit time → **power**.
C17	O/N 20 P11	**C**	Efficiency = useful ÷ input = (input − wasted) ÷ input. Oil: (500−300)/500 = 40%; nuclear: (200−160)/200 = 20%; hydro: (10−1.0)/10 = 90%. Least efficient = nuclear, most efficient = hydroelectric → **row C**.
C18	O/N 20 P12	**D**	Power is the rate of doing work, i.e. **work done per second**.

Note from Megalecture. These are original Megalecture worked solutions prepared for revision use. Watch the units in every calculation — convert grams to kilograms and minutes to seconds before using $KE = \frac{1}{2}mv^2$, and always use the *vertical* height (not the slope length) in $GPE = mgh$.